

# MEMORY



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#### Editorial

#### Aliye Ahu GÜLÜMSER • Editor

Memory, a fascinating cognitive faculty, has been a subject of exploration in scholarly, scientific, and poetic realms for centuries. The interplay among reality, memory, and perception forms a foundation for philosophical inquiry and scientific revelations. In the contemporary era of rapid urbanization, the relevance of memory in the built environment cannot be overlooked.

Spaces we inhabit are not passive backdrops but active contributors to the narratives of our lives. Thoughtful environmental design enhances well-being, fosters a sense of belonging, and contributes to the richness of our memories. Shaping our world necessitates an awareness of its enduring impact on human memory. With its extraordinary flexibility capacity, the human brain responds to environmental stimuli beyond the visual and spatial realms.

Architects and designers, once primarily concerned with aesthetics and functionality, now play pivotal roles in the nuanced interplay between the mind and the built environment. This relationship unlocks the potential to create environments that resonate with the past, enrich the present, and inspire the future.

Every architectural element becomes a visual repository of our experiences as we navigate the built landscape. The interplay of light and shadow, the vibration of the city, and the harmony of natural elements are engraved in our memories. Structures we create are not merely physical entities but tools for preserving and enhancing memory. The spaces we inhabit become integral components of the narrative of our lives, influencing the rhythm of our memories and leaving an indelible mark on our collective consciousness. Consider the dynamic cityscape where architectural diversity and spatial planning converge. Urban design shapes how we navigate and experience our environment. Crowded streets, squares, and architectural wonders become chapters in a city's collective memory. The design of public spaces influences the rhythm of our daily lives, encouraging a sense of community or solitude, connection or isolation.

Architects, urban planners, and designers bear significant responsibility as custodians of collective memory. Their decisions reverberate over time, leaving an indelible mark on communities' stories about themselves. Today's design choices reflect on the future and shape the narratives of future generations. In this context, architecture is not just about erecting buildings; it involves crafting the fabric of our collective memory.

Choices in architectural design and spatial planning transcend aesthetics and functionality, enhancing a sense of place, identity, and continuity. By weaving the threads of memory into our cities' plans, we transform the built environment into a living archive—a testament to the stories, experiences, and aspirations of the communities that call these places home.

Architecture, often lauded for its aesthetic appeal, transcends mere visual appreciation. It becomes a mediator of memory, a storyteller etching narratives into the fabric of our environment. Historic landmarks, contemporary structures, and neighbourhood architecture all find a place in our collective memory. The built environment is an evocative tool, providing visual cues that trigger memories and emotional responses to specific places.

Spatial planning and urban design create complexity and shape our mental maps and spatial memory. A well-designed urban landscape fosters a sense of community and belonging, creating environments where memories are not only formed but are woven into the city's infrastructure.

Design assumes a highly personal dimension in the intimate spaces we call home. The layout of rooms, the interplay of light, and the choice of materials contribute to the atmosphere, influencing our daily experiences and the memories we associate with them. Architects, urban planners, and designers become guardians of collective memory, leaving an indelible mark on the landscape of memory.

In an age of rapid urbanization and architectural innovation, those who shape our built environment bear immense responsibility. They are not only creators of spaces but also keepers of a community's collective memory. Their decisions ripple over time, influencing future generations' stories about the places we call home.

Ultimately, the convergence of memory and the built environment creates a dynamic interaction that shapes the essence of our lives. As we enter an era of rapid urbanization and architectural innovation, let us embrace the potential to create environments that inspire, connect, and endure in the collective memory of future generations. Memory will always exist in our cities and our places.

This issue coincides with the culmination of the 250th Anniversary of our university. Simultaneously, November is a month devoted to remembering our roots. Hence, it is with great pride and honour that I write this editorial and dedicate it to Gazi Mustafa Kemal Atatürk whose memory accompanies me at all times and in every place.

Enjoy our November 2023 issue watching the rain and sipping your drink from the window for an unforgettable memory!

## $\Lambda$ Z

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## From Istanbul to Detroit: International networks of Islamic art in the early 20th century

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#### Abstract

While past decades have seen the rise of historiographical studies on Islamic art exploring collections, exhibitions and influential figures, the international nature of the formative years of the discipline, especially that of networks of people, is an aspect that needs further investigation. This article explores the beginnings of Islamic art in the United States by taking a well-known figure in Turkey at its center. Mehmet Aga-Oglu, curator of Islamic art at the Evkaf Museum, migrated from Istanbul to Detroit in 1929 to create a collection of Islamic art for one of the oldest museums in the country, Detroit Institute of Arts (DIA). A group of international scholars facilitated this transition in their common goal to transform the United States into a leader in the academic studies of Islamic art history. By taking this little studied case, this article explores the key role this network of scholars played in establishing a new academic discipline in North America, which resulted in a little-known connection between Turkey and the United States as well as a keen interest in Turkish art and collections in Turkey in furthering the scholarship of Islamic art produced in the first half of the 20th century. To this end, this article outlines the beginnings and state of the field in 20th century; explores DIA's search for a curator and Aga-Oglu's appointment through the efforts of Bernard Berenson, Rudolf Meyer Riefstahl and Wilhelm R. Valentiner to highlight their unrecognized contributions; and Aga-Oglu's curatorial work at DIA from 1929 to 1933.

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#### Keywords

Historiography and formation of Islamic art, Detroit Institute of Arts, Mehmet Aga-Oglu, Rudolf Meyer Riefstahl, Wilhelm (William) R. Valentiner.

#### 1. Introduction

The past two decades have seen the rise of historiographical studies on Islamic art history that explored the formation of major museum and private collections, organization of large-scale international exhibitions and impact of figures such as collectors, curators, dealers and scholars had on the perception and the scholarship of Islamic art. Among the many interesting findings of these exploratory studies, the international nature of the formative years (1850-1950) of the Islamic art history discipline, especially that of the networks of people, is one of the aspects that needs further investigation.

While the Islamic art history as a scholarly field of inquiry was established in Europe in the 19th century, the academic foundations of Islamic art was formed much later in the case of the United States dating back to as late as the early 20th century. This article explores the beginnings of the Islamic art history in the United States by taking a figure rather well-known in the art history field in Turkey at its center.

Dr. Mehmet Aga-Oglu (1896-1949), who was a curator of Islamic art at the Evkaf Museum (Museum of Pious Foundations) and a professor at the Istanbul University, migrated from Istanbul to Detroit, Michigan in 1929 to create a collection of Islamic art for one of the oldest museums in the country, the Detroit Institute of Arts (DIA). A group of international scholars, whose specialty varied from European art to Islamic art, facilitated this transition in their common goal to transform the United States into a leader in the academic studies of Islamic art history as well as enhancing Aga-Oglu's pioneering role in setting the academic standards of this burgeoning field in North America.

By taking this intriguing and under-examined case, this article aims to point out the key role the international network of scholars spread across the continents played in establishing a new academic discipline in North America, which resulted in a rather little-known connection between Turkey and the United States as well as a keen interest in Turkish art and collections in Turkey in furthering the scholarship of Islamic art produced in the first half of the 20th century in contrast to the well-established and uncontested taste for Persian art at the time.

To demonstrate these, this article first outlines the beginnings of the Islamic art history as an academic discipline and the state of the field in the United States in the early 20th century; then explores the DIA's search for a curator of Islamic art and Aga-Oglu's appointment to this role thanks to the efforts of a number of internationally known art historians such as Bernard Berenson (1865-1959), Rudolf Meyer Riefstahl (1880-1936) and Wilhelm [William] R. Valentiner (1880-1958) through the primary archival material housed at the DIA and the Biblioteca Berenson I Tatti to highlight their unrecognized contributions to the field of Islamic art; and lastly Aga-Oglu's curatorial work at the DIA from his arrival in September 1929 to his departure from his curatorial position in the Fall of 1933 due to the economic depression.

## 2. Beginnings of Islamic art history discipline

The beginnings of the Islamic art discipline date back to the 19th century Germany when the historical studies emerged as an academic field of inquiry and Islamic art history appeared as one of its subfields among many others, such as economic history, intellectual history, social history etc. The Colonial European Empires initiated and developed an interest in the study of the cultures of Muslim lands through the work of orientalist scholars, artists, architects, and engineers who travelled to the Near East. The early studies born out of exploratory travels in the region were mainly surveys of the architectural monuments (Vernoit, 2000, pp. 1-5).

By the late 19th century, the notion of Islam as a "cultural entity" and a "religious system" was well established leading the way to new forms of scholarship, hence the "discipline" of Islamic art emerged. Detailed inquiries were mostly focused on the early period of Islam with the aim to trace its formation, development and discover its "essence," and specialists dedicating their entire careers to explore Islamic art and culture emerged in contrast to the Western travelers, historians and philosophers of the early 19th centu-



**Figure 1.** Mehmet Aga-Oglu (University of Michigan Faculty and Staff Portrait Collection, Bentley Historical Library, University of Michigan).



Figure 2. Halil Edhem (Url-1).

ry, who expressed "general comments" on the Islamic world (Vernoit, 2000, p. 32).

Another trend that became influential in the 19th century was the racial theories developed by Joseph-Arthur de Gobineau, Ernest Renan, and others. As explained by Vernoit (2000), Gobineau in Essai sur l'inegalite des races humaines (1853-5), made the claim that "Indo-Europeans and Semites possessed different racial characteristics" (p. 6) giving superiority to the Indo-Europeans. As the Persians belonged to this superior race, Persia came to be seen as "the principle source of artistic inspiration in the Muslim world" (p. 6). This view dominated the field for multiple decades placing the Persians at the top of the artistic hierarchy in the Islamic world, whereas Arabs ranked second as they "created a flourishing civilization in medieval times," (p. 6) and the Turks occupied the lowest rank. Quoting from Ferguson, "the most stolid and least refined, and the least capable of elaborating such an art as we find in all other countries subject to this faith [Islam]" were the Turks (as cited in Vernoit, 2000, p. 7).

The impact of the racial theories is perhaps most visibly seen in the early scholarship on Islamic ceramics in the mid-19th century. For instance, the ceramics found at Lindos on the island of Rhodes were attributed to the Persians and called as "Lindos" or "Rhodian" ware, although they were originally from Ottoman İznik. In a similar vein, another type of İznik pottery, that of pale-purple, found in Damascus, hence called "Damascus" ware, were again attributed to Persia (Vernoit, 2000, p. 8; Lukens, 1965, pp. 38-39).

Another incident demonstrating the widespread acceptance of the racially biased opinions was the judgment made by Owen Jones during the first international exhibition known as the Great Exhibition held at the Crystal Palace in London in 1851. Bringing together artefacts from across the world, in these international exhibitions, products were categorized along their national origins, thus introducing "the concept of nationhood" and national styles in art and architecture. It is important to note here that the first pub-

lic display of Islamic art took place in these international exhibitions of the 19th century. Providing a comparison of artefacts from different parts of the world, Owen Jones expressed that "the productions of Turkey 'were the least perfect of all the Mohammedan exhibiting nations" (as cited in Vernoit, 2000, p. 14).

Despite and perhaps due to the lack of appreciation for Turkish artefacts, the Ottoman government provided support for studies on cultural heritage. Among the international exhibitions, Weltausstellung 1873 Wien (The Vienna International Exposition of 1873) is particularly significant for the development of scholarship on Ottoman art and architecture. Les costumes populaires de la Turquie en 1873 (1873) by Osman Hamdi and Marie de Launay with photographs by Pascal Sebah; L'architecture ottoman (1873) again by De Launay and four artists, and Le Bosphore et Constantinople (1873) by Philipp Anton Dethier were prepared for this occasion under the patronage of the Ottoman government. In contrast to the commonly held opinion that only the Western scholars produced the early scholarship on the Near East, these works exemplified the early attempts by the Ottomans to write their own history of Ottoman art, architecture, and culture (Vernoit, 2000, p. 15; Necipoğlu, 2007, pp. 141-183).

In the United States, international exhibitions took place in the last quarter of the 19th century, first one held in Philadelphia (1876), followed by Boston (1883), New Orleans (1884-85), Chicago (1893), and St. Louis (1904). While the ones that were held after the First World War in Europe could not reach to their former glory, the ones in the United States were more effective in promoting the arts of the Islamic world. Particularly noteworthy among those were the Sesqui-Centennial Exposition in Philadelphia in 1926, especially for Persian art as Arthur Upham Pope (1881-1969) and Phyllis Ackerman (1893-1977) organized the "First Congress and Exhibition of Persian Art and Archaeology" on this occasion, and the New York World's Fair in 1939 (Vernoit, 2000, p. 16).

In addition to this geographical shift, another distinguishing factor between the 19th and 20th century international exhibitions was the change in the perception of Islamic artefacts. The 19th century international exhibitions treated these artefacts as industrial manufactures, finding interest in "their technical merits and the quality of their designs" (Vernoit, 2000, pp. 16-18), whereas in the 20th century these works were treated as having aesthetic value, hence demonstrating an increase in their appreciation as art works.

The specialized exhibitions on Islamic art by public institutions like museums emerged in such an environment of increased appreciation. In Europe, starting with *the Exhibition of Persian Art* at South Kensington Museum, London in 1876, a number of Islamic art exhibitions took place in various European centers from Paris to Stockholm, the most prominent one being *Meisterwerke Muhammedanischer Kunst* in Munich in 1910 (Vernoit, 2000, pp. 18-20).

In the United States, special exhibitions on Islamic art began to take place a few decades later than Europe, at the beginning of 20th century. For instance, the Metropolitan Museum of Art (MMA), founded in 1870, acquired its first Islamic art objects in 1871. While in the 19th century, artworks from the Islamic lands were exhibited along with material from other parts of the world as decorative arts objects divided according to material, such as porcelain, metalwork etc., the collectors' demand for their gifted objects to be displayed as an assemblage pushed the museum to exhibit Islamic works on its own (Lindsey, 2012). An important turning point in the MMA's move toward "specialized temporary exhibitions" was a loan carpet exhibition taking place in 1910 with 50 objects from ten private collections and three museums (Valentiner, 1910b, pp. 221-222; "Loan Exhibition of Early Oriental Rugs", 1910, pp. 247-248). It was curated by William R. Valentiner, the decorative arts curator of the museum, who later became the director of the DIA and hired Mehmet Aga-Oglu as the first Near Eastern art curator of the Institute.

In the following two decades from 1910 to 1930, the MMA, Museum of Fine Arts in Boston (Boston MFA) and the Pennsylvania Museum organized exhibitions on different mediums and schools of Islamic art, such as the Exhibition of Persian and Indian Manuscripts, Drawings and Paintings in 1914 at the Boston MFA; the Exhibition of Oriental Carpets in 1921 at the MMA; the International Exhibition of Persian Art in 1926 at the Pennsylvania Museum in conjunction with the Sesqui-Centennial Exposition; the Loan Exhibition of 'Polonaise' Carpets in 1930 at the MMA (Vernoit, 2000, pp. 202-203).

It was only in 1930 that the first comprehensive survey exhibition on Islamic art in the United States was organized. Taking place at the DIA, the exhibition was curated by their newly appointed curator, Mehmet Aga-Oglu who arrived at Detroit from Istanbul in September 1929. It would be beneficial to investigate the circumstances of Aga-Oglu's appointment to an American institution as it portrays the state of the field in the United States and the expectations from a curatorial position at that time.

### 3. Detroit in search of a curator of Islamic art

The information on Aga-Oglu's early life is scant and no records, archival or otherwise, could be located at institutions in Turkey. Therefore, biographical details before his move to the United States are gleaned from the obituaries written at the time of his death by his colleagues in the United States, namely Adele Coulin Weibel (1880-1963) from the DIA and Maurice S. Dimand (1892-1986) from the MMA. According to these accounts, Aga-Oglu was born in Yerevan in 1896 to Turkish parents and received his training in history, philosophy, and languages at the Oriental Department of the University of Moscow, from where he graduated with a degree of doctor of letters in 1916. Upon graduation, pursuing his interest in Islamic art, he travelled extensively in Central Asia and Near East for five years. In 1921, Aga-Oglu arrived in Istanbul to resume his studies at Istanbul University, where he met Halil Edhem (1861-1938).

Halil Edhem guided Aga-Oglu's career by sketching a program for him to study Islamic art in Germany and Austria with the founding figures of the field for the next four years. In 1922, Aga-Oglu was in Berlin studying Near Eastern art and archaeology with Ernst Herzfeld (1879-1948) and Carl Heinrich Becker (1876-1933). He studied classical and early Christian archaeology, and Western art and aesthetics at the University of Jena. Afterwards, he went to Vienna to study under Josef Strzygowski (1862-1941) from 1924 to 1926. He obtained his second doctoral degree in Turkish architecture from the University of Vienna (Weibel, 1951, pp. 267-271; Dimand, 1949-50, pp. 208-209; "Museum Notes", 1929, p. 14; "Dr. Aga-Oglu, Islamic Art Scholar, Dies", 1949, p. B2; Simavi, 2012, p. 2). Although his supervisor Strzygowski desired to keep him in Vienna, Aga-Oglu decided to return to Istanbul in 1927 (Riefstahl, 1928c), and became the curator in charge of the Islamic art collection housed at the Çinili Köşk, a part of the Archaeology Museums at the time where Halil Edhem was the director, and also taught Islamic art at the Istanbul University until he was hired to the DIA in Michigan in 1929.

Established in 1887 as one of the first museums in the United States, the DIA was considered to be a small municipal museum at the industrial center of American Midwest in the 1920s. Valentiner, a German born art historian specializing in Dutch art, was hired as the museum's director in 1924 and his tenure of two decades, from 1924 to 1945, is regarded as a golden era when he transformed the DIA into a universal survey museum with a world class collection (Peck, 1991; Richardson, 1992, pp. 37-40).

In his aim to build the museum's collection in an encyclopedic character, Valentiner began the search for a qualified curator of Islamic art among other fields. Benjamin March (1899-1934), a scholar of Chinese art, was already hired as the Asian art curator at the Institute and the position for the Near Eastern art curator was envisioned to be under his department. To aid Valen-

tiner in this search, March approached Rudolf Meyer Riefstahl for suggestions on potential candidates. Riefstahl was among the few specialists of Islamic art in the United States at the time holding a teaching position at the New York University. Riefstahl responded to this request expressing that there was no such trained person in the United States. He added that if the museum wished to invest in the training of an American, it would require multiple years for the person to be ready to take up such a role. Riefstahl's advise to the museum was to conduct an international search to fill the position. Teaching at Robert College at the time, hence being well-connected to the academic circles in Istanbul, Riefstahl suggested Mehmet Aga-Oglu could be an ideal candidate with his training in Russia, Turkey, Germany and Austria; his language skills (he knew Turkish, Arabic, Persian, Russian, German and French, his English was reading knowledge with very limited speaking ability but considering the number of languages he already acquired, Riefstahl assured that he could very quickly become fluent); and his knowledge of the material through his access to the collections in Istanbul and his extensive travels in the region. The only concern he had was the potential rage of Halil Edhem if he became aware of these plans to take Aga-Oglu away to America as he was trained specifically for his position in Istanbul. Riefstahl's solution was to present this as a temporary, one year only, opportunity for Aga-Oglu to spend time in the United States so that Halil Edhem's blessings could be granted (Riefstahl, 1928b).

Another instrumental figure in enabling Aga-Oglu's appointment to the DIA was Bernard Berenson, prominent scholar of Renaissance art, collector and connoisseur. In 1928, Berenson and his wife spent considerable time in Istanbul where they got to meet and acquaint themselves with Aga-Oglu. Riefstahl, therefore, suggested Valentiner to get in touch with the Berensons for an assessment of Aga-Oglu's both scholarly and personality qualities for the position in Detroit (Riefstahl, 1928d).



Figure 3. Bernard Berenson at Villa I Tatti, 1903. (Url-2)

Meanwhile, Berenson also contacted Paul Sachs (1878-1965) at Harvard University promoting Aga-Oglu for a curatorial position at Harvard before the DIA appointment went in effect, demonstrating Berenson's involvement in finding a suitable place for Aga-Oglu in the United States as well as his investment in the flourishment of Islamic art as an academic field of study in the New Continent (Cuddon, 2013, p. 21).

Quoting Berenson as cited in Cuddon (2013):

I don't see him in Detroit... My ideal for him and for Harvard would be that he profess Islamitic [sic] art in my beloved Alma Mater. It is a far more important field than I could have imagined before going to Turkey. Aga Oglu has moreover material up to his sleeve, and ideas which will make him an ornament to any institution that can claim him. I should wish it to be Harvard. (p. 21)

These correspondences among the leading scholars in somewhat different

subject areas to find the perfect fit to establish a non-existent field in the United States demonstrates how international and well connected the art history network was already in those years.

In addition to the Berensons, further inquiries were made in the German-speaking Islamic art network for Aga-Oglu's appropriateness for the Detroit position. Riefstahl checked in with colleagues at the German Scientific Library while in Istanbul to gather information on Aga-Oglu. He also suggested March to contact Ernst Kühnel (1882-1964), Friedrich Sarre (1865-1945) and Strzygowsky to get "unbiased opinion" on Aga-Oglu (Riefstahl, 1928c).

After what seems to be a thorough background check, Valentiner prepared the letter offering Aga-Oglu the position of assistant curator for the Near East at the DIA with a yearly salary of \$4,000 on October 20,1928. Aware of the lack of scholarly resources for research and absence of extensive collections to draw on, Valentiner quite frankly expressed that the conditions in Detroit could not match what Aga-Oglu already had in Istanbul, but he would be able to "build up a new department" and "educate the people in town." New York not being too far, Valentiner suggested Aga-Oglu could connect with scholars residing there, give lectures and contribute to the museum's journal by writing on Islamic art and the new acquisitions of the museum (Valentiner, 1928a).

Valentiner's offer letter did not reach Aga-Oglu until the first week of January 1929 due to Riefstahl's intervention. In a November 22, 1928 dated correspondence to Valentiner titled as "strictly confidential," Riefstahl expressed four concerns for Aga-Oglu's appropriateness for the job which were expressed to him by Berenson and Mrs. Riefstahl. The first one was that Aga-Oglu had not made much progress in English; the second concern was related to his personality, that while Aga-Oglu was "the highest type of scholar", he did "not have the aggressiveness which is necessary for a position in the Middle West"; third concern was that if the American chapter of his career would not be successful, this may "uproot him

entirely & leave him in a worse position then now," in this instance Riefstahl is referring to his perception of the unlikelihood of Aga-Oglu reaching a high rank in Turkey due to his origin as an Azeri, and the fourth one was the impossibility of him to come to the DIA on January 1. Riefstahl's suggestion was to make a tentative offer and arrange an in-person meeting with Aga-Oglu in Europe for the following summer for Valentiner to make his own judgment (Riefstahl, 1928e).

However, Valentiner did not seem to mind these concerns and was eager to have Aga-Oglu onboard as soon as possible. In his response to Riefstahl on December 1, 1928, he wrote that it did "not make much difference about his English, and as for his aggressiveness, which you think is necessary for a position in the middle west, I think it can be done by others in the Museum." Valentiner further added that "If he [Aga-Oglu] can not come I shall be sorry indeed from all that I have heard about him" (Valentiner, 1928b). Upon receiving the offer letter in early January 1929, Aga-Oglu immediately accepted the position (Aga-Oglu, 1929b). It was agreed that he would start in Detroit on September 1, 1929 so he would have time to wrap up his duties at the museum and the university in Istanbul (Valentiner, 1929).

## 4. First survey exhibition of Islamic art in the United States

Upon his arrival at Detroit, the first undertaking of Aga-Oglu was to organize an exhibition that would bring together all schools and mediums of "Mohammedan" art, as it was called then, at the DIA. The few exhibitions that took place in the United States at the time, as mentioned above, focused only on a certain medium and represented the material in ethnoracial terms, such as Persian, Indian etc. Therefore, Aga-Oglu's aim to represent the Islamic art tradition as a whole was a first in the United States at its time ("Detroit Museum Shows Precious Art of Islam", 1930, p. 11; Simavi, 2012, p. 4).

Aga-Oglu travelled to New York to see the available material in his new home country in May, June, and September 1930 (Aga-Oglu, 1929a). Due

to economic constraints, the DIA could not pay for insurance and transportation fees, so rather than organizing an exhibition of loans from other public collections, they had to go after the material in the hands of New York dealers (Valentiner, 1930), which is unthinkable in contemporary museum practice but was an accepted convention at the

but was an accepted convention at the time. These dealers were particularly interested in the opportunity to loan their artefacts as Detroit was known for its wealthy patrons due to the flourishing manufacturing industry. Many Detroit industrialists were art collectors themselves and were also serving on the DIA's board. Therefore, an exhibition showcasing the material on sale in Detroit would provide an opportunity for these objects to be purchased either for the private collections or on behalf of the museum.

This first survey exhibition of Mohammedan Decorative Arts took place from October 21 to November 23, 1930 and was the 14th loan exhibition held at the museum. There is no photographic record of the show, however a look into the exhibition catalogue gives an idea on the content if not of the visual organization. With a total of 171 objects listed in the catalogue, the exhibition featured 5 works of calligraphy, 8 manuscripts, 52 miniature paintings and 3 lacquer paintings, 39 pottery, 7 glassworks, 9 metalworks, 3 works in ivory, stucco, and wood, 30 carpets and 15 textiles. Only 9 of these objects were from the DIA's own collection and the rest were loaned from dealers and private collectors such as Costilayan and Company, Demotte, Duveen Brothers, Mr. and Mrs. Edsel B. Ford, Edward Wells, Fahim Kouchakji, French&-Company, H.K. Monif, Jackson Higgs, Josef Beilouny, Kevorkian, Leon Dalva, M.A. Koshif, Parish-Watson&Company, R. Hein, Stora, Valentiner, Zado Noorian, and a few anonymous lenders (Aga-Oglu, 1930a).

In the introductory essay to the catalogue, Aga-Oglu (1930a) described "Mohammedan art" as "extends over three continents, Asia, Africa and Europe, encompasses a period of more than a thousand years, and is carried on by various peoples such as Arabs, Persians and Turks" (p. 3). As he listed all the previous civilizations that occupied this vast geography before the advent of Islam, he emphasized that Islamic art "as heir to all these civilizations... combine the technical traditions and artistic epochs into its own art" (p. 3). Despite the multiplicity of influences, Aga-Oglu emphasized that Islamic art "nevertheless forms a unit, the basis of which is found in the Mohammedan religion...[which] bridged national differences as well as historical traditions, forcing not only the spiritual interests but also the everyday customs of the varying countries into one uniform mould" (p. 3).

After this brief description, Aga-Oglu (1930a) provided information on each medium presented in the exhibition, starting with calligraphy especially seen in the Qur'an manuscripts, and moving on to the arts of the book, which was the most prominent section of the exhibition with 52 examples representing all schools of Persian painting and some examples of Indian painting, whereas Turkish painting was totally absent. In the catalogue, Aga-Oglu (1930a) presented Persia as the most important contributor to the Islamic painting tradition whereas Turkey did not have the right soil for its flourishment and had been under the influence of the Persian tradition (p. 6). Among the 171 objects in the exhibition, Turkish art was represented with 9 objects only: 4 ceramics (3 from İznik and 1 from Kütahya), 4 brocades and a carpet.

In some ways, this exhibition echoed the conventions of the time where prominence was given to Persian art in terms of the objects featured. The commonly held belief based on ethno-racial characteristics determined that Arab art was appreciated for the early Islamic and the medieval periods, Persians were considered to bring the very qualities to Islamic art that were most deserved to be appreciated with their decorative repertoire, whereas the Turks were renowned for their weaving traditions, such as carpets and textiles (Vernoit, 2000, pp. 6-7, 14; see also Necipoğlu, 2012, pp. 57-75; Cuddon, 2013, pp. 13-33). It would be too farfetched to claim that Aga-Oglu hierarchized the contributions of different ethnic groups in his catalogue essay as he outlined the origins, influences and development of each medium at different time periods and different geographies that Islam ruled as a religion. As outlined in the introduction of the catalogue and through the display of all schools and periods of Islamic art together, the underlying message that Aga-Oglu conveyed was one of unity, which the Islam religion provided the basis of.

However, it is important to point out that in the instance of the Islamic painting tradition, Aga-Oglu (1930a) stated that the Persians surpassed all others whereas Turkey "furnished but a poor soil for its development" (p. 6). Reiterating the commonly held notions of his time, this is an interesting remark coming from Aga-Oglu. In contrast to his contemporaneous scholars in the field, Aga-Oglu with his access to the collections in Turkey must have been more knowledgeable about the Ottoman book arts along with others. An anecdote shared in a letter by Riefstahl addressed to Berenson, in fact, give a quite limited but an interesting glimpse into Aga-Oglu's time in Istanbul. On March 9, 1929, Riefstahl enthusiastically reported on Aga-Oglu's discoveries in the Topkapı Palace Library to Berenson, claiming "the entire history of Islamic miniature painting will have to be first written or re-written on the basis of the Stamboul material". Riefstahl encouraged Aga-Oglu to publish his findings in the United States with American funding and assistance of American scholars under Aga-Oglu's guidance. Riefstahl envisioned this to be a perfect opportunity to realize his "own Institute idea" where American scholars would have the access to the "immense Seraglio material" and Aga-Oglu would be the bridge in-between. The idea to establish an institute by Americans came to Riefstahl when he learned about the authorization given to Germans to open an Archaeological Institute which had the support of Halil Bey and Köprülüzade Fuad Bey (Riefstahl, 1929a and b). To realize this, Riefstahl suggested to mobilize "two or three serious scholarly institutions in the United States" to apply for a starting grant to the Rockefeller Board. The first project Riefstahl had in mind was an Islamic architecture survey with four or five resident American scholars in Istanbul assisting him. Research on Classical and Byzantine material could be included at a later stage with a good library and quarters in Istanbul. While Riefstahl admitted "all that is pipe dreams now," he still thought that "this possibility of alliance with Mehmed (whom Halil loves fatherly) is a tremendous step ahead concerning all possibilities" (Riefstahl, 1929b).

This was only one among other enthusiastic letters Riefstahl sent to Berenson between 1927 and 1929 reporting on his new discoveries in Turkey and his interest in promoting Turkish art as he was carried away with the possibilities and opportunities of academic research during his stay. Riefstahl's own research varied from Turkish rugs to Seljuk architecture in Anatolia at this time. For instance, while in a July 1, 1927 dated letter, Riefstahl (1927) stated that "it is very curious how an exact analysis in the field of Turkish art brings new conclusions," on March 8, 1928, he added:

Deeper I enter the field of Turkish art, the more interesting and unpublished material do I strike. And in the long run I hope to be able to make a useful contribution to research by helping to open up this rather neglected field.

As for the libraries and the collection of the Evkaf Museum, where Aga-Oglu was the curator at the time, Riefstahl stated that there were "wonderful treasures," however "as far as buying possibilities are concerned, there is almost nothing left" (Riefstahl, 1928a).

Neither Riefstahl's idea for an American Institute in Istanbul (at least one focusing on the Islamic period) nor a collaboration with Halil Edhem or Aga-Oglu to promote Turkish art and collections materialized, and the art of the Seljuks and Ottomans did not receive the attention and appreciation in the United States that Berenson and Riefstahl enthusiastically advocated for in their letters, at least in their lifetimes.

Circling back to Aga-Oglu's 1930 exhibition, it preceded another significant exhibition for the field, that of *the International Exhibition of Persian Art* 

at Burlington House, London in 1931 organized by Pope. The exhibition and the events surrounding it received considerable press and public attention, enhancing the already established popularity of Persian art. For many, this exhibition was a landmark and "set the standard for those that followed" (Vernoit, 2000, p. 21). Many objects that were exhibited in London were also featured in the DIA exhibition. Both Aga-Oglu and Valentiner served on the organizing committee of the Burlington House exhibition and the DIA loaned six objects from its collection to the London exhibition ("Americans Lend Treasures of Art..., 1930, p. 34; "Annual Report for the Year 1930", 1931, p. 46; Simavi, 2012, p. 4).

On the academic side, during the International Congress of Iranian Art held in conjunction with the London exhibition, Aga-Oglu announced that he discovered a history of Persian painting written by the court painter Dost Muhammed in 1544 as a preface to the Bahram Mirza album in the Topkapı Palace Museum (TSMK H. 2154, Thackston, 2001). This scholarly contribution became a media story, featured even in news outlets such as The New York Times ("Persian Art History Discovered at Show ... ", 1931) as a discovery that "will alter the study of Persian art" and "will mean virtually the re-writing of the history of Persian painting" (p. 37). Since it was announced as a discovery Aga-Oglu made on this occasion in London, it could not be the discovery that Riefstahl referred to in his letter to Berenson.

## 5. Building a collection of Islamic art in Detroit

the early decades of its In establishment, the DIA had limited number of objects in its collection from the region, which were some antiquities acquired through legally excavated sites in the Middle East through their subscription to the Egypt Exploration Fund and the collection of Frederick K. Stearns, a pharmaceutical manufacturer who in 1890 donated 10,000 objects he obtained during his travels to the Near and Far East (Peck, 1991, pp. 40-41).

It was only starting in 1917 onwards that objects from the Islamic lands entered the museum's collection though few in numbers at first. In 1924, the DIA made its first purchases for the Islamic department: a 13th century ceramic bowl from Rayy and a 15th century Persian tile. The following year, 1925, witnessed a big leap in the number of acquisitions. 43 new acquisitions of this year were either gifts or purchases from well-known dealers such as Dikran Kelekian (1867-1951), Kirkor Minassian (1874-1944) and Pope. Among these, the majority of objects were from Iran, with a few examples from Turkey and Mughal India. The following few years from 1926 to 1928, until the arrival of Aga-Oglu in 1929, the acquisitions were again few in number and the Turkish pieces among these were all İznik pieces, either plates or tiles<sup>1</sup>.

This increased interest in the Islamic art from 1924 onwards must be due to Valentiner's directorship. As mentioned above, before becoming the director of the DIA, Valentiner worked at the MMA as their decorative arts curator and curated one of the earliest Islamic art exhibitions in the country with his 1910 loan exhibition of Oriental rugs. He also authored 7 articles between 1908 and 1913 in The Metropolitan Museum of Art Bulletin on Islamic art (Valentiner, 1908, 1909, 1910a and c, 1912, 1913a and b). Therefore, Valentiner had familiarity with Islamic arts from his curatorial experience in decorative arts. Moreover, he must have cultivated relationships with the New York based dealers during the years he was working for the MMA. For instance, Valentiner was corresponding with Riefstahl and Pope while in Detroit, and it was through them that he made some of his Islamic art purchases for the museum. To expand the Western art collection of the DIA, he was also working closely with dealers such as Sir Joseph Duveen (1869-1939), G. J. Demotte (1877-1923) and Kelekian, who are well-known for their access to the Near East. Hence, it would not be misleading to argue that Valentiner must have laid the groundwork upon which Aga-Oglu built the Islamic art collection at the DIA.



*Figure 4.* Islamic, Turkish, Dish, between 1565 and 1570, underglaze-painted fritware. Detroit Institute of Arts, City of Detroit Purchase, 28.145. (Url-3).



*Figure 5.* Islamic, Turkish, Tile, ca. 1600, underglaze-painted fritware. Detroit Institute of Arts, City of Detroit Purchase, 25.36. (Url-4).

In 1929, the year Aga-Oglu arrived to Detroit, 12 objects entered the DIA's collection of Islamic art. Then, right after the first Islamic art exhibition of the museum, Aga-Oglu was able to acquire as many as 45 objects in 1930 and 1931 as shown in the bulletins and annual reports of the DIA indicating that the exhibition played a key role for the DIA's collection acquisitions<sup>2</sup>. Some of the highlight objects of this period are the enameled glass bottle from Egypt purchased as a result of the 1930 exhibition from Otto Burchard, the Persian Qur'an written on colored Chinese paper from the 15th century, and 25 pieces of Persian ceramics purchased from Pope.

In the early 1930s, Aga-Oglu received many offers for the museum's collection, however, due to the depression era as well as his concerns regarding the artistic value and authenticity, he declined majority of them. Although Aga-Oglu was actively looking for Persian manuscript paintings to acquire, he could not get hold of many (Aga-Oglu, 1929a). His one major acquisition in this branch is a page from the Demotte Shahnama acquired in 1935. One of his aspirations was to bring together all the dispersed folios of the Demotte Shahnama for a publication project, but he was not able to materialize this during his lifetime.

## 6. Depression era and search for a new position

By 1932, the DIA being a city museum, reached to a point of not being able to support its staff members because the city almost became bankrupt due to the economic depression. Valentiner with the support from the president of the museum Mr. Edsel B. Ford (1893-1943), sent letters to colleagues across the United States to ask for positions for his staff.

In an April 13, 1932 dated letter, Valentiner wrote to Sir Joseph Duveen, a highly influential art dealer, asking for help in securing Aga-Oglu a position by speaking to his contacts should he have to leave the museum on July 1, 1932 due to economic constraints. A year later, on April 13, 1933, this time Valentiner approached the Freer Gallery of Art in Washington, DC for Aga-Oglu but the museum conforming with regulations imposed on the government agencies could not hire new staff members (Lodge, 1933). Berenson also contacted Boston MFA and the Fogg Museum at Harvard throughout the 1930s for a position for Aga-Oglu (Cuddon, 2013, p. 21). Becoming suspicious about motives then director of

the Fogg, Edward Waldo Forbes (1873-1969) made inquiries with a number of people on Aga-Oglu checking whether he was a true scholar or a dealer under disguise. In the end, he was assured of Aga-Oglu's integrity as a scholar, however Joseph Upton (1900-1981), assistant curator of Near Eastern art at the MMA, expressed that though Aga-Oglu "has a broad knowledge of Muhammedan art and of the cultural background," he believed "his historical and stylistic opinions are colored and biased by an attempt to make every source of inspiration and development in the field Turkish" (as cited in Cuddon, 2013, pp. 21-22).

It is important to point out here that while Aga-Oglu's doctoral dissertation was on Turkish architecture and his publications were mostly on Turkish art when he was in Turkey, his research in the United States did not have this focus, with the exception of one article that he published in The Art Bulletin entitled "The Fatih Mosque at Constantinople" (1930c). One reason for this could be the unavailability of the Turkish material in the United States. As a curator, he was drawing mostly from what was available in the American collections and on the American market for his exhibitions, acquisitions, and research projects; and in the 1930s the trend for Persian art was high in the United States. Moreover, as his offer letter indicated, one of his main duties was to educate the public

on Islamic art. Therefore, Aga-Oglu's projects focused on introducing this



*Figure 6.* Possibly Islamic, Syrian; possibly Islamic, Egyptian, Bottle made for the Rasulid Sultan Hizabr al-Din in Yemen, between 1296 and 1321, glass, gold, enamel. Detroit Institute of Arts, City of Detroit Purchase, 30.416. (Url- 5).



*Figure 7. Islamic, Iranian, Qur'an, 1450 - 1460, leather and paper with ink and gold. Detroit Institute of Arts, City of Detroit Purchase, 30.323. (Url-6).* 



*Figure 8.* Islamic, Iranian, Folio from the Great Mongol Shahnama: Ardashir Battles Bahman, Son of Ardavan, ca. 1335, ink, opaque watercolor, and gold on paper. Detroit Institute of Arts, Founders Society Purchase, Edsel B. Ford Fund, 35.54. (Url-7).

little-known art tradition to the audiences in the United States and establishing it as a scholarly field of inquiry with solid methodology. However, it should be stressed that with his publications Aga-Oglu brought attention to little or unknown works of Islamic art held in the museum collections of Istanbul such as his articles "Ein Prachtspiegel im Topkapu Sarayı Museum" in Pantheon (1930b); "Some Unknown Mohammedan Illustrated Manuscripts in the Library of the Topkapı Sarayı Müzesi at Istanbul" in Orientalistische "Islamische *Literaturzitung* (1931); Metallarbeiten aus Istanbuler Museen" in Belvedere (1932); "Preliminary Notes on Some Persian Illustrated mss. in the Topkapu Sarayı Müzesi, Part I" in Ars Islamica (1934) and his 1935 book entitled Persian Bookbindings of the Fifteenth Century.

In the end, Aga-Oglu secured a teaching position at the University of Michigan (UM), enabling him to stay in Detroit and keeping a joint appointment at the DIA and the UM simultaneously starting with the 1933 academic year ("Staff Changes", 1934, p. 14; Peck, 1991, p. 193), however, his curatorial position at the DIA was more of an honorary title which enabled him to organize joint programs with the museum and the university. This arrangement lasted until 1938 when Aga-Oglu resigned from his post at the University, which ultimately ended his honorary role at the DIA.

#### 7. Concluding remarks

Before his arrival at Detroit, in a letter dated March 23, 1929 to Valentiner, Aga-Oglu (1929c) wrote, "I shall come to the United States with great hopes, for I believe I shall find there an opportunity for useful work, which is the best thing a scholar can desire". Indeed, in the following twenty years that Aga-Oglu spent in the United States from 1929 to his death in 1949, he found the "opportunity for useful work" accomplishing many firsts for the study of Islamic art in the New Continent, which was made possible with support from institutions such as the DIA and the UM among others and a strong network of international scholars despite the hardships due to the economic circumstances as as the limited employment well opportunities due to the nascent state of the field. Although a collaboration with Riefstahl to further the research on Turkish art or acting as a scholarly bridge between Turkey and the United States as Riefstahl wished for Aga-Oglu did not materialize, Aga-Oglu was able to form an international platform to advance the scholarship on Islamic art in the United States through the journal, Ars Islamica, providing a venue for international scholars to share their latest research, as well as establishing the first academic program in the country, the Research Seminary in Islamic Art, transforming the UM into a leading institution for this new academic field.

As for the DIA, upon Aga-Oglu's departure Adele Coulin Weibel served

as the Near Eastern art curator from 1938 to 1949, then until 1963 as curator emeritus in addition to her role as textiles curator. Her career trajectory is reminiscent of Aga-Oglu. Trained in Europe, Weibel moved to the United States in 1915. She met Riefstahl in New York, who encouraged her to specialize in textile arts and around the same time her path crossed with Valentiner while she was a lecturer at the MMA. She returned to Europe to study with Arthur Weese at Berne and with Strzygowski at Vienna, and became curator of textiles at the DIA when Valentiner established the department in 1927 (Textile Department Records, 1876-1973, pp. 1-2).

During Weibel's curatorship, Near Eastern art galleries were re-arranged in 1942 ("Growth of the Collections", 1943, p. 35), however, no Islamic art exhibition was organized with the exception of an exhibition of Persian architecture photographs by the American Institute for Iranian Art and Archaeology in 1939 ("Accessions", 1940, p. 58). The collection continued to grow, though at a slow pace, with 40 acquisitions over the course of twenty years<sup>3</sup>, yet Weibel was quite a prolific textiles scholar along with many other responsibilities she assumed in her long career at the DIA (Textile Department Records, 1876-1973, p. 2).

When Valentiner retired in 1945, he had accomplished to create a world class collection for the DIA. His efforts are still lauded as his many important acquisitions "established the framework of today's collections" (Url-8). As for Valentiner's interest in Islamic art, it was not forgotten by the museum patrons, whose gifts in his memory to the DIA in 1958 were all works of Islamic painting.

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#### Endnotes

<sup>1</sup> All the acquisition information presented here is obtained through the Bulletins of the Detroit Institute of Arts of the City of Detroit between the years 1924 and 1929 and Object Card Records located at the Detroit Institute of Arts Research Library and Archives.

<sup>2</sup> All the acquisition information presented here is obtained through the Bulletins of the Detroit Institute of Arts of the City of Detroit between the years 1929 and 1931.

<sup>3</sup> All the acquisition information presented here is obtained through the Bulletins of the Detroit Institute of Arts of the City of Detroit between the years 1938 and 1959.

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## Dispute risk management in the procurement systems used in highrise building projects

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#### Abstract

Dispute risk is inherent in high-rise building projects because of project complexity and uniqueness. The type of dispute risk management required depends on the procurement method used. No previous study has focused on any specific type of project, such as high-rise building projects, although a need exists to manage dispute risks in procurement systems used in high-rise building projects. Thus, this study aimed to explore the systematic dispute risk management in traditional method with measure and pay (M&P), traditional method with lump sum (LS), and design and build (D&B) with LS procurement systems used in high-rise building projects. Delphi technique comprising three rounds of a questionnaire survey was used to collect the empirical data. By analysing the collected data, dispute risk factors were identified; the severity of the risk factors was assessed; the identified risk factors were allocated among the client, consultant, and contractor; and the appropriate risk response strategies were identified in respect of the procurement systems. 'Lack of skilled labour' and 'inability to complete work on time' were the two most significant risk factors of all three procurement systems. In risk allocation, the risk should be allocated to the party that can best tolerate and manage the risk. Risk response strategies were found to be common in all three procurement systems. Dispute risks can be avoided at the commencement of the project itself by accommodating standard conditions of the contract together with an appropriate (this can be innovative) procurement system.

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#### Keywords

Dispute risk, High-rise buildings, Procurement systems, Risk management.

#### 1. Introduction

The construction industry is particularly prone to risks because of the highly variable atmosphere created by its complex and dynamic project which environments, ultimately lead to disputes (Fevranoglou & Diakaki, 2019). Dispute risks can cause disagreements among project stakeholders in the absence of systematic risk management and appropriate procurement systems making proper risk allocation difficult (Artan Ilter & Bakioglu, 2018), adversely affecting the technical, operational, socio-political, and business aspects of the project (Cakmak & Cakmak, 2014). Hence, effective risk management, a challenging task for industry practitioners, becomes necessary (El-Sayegh, 2014; Mishra & Malik, 2017). The successful implementation of an effective risk management system is heavily influenced by three procurement variables: project delivery method, the form of payment, and collaboration or partnering arrangements (Younis et al., 2008; Jayasuriya & Rameezdeen, 2011; Xiong et al., 2017). With construction becoming projects increasingly complex and dynamic, different procurement systems have come into play (Osipova, 2008; Khemiri et al., 2017). Each of these procurement systems involves contracts, contractual relationships, information flows, and varying roles and responsibilities within the planning team (Khemiri et al., 2017), requiring a change in the traditional approaches of risk management (Dey & Ogunlana, 2004; Hubbard, 2020).

Risk perception is mostly subjective, and most risk management studies that have been conducted based on surveys and case studies have focused on one stakeholder (Kartam N.A. & Kartam S.A., 2001; Wang & Chou, 2003; Wiguna & Scott, 2006; Xia et al., 2018). Nevertheless, the aim of risk management is to reduce the risks faced by all stakeholders, regardless of which stakeholder carries the risk (Hubbard, 2020). Thus, when determining risks in a project, all the parties should be taken into consideration (Eke et al., 2019). Hence, understanding the combined role of contracting parties in risk management will be important.

Out of many stakeholders involved in a construction project, usually, a large interaction is expected from the internal stakeholders (specifically client, contractor, and consultant) with regard to the finance and management aspects of the project; hence, their engagement is worth special attention (Ujene & Edike, 2015). Since the roles and responsibilities of different contracting parties depend on the client's criteria for procurement, procurement influences risk management (Deep et al., 2018). Rameezdeen and Silva (2002) and Sivakumaran et al. (2015) classify procurement systems based on the project delivery methods adopted [traditional method, integrated systems (design and build), management-oriented systems, and collaborative systems] and on the form of payment [lump sum, measure and pay, and prime cost]. While there is an underlying need to manage the risks depending on the procurement system used, the complexity and dynamic nature of high-rise building projects increase the uncertainty and risks of the projects (Basari, 2017; Sakthiniveditha & Pradeep, 2015).

There are numerous past studies on systematic risk management in avoiding construction disputes (Younis et al., 2008; Arslan et al., 2017). Moreover, there are many studies that cover risks associated with high-rise building projects (San Santoso et al., 2003; Hassanain, 2009; Nieto-Morote & Ruz-Vila, 2011; Basari, 2017). In addition, some researchers have focused on the risk management of different procurement systems (Bing et al., 2005; Ogunsanmi et al., 2011). Even though highrise building projects are increasing (Li et al., 2018), no studies on the dispute risks of procurement in high-rise building projects have been conducted. Thus, the literature that deals with project dispute risks of procurement in high-rise building projects is scarce. Moreover, this study adopted a holistic approach, unlike most other studies on construction risks faced by only one project stakeholder (Kartam & Kartam, 2001; Wiguna & Scott, 2006).

The aim of this study, therefore, was



*Figure 1.* Conceptual flow chart of dispute evolution, Adapted from: Younis et al. (2008).

to address the knowledge gap in risk management by exploring the dispute risk factors of procurement in highrise building projects. The objectives of the study were to (1) determine procurement systems frequently deployed in high-rise building projects, (2) evaluate the most significant risk factors that can create disputes in the identified procurement systems, (3) determine risk allocation among the internal stakeholders of the identified procurement systems, and (4) determine the risk response strategies appropriate for the identified risk factors.

The following sections present the findings of a comprehensive literature review, the methodology used in the study, and the findings of the study. The conclusion, recommendations, and potential future research directions are finally presented.

#### 2. Literature review 2.1. Disputes as a risk in construction

The risks in the construction industry are frequently either disregarded or illogically dealt with by simply adding a contingency to the cost estimate (Addo, 2015), resulting in expensive delays, litigation, bankrupt contractors, poor contractor performance, and high construction project cost (Renault et al., 2016). Since this approach is ineffective, procurement systems have been significantly changed, with clients allocating greater risks to contractors (Wang, & Wang, 2022; Baloi & Price, 2003). Thus, the management of risks has become an all-time need for completing projects on time and conforming to the expected quality and safety requirements while remaining within the expected budgets (El-Sayegh, 2014; El-Sayegh et al., 2021). Various risk management processes have been developed by past researchers. According to Lee et al. (2019), dispute risks in construction can also be managed by employing these processes. This study adopted the process outlined by Kayis and Amornsawadwatana (2007), which has a three-fold approach: risk identification, risk assessment, and risk treatment. Furthermore, risk treatment is divided into two steps: risk allocation (Perera et al. 2009) and risk response (Jayasudha & Vidivelli, 2016).

In the construction industry, many disputes arise because of its complexity, high riskiness, competition, and multidisciplinary environment Cakmak & Cakmak, 2014). Conflicts, which lead to disputes, are 'inevitable in human relationships' (Karthikeyan & Manikandan, 2017). In construction projects also, disputes are inevitable because of the involvement of humans with various perceptions. Ojo (2010) reflected that risk occurrence in construction projects, which is not well analyzed or integrated, is a leading cause of claims and disputes. Figure 1 demonstrates how risks lead to disputes and the factors that influence dispute evolution.

Construction disputes incur costs, both direct and indirect, to different parties, and the costs and antagonism increase as the disputes escalate in the later stages of the projects. The situations can go out of control with indirect costs when one party starts blaming another party for the actions/ inactions of the latter that have caused damages to the first party, thereby amplifying the disputes (Saleh, 2019). However, dispute resolution also costs money, and the magnitude and severity of the dispute would not be known until the dispute has occurred (Song et al., 2009). When the frequency of the disputes is not known, the potential total dispute resolution cost remains uncertain (Song et al., 2009). Thus, disputes create risks and vice versa. Although not all risk factors lead to disputes, factors such as the procurement selection method and behavioural attitude have an impact on the causal chain that leads to a dispute risk (Younis et al., 2008). Therefore, proper procurement selection is one approach that can be adopted to manage risks.

## 2.2. Procurement systems adopted in high-rise building construction

No studies have been conducted on the risks of procurement in high-rise building projects. However, a clear link exists between the studies conducted on the risks of high-rise building projects and studies on the risks of common procurement systems.

Procurement systems are categorized into four broader types as the traditional method, integrated systems (design and build), management-oriented systems, and collaborative systems based on the project delivery and as a lump sum, measure and pay and prime cost based on their form of payment (Rameezdeen & Silva, 2002). The traditional method or the separated systems method is the most widely used project delivery method in many countries, where the construction starts after the design is completed (Eriksson & Laan, 2007; Sackey & Kim, 2018). The client first appoints a consultant to do the design, and after completing designing in fully, the tendering procedure is held, and a contractor is selected thereafter to carry out the project (Ali et al., 2022; Tang et al., 2019). Design and build have several forms where it is characterized as the contractor taking both design and construction responsibility (McDermott, 1999; Sackey & Kim, 2018). In lump-sum arrangements, the contract sum is agreed before the construction starts, and the risk is very high to the contractor (Rathnasabapathy & Rameezdeen, 2006; Gad et al., 2020). Measure and pay contracts are used where the work has been substantially designed, but final details have not been completed while the contractor is paid according to the amount of work done as measured after the physical completion (Wijewardana et al., 2013). Based on the fundamental principles, several combinations like traditional method with measure and pay, traditional method with lump sum, design and build with measure and pay, design and build with lump sum, are commonly used.

Studies on common procurement system risks, such as Oztas & Okmen (2003) and Gad et al. (2020) on Design And Build (D&B) delivery and fixed price-lump sum payment; Bing et al. (2005) on the private finance initiative, and Ogunsanmi et al. (2011) on D&B have identified the common risks of procurement, which are similar to the most significant economic and financial risks of high-rise apartment projects identified by Perera et al. (2020). Therefore, although under-researched, the risks of project procurement could be significant in high-rise building projects.

#### 2.3. Need for dispute risk management in the procurement systems of high-rise building projects

Disputes in construction projects caused by various risk factors have to be managed because of their irreversible negative impacts on the project (Zhong et al., 2022). A major benefit of risk management in construction projects is that it enables to selection of the most appropriate form of procurement/contract (Zhao et al., 2013). Procurement dispute risks are inherent to certain types of projects, such as high-rise building projects, even if the procurement system has been wisely selected (Mante et al., 2012). Almost all cities in the world have been developing their urban habitat skyward (Fernando, 2016). Increased competition among the projects demands systematic risk management (Ogunsanmi, 2016). Although the procurement system adopted in the project can create risk factors leading to disputes among the project stakeholders (Mante et al., 2012), the impact of the risks can be minimized through the systematic management of the risks. Highrise building projects have specific types of risks owing to their size and complexity (Nieto-Morote & Ruz-Vila, 2011); dynamic nature and project duration constraints (Basari, 2017); high-cost overruns (Fernando, 2016); management and design process (San Santoso et al., 2003); and high occupant density, design configuration, and excessive fuel load during a fire (Hassanain, 2009; Rahmani & Salem, 2018; Sakthiniveditha & Pradeep, 2015). While risk is just only one of the governing parameters of procurement

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Table 1. Risk factors of high rise buildings.

1. Physical risk		1. Earthquake 2. Landslides and subsidence	1		1	1	1
		3. Fire	1			1	1
		5. Heavy rain	1			1	
		6. Flood 7. Extraordinary wind	1		1	1	
2. Personal risk	2.1	8. Pestilence 1. Frequent job changes by skilled labour	4	$\vdash$	-	1	1
	Technician and labour	2. Lack of skilled labour 3. Lack of unskilled labour	1			1	4
		4. Strikes and labour disputes	1		1	ľ	ľ
		5. Low productivity 6. Poor workmanship	1	1		1	
		7. Brawls and fighting 8. Use of illegal foreign labour	1				
		9. Gambling	4				
		11. Unable to understand drawings	1			1	
	2.2	12. Communication problems 1. Lack of funds to proceed with work (Insolvency)	1	$\vdash$			1
	Subcontractor	2. Lack of required technical skill 3. Unable to finish work on time	1				
		4. Low quality of work 5. Linable to find qualified subcontractors	1			~	,
		6. Low productivity	1	1		~	Ť
		8. Subcontractor unable to afford adequate labour	1				
		9. Subcontractor takes jobs in several projects 10. Subcontractor abandons project	1				
	2.3 Contractor	1. Incompetence and lack of responsibility 2. Absenteeism	4				
		3. Brawls 4. Lack of experienced staff	1				,
	2.4 Engineer	1. Incompetence and lack of responsibility	4	Ý			~
		2. Absenteeism 3. Brawis	4				
	2.5	4. Lack of experienced staff 1. Does not understand his role/duty	1	1			1
	Consultants	2. Poor construction method 3. Delays in materials and shop drawing approximate	4				
		4. Communication and coordination problem	1			ľ	1
		5. Unsnohesty 6. Unaccountability of work	1				
	2.6 Client	1. Interference 2. Change orders	4	1		1	1
		3. Client lacks the managerial capability 4. Quality expected beyond standard and exectification	1	Ĺ		Ľ	ĺ,
3. Technical risk	3.1 Materials	1. Affordable material is more expensive than researched in BOO	1			1	-
		2. Proposed materials are not approved 3. Material shortage	1				
		4. Late material delivery	1	1	ľ	1	
		<ol> <li>Quainy of material below standard</li> <li>Material damage during storage</li> </ol>	1	1		1	1
	3.2	7. Material damage during transportation 1. Low productivity and efficiency	4	1	-	1	-
	Equipment	2. Frequently out of order or damaged 3. Inappropriate equipment causes problems	1			1	
		4. Unavailability of spare parts or cost is high	1		1		
		5. Need to import from other countries	1				
	3.3	7. High maintenance cost 1. New technique is required	1	$\vdash$	1	1	-
	Technique 3.4	2. Quality criteria are difficult to achieve 1. Failure to construct as planned	4	-			1
	Construction Process	2. Coordination problems 3. Delay on the procession the of site after LOA	1				1
		4. Communication problems	1	1		1	1
		<ol> <li>Ked tape in liaisons with public service consumes too much time</li> </ol>	1				
		<ol> <li>rregularity of workload</li> <li>Severe climate causes low productivity</li> </ol>	1				
		8. Errors or omissions in BOQ 9. Insufficient time to prepare bids	1				1
	3.5	10. Delay of information from designers 1. Access problem	4	-	-	1	-
	Construction	2. Construction site is adjacent	1			ľ	
		4. Traffic congestion	1	1			
		5. Local regulations 6. Theft	1	1			1
	3.6 Ground	7. Project is threatened by hooligans 1. No site investigation or boring log	1	-			-
	condition	2. Inadequate site investigation 3. Errors in information of site investigation	1	1			1
		4. Unforeseen problems	1				
<ol> <li>Satety accident risk</li> </ol>		<ol> <li>severe accidents occur</li> <li>Inappropriate machine induces accident</li> </ol>	1	1	1		
		3. Machine is not checked before operating 4. There is no fence or protection net	1		1	1	
5. Construction		5. There is no fire protection system at site 1. Inadequate and ambiguous specifications	1	1		1	./
Design causes risk		2. Errors in drawings	1			1	Ľ
		mcomplete design scope     4. Need innovative construction methods	1	ľ			1
		5. Need new materials and equipment 6. Non-standard details of drawing induce low quality	1				
		of work and error in the estimate 7. Likelihood of change	1				
6. Political and		8. Incompatibility between drawings and method 1. Frequent changes in law	4				
regulation risk		2. War, revolution and civil disorder 3. Requirement to use least interve	1		1		
		requirement to use local labour     4. Customs and import restrictions	1				
		5. Unstable politics 6. Embargo	4		1		1
		<ol> <li>Long procedure for approval and permits</li> <li>Cost for corrupt government officials</li> </ol>	1	1			
7. Financial risk		1. Payment risk of completed work 2. Skow payment by clients due to disputes	4				
		3. Retention is not returned	1	ľ	×	ľ	ľ
		<ol> <li>Enquisated damages for delay</li> <li>Adequate payment for variations</li> </ol>	1				
		<ol> <li>Financial problems due to errors in estimating</li> <li>Loss due to default of contractor, subcontractor.</li> </ol>	1				1
		supplier or client 8. Inflation	1	1		1	1
		9. Exchange rate fluctuation 10. Local and national taxes are high	1	1	1		Ê
		11. Bid and performance bond are unfairly called	1				
		13. labour cost is higher than predicted	1				
8. Contractual		14. Material cost is higher than predicted 1. Unfair and unreasonable stipulation	4	$\vdash$	$\vdash$	$\vdash$	-
risk		2. Ambiguous clauses that have several meanings 3. Work conditions differ from contract	1				1
		4. Misinterpretation	1				
		<ol> <li>Extent of work differs from contract</li> <li>Red tape in litigation</li> </ol>	4	L			L
0 Country and		1. Construction process causes pollution	1	1			
regulations		2. Waste treatment required by law	1.4				

system selection, the special characteristics of high-rise building projects also matter in procurement system selection, making procurement complicated and thus risky (Luu et al., 2003).

There have been numerous studies conducted on risk management

in the construction sector (Williams, 1995; Wang et al., 2004). A substantial amount of study has been conducted on various elements of risk management around the world (Wiguna & Scott, 2006) with several country-specific models on how to identify, analyse, and manage severe risks. These studies have sufficiently covered contracting parties' perceptions of risk and risk managemen (Kangari, 1995; Cheung, 1997; Ahmed et al., 1999; Kartam & Kartam, 2001; Rahman & Kumaraswamy, 2002) whilst directing both practitioners and researchers on effectively managing risk. However, the majority of the research cited above were primarily based on a single set of project participants. In most cases, only the contractor's point of view was taken into account when determining risk factors (Kangari, 1995; Ahmed et al., 1999; Bing et al., 1999; Kim & Bajaj, 2000; Kartam & Kartam, 2001; Wang & Chou, 2003; Fang, Fong, & Shen, 2004; Wiguna & Scott, 2006). However, risk management attempts to reduce hazards for all stakeholders, regardless of who bears the risk (ASCE, 1979). As a result, the project risk should not be evaluated just by the perspectives of one side. Furthermore, risk management examines the whole project cost as a result of the perceived risks of the many stakeholders, instead of just the costs absorbed by individual parties independently (Rahman & Kumaraswamy, 2002). As a result, it is critical to comprehend the contracting parties' collaborative effort toward risk management.

Santoso et al. (2003) has developed risk factors which generally suits to high rise projects in Jakarta by filtering and modifying risk factors derived from various researches. But it emphasis risk factors only important to contractors. Therefore, risk factors for this study purpose is listed out by filtering the risk factors used by Santoso et al. (2003). Only risk factors relevant to Sri Lankan high-rise projects were filtered from a preliminary survey, and the author's experience with high-rise buildings was applied. This risk factors adopted for this research is give in Table 1 below under the risk taxonomy used by Santoso et al. (2003).

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Research has been conducted on the importance of systematic risk management in avoiding construction disputes (Younis et al., 2008; Arslan et al., 2017) and on the risks associated with highrise building projects (San Santoso et al., 2003; Hassanain, 2009; Nieto-Morote & Ruz-Vila, 2011; Basari, 2017). Few researchers have focused on the risk management of different procurement systems (Bing et al., 2005; Ogunsanmi et al., 2011). However, none of these studies has focused on any specific type of projects, such as high-rise building projects, although a need exists to manage dispute risks in procurement systems deployed in high-rise building projects. This study adopted a holistic approach, unlike most other studies on construction risks faced by only one project stakeholder (Kartam & Kartam, 2001; Wiguna & Scott, 2006). Therefore, the study aimed to address the literature gap and the industry need for dispute risk manage-

ment in the procurement systems adopted in high-rise building projects through risk identification, risk assessment, risk allocation, and risk response in respect of the main project internal stakeholders, namely, the contractor, client, and consultant.

#### 3. Methodology

Describing risks qualitatively is considered convenient; however, researchers object to that type of approach as the collected data would then depend on linguistic variables and be subjective, giving imprecise outcomes (Islam & Nepal, 2016). Delphi is acceptable in risk-based construction research (Markmann et al. 2013; Perera et al. 2014; Hosny et al., 2018; Jepson et al., 2020), especially when data is to be collected through a questionnaire survey. Delphi can be applied in risk management owing self-validating mechanism to its (Sourani & Sohail, 2014). Therefore, this study adopted the modified Delphi technique, a quantitative approach, to determine the risk factors that lead to disputes in procurement systems deployed in high-rise building projects and how they should be allocated and responded to. The study used

a modified Delphi approach as the experts reach an agreement in the first round then in the second round, the question is eliminated since the expected result is achieved. Further, Chan (2022) proved that using the Delphi consensus method is more significant in validating the gathered and reviewed data. According to Xia & Chan (2012), an acceptable degree of consensus can be achieved by conducting the Delphi in three rounds; thus, this study had three rounds, namely Round 1, 2, and 3.

The data were collected using the questionnaire survey technique. The questionnaires were designed to target each objective of the study. The Delphi round 1 was a preliminary survey to identify types of procurement systems used in high-rise buildings and risk factors leading to disputes in procurement systems of high-rise building projects, where the literature findings were illustrated in tabular format for the respondents to provide their responses. Similarly, the remaining two rounds followed the same approach where literature findings and findings from previous rounds were presented in tabular formats.

#### 3.1. Delphi round 1

## 3.1.1. Part 1: Procurement systems frequently used in high-rise building projects

From the literature, six procurement systems were identified under two categories. They were thereafter assessed based on their applicability for 'individual use' or for 'use in combined systems'.

## 3.1.2. Part 2: Risk factors that lead to disputes in procurement systems of high-rise building projects

The experts were presented with 130 risk factors of high-rise building projects identified from the literature and were asked to indicate whether they lead to disputes or not by marking them with a "YES" or a "NO," respectively.

#### 3.1.3. Evaluation

Procurement systems that scored above 50% were identified as being common,

and the risk factors that scored above 50% were identified as causing disputes in procurement systems deployed in high-rise building projects.

#### 3.2. Delphi round 2

3.2.1. Part 1: Severity of the risk factors that lead to disputes in the procurement systems commonly used in high-rise building projects

The experts were asked to comment on the severity of the risk factors shortlisted from Round 1 by considering the frequency and impact under each procurement system identified. The frequency of occurrence ' $\alpha$ ' and the significance of the impact ' $\beta$ ' of each risk factor had to be indicated using a 5-point scale varying from very low to very high. The severity index was constructed to rate the risk factors based on their criticality. Equation 1 (top) and Equation 2 (bottom) given below were used to calculate the severity index of each risk factor.

 $S_{j=}\alpha_{j}\beta_{j}$ 

 $S_i^{\dagger} = \text{Risk severity level indicated of i<sup>th</sup> risk factor indicated by the j<sup>th</sup> respondent$  $<math>a_i = \text{Frequency level of risk occurrence indicated by the i<sup>th</sup> respondent$  $<math>\beta_i = \text{Significance level of risk occurrence indicated by the j<sup>th</sup> respondent }$ 

 $RS^i = \frac{\sum_{i=1}^n s_j^i}{\sum_{i=1}^n s_j^i}$ 

 $RS^i$  = Risk Severity Index of i<sup>th</sup> risk factor n = number of responses

This method had been used by Zou et al. (2006), Sun et al. (2008), and Perera et al. (2014).

#### 3.2.2. Part 2: Allocation of risk factors of procurement systems commonly deployed in high-rise building projects

The experts were asked to strike-out the parties (client, contractor, and/ or consultant) who should not be allocated any risks.

## 3.2.3. Part 3: Risk response strategies applicable to dispute risks in high-rise projects

The experts were presented with 15 risk response strategies applicable in highrise construction projects identified from the literature and were asked to indicate whether they are applicable or not by marking them with a "YES" or a "NO," respectively.

#### 3.2.4. Evaluation

The parties to which risk should be allocated and which risk response methods are suitable for the next round can also be identified (when above 50% is achieved).

#### 3.3. Delphi round 3

#### 3.3.1. Part 1: Risk allocation among the main three internal stakeholders of a construction project (for most significant risk factors)

When a risk factor occurs under the listed procurement processes, the experts were asked to designate the percentage of risk that should be borne by each party. To analyse the results, the average method was used as shown below (Equation 3).

 $A^i = \frac{\sum_{j=1}^n P_j^i}{n}$ 

A<sup>i</sup>= Average Percentage of Risk allocation of i<sup>th</sup> party P = Rating (percentage) of each Factor given by the j<sup>th</sup> respondent n = Number of responses

## 3.3.2. Part 2: Risk response strategies applicable to the significant risk factors

The experts were asked to identify from among the response strategies shortlisted in Round 2, the response strategy most suitable for each of the risk factors identified as significant. The Relative Importance Index (RII) was used to evaluate the significance of each risk response strategy. RII facilitates the evaluation of a nonparametric sample by giving a value for each factor and is commonly used to determine the relative significance of several attributes (Doloi, 2008) using Equation 4 given below.

 $RII = \frac{\sum Wn}{NA}$ 

 $\label{eq:W} \begin{array}{l} W = Rating \mbox{ of each factor given by the respondent} \\ n = Frequency \mbox{ of the responses} \\ N = Total number \mbox{ of responses} \\ A = Highest weight \end{array}$ 

The adopted research methodology is graphically illustrated below,

As the sample of the survey, 35 ongoing high-rise building projects which consisted of more than 20 floors were selected. This is covered almost all high-rise

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construction projects over 20 floors in Sri Lanka. The questionnaires were sent to 90 professional engineers, quantity surveyors, and architects in those 35 projects who possess more than 15 years of experience in high-rise projects. Each project stakeholder, namely the client, constructor, or consultant, was represented by 30 out of 90 sample of experts. All of the experts possessed good communication skills and were willing to participate in all three rounds of the questionnaire survey. The questionnaire survey was conducted either face-to-face or via email. The interviewee profiles and the response rates are given in Table 2.

Most of the Managing Directors, Construction Managers, and Project Managers selected for the questionnaire survey have worked as Risk Managers in highrise projects. Further, the risk management division is a subdivision under the project management unit in most of the projects.

#### 4. Findings and analysis

The study findings are discussed under three headings: procurement systems frequently used in high-rise building projects, dispute risk factors that are significant, risk allocation among internal project stakeholders, and risk response strategies. One of the major concerns in data collection is the reliability of the responses. Therefore, Cronbach's alpha value was calculated during each round, which is considered a measure of internal consistency (Bonett & Wright, 2014). Cronbach's alpha value should surpass the 0.700 threshold, if the alpha value tends more towards 1 more, it is considered to be more reliable (Aghimien, Aigbavboa, & Oke, 2020). During all three rounds, Cronbach's alpha value exceeded the 0.7 thresholds implying that the questionnaire inputs were consistent and reliable.

#### 4.1. Procurement systems frequently used in high-rise building projects (Delphi round 1: Part 1 findings)

According to the survey results, four procurement systems are frequently used in high-rise building projects, namely the traditional method with measure and pay (M&P), traditional method with Lump Sum (LS),



#### Figure 2. Research methodology.

D&B with M&P, D&B with LS with percentage responses of 43%, 23%, 28%, and 6%, respectively. Since combining D&B with M&P is not encouraged and considering the relatively low response, this procurement system received only the traditional method with M&P, traditional method with LS, and D&B with LS were considered in the next round.

#### 4.2. Significant risk factors which lead to disputes of the procurement systems (Delphi round 1: Part 2 and Delphi round 2: Part 1 findings)

One hundred and thirty risk factors related to construction disputes were identified from the literature, and the two risk factors, earthquakes and landslides/ subsidence among them, were considered inappropriate as they only occur in particular geographic regions. Seventy-eight respondents (87%) agreed that the remaining one hundred and twenty-eight risk factors could cause disputes. The respondents

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Table 2. Survey samples of the Delphi rounds.

Designation	Nr of years with high- rise experience	Round 1	Round 2	Round 3	
Managing Director	20+	4	3	3	
Commercial Manager	20+	6	5	5	
Arbitrator	15 to 20	7	7	6	
	15 to 20	1	1	0	
Project Manager	20+	5	5	5	
	15 to 20	5	5	5	
Construction Manager	20+	4	3	3	
2	15 to 20	4	4	4	
Contracts Manager	20+	2	2	2	
	15 to 20	8	8	8	
Chief Architect	20+	3	2	2	
	15 to 20	5	5	5	
Chief Engineer	20+	5	4	3	
	15 to 20	5	5	4	
Chief Quantity Surveyor	20+	2	2	2	
Total number of responses		66	61	57	
Frequency of the responses		73.3%	67.8%	63.3%	

**Table 3.** Severity Indexes of the risk factors of procurementsystems used in high-rise building projects.

			Severity Index						
Risk Taxonomy	Risk Sub Taxonomy	Risk Factor	Traditiona I method with LS	Traditiona I method with M&P	D&B with LS				
1. Personal risk	1.1 Technician and labor	R1. Frequent job changes made by skilled labor	14.94	14.85	14.76				
		R2. Lack of skilled labor	20.41	20.68	20.44				
		R3. Lack of unskilled labor	14.76	15.00	14.88				
		R4. Poor workmanship	13.91	14.03	14.12				
	1.2	R5. Lack of technical skills	15.12	15.12	15.35				
	Subcontractor	R6. Inability to complete work on time	19.44	19.71	19.85				
		R7. Subcontractors' inability to afford the required labor	13.06	12.97	12.94				
		R8. Subcontractors' involvement in several projects	14.09	13.97	13.74				
	1.3 Contractor	R9. Lack of experienced staff	12.29	12.29	16.29				
	1.4 Consultant	R1O. Lack of understanding of the roles/duties	15.50	16.09	2.44				
		R11. Delays in receiving material and shop drawing approvals	16.82	16.35	3.06				
		R12. Communication and coordination issues	16.15	16.32	2.68				
	1.5 Client	R13. Interference	15.94	15.88	15.79				
		R14. Change orders	15.06	15.29	15.56				
2. Technical	2.1 Technique	R15. Need for a new technique	8.62	8.38	13.44				
risk	2.2 Construction process	R16. Insufficient time available to prepare the bids	16.94	9.74	16.59				
		R17. Delay in receiving information from the designers	14.94	15.32	5.59				
3. Construction		R18. Need for innovative construction methods	11.41	11.41	17.91				
risk		R19. Need for new materials and equipment	11.44	11.44	13.97				
4. Political and		R20. Frequent changes made to the applicable laws	11.74	11.91	14.88				
regulation risk		R21. Requirement to use local labor	13.06	13.06	13.15				
5. Financial risk		R22. Actual labor cost becoming higher than the predicted labor cost	11.74	11.35	14.76				

LS: Lump Sum, M&P: Measure and Pay, D&B: Design and Build

were also free to include any new risk factors.

The significance of each risk factor was calculated based on its severity index as outlined in the section on "Research Methodology", and only the risk factors that had severity indexes exceeding 50% (>12.5) were identified as significant Perera et al. (2014) justified that the cut off can be above 25%) (Table 3).

In Table 3, the degree of severity has been indicated using a colour scale in which black depicts the highest severity and light grey the lowest severity. White tabs denote that the risk factor is insignificant.

Only five risk taxonomies among the identified nine were found to significantly contribute to disputes in high-rise building projects. Physical risks, accident risks, contractual risks, and legislative risks were found to be insignificant. Even though the impacts of physical and accident risks are high, their occurrence has a very low probability, which makes them insignificant. The mitigation actions employed in high-rise building projects also make them insignificant. This is because of the mitigation actions already taken by each high rise project in Sri Lanka due to its high risks and legal influence. All five risk taxonomies are significant in D&B with LS systems, while personal risks, technical risks, and political and regulatory risks are significant in both traditional method with LS and traditional method with M&P systems. Out of the 22 risk factors, 16 are significant in traditional method with LS systems, 15 is traditional method with M&P systems, and 18 in D&B with LS systems.

The four consultant-relevant-risk factors, namely 'lack of understanding about the roles/duties', 'delays in receiving material and shop drawing approvals', 'communication and coordination issues,' and 'delays in receiving information from the designers' are insignificant in D&B with LS systems although they are significant in the other two procurement systems. This insignificance can be attributed to the poor involvement of the consultants in D&B with LS systems in which the consultant is only involved in construction supervision and not in designing. The reason for it may be the comparatively less involvement of consultants in D&B with Lump Sum systems as they only involve in the construction supervision part but not in the design part. However, delays in receiving information from the designers are not applicable in D&B with LS systems as the designing in these systems is done by the contractor.

The risk factors 'lack of experience in contractor's staff,' 'need for a new technique,' 'need for innovative construction methods,' 'need for new

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materials and equipment, 'frequent changes made to the relevant laws,' and the 'actual labour cost becoming higher than the predicted labour cost' is significant only in D&B with LS systems since, in these systems, the contractor does the design only after the design cost has been finalized. Labour can be categorised as skilled and unskilled, and it can be noted that the risk significance of labour scarcity in both aspects is quite different from each other. This is because high-rise constructions require a skilled and well-trained labour force. Therefore, their shortage of service is more significant than unskilled labour. Besides, there is a risk of a shortage of unskilled labour also due to attractive job opportunities in other fields like agriculture, transport, etc.

The risk factor 'insufficient time to prepare bids' is insignificant only in traditional method with M&P systems, because in these systems, the contract sum is determined only after the construction has commenced, and the contractor is paid according to the amount of work done measured after the physical completion of the work. Therefore, the risk is less than the risk of any other system.

'Lack of skilled labour' and 'inability to complete work on time' are the two most significant risk concerns in all three procurement systems. The 'need for new building methods,' which is relevant exclusively in D&B with LS systems, is the third most significant risk factor.

Building maintenance units, Aluminum and glazing systems, IT infrastructure systems, and vertical transportation systems, which are unique to high-rise building projects, require special skills. Even though most of the other types of buildings also have these services, high-rise buildings require special installation/ maintenance skills in respect of these services. Even though most of the other buildings also have services such as LPG gas, fire protection, mechanical ventilation and air conditions, electrical, drainage, home automation, high rise buildings require special skills for those due to their complexity. For instance, a chiller system may require for high rise buildings while others are using normal split

units. Moreover, there is a construction boom in Sri Lanka as a result of foreign investments in post-war development, which has ultimately resulted in a highskill labour scarcity. However, in accordance with Sri Lankan law, foreign labours are not allowed to work in Sri Lanka, and only a few can be recruited for Board of Investment (BOI) projects under the special approval of BOI.

Although high-rise building planning is done considering the complexity of the buildings caused by their heights, time extensions cannot be avoided during their construction. Variations issued by the client also require time extensions. Most high-rise buildings are apartments, in which clients usually request changes, thereby delaying all interrelated works and causing time extensions. Therefore, completing work on time is highly risky.

'Need for innovative construction methods' under design risk is the third most significant risk in D&B with LS systems, where the contractor does both the design and construction for a pre-determined price. Designing and constructing high-rise buildings using innovative methods without obtaining the services of specialist consultants is challenging despite its high demand. Even though the D&B contractor can outsource specialist consultants, determining the cost in advance becomes difficult because it has been pre-determined, thereby making the exercise highly risky.

#### 4.3 Allocation of significant risk factors which lead to disputes among the internal stakeholders of the significant procurement systems (Delphi round 2: Part 2 and Delphi round 3: Part 1 findings)

Risk allocation of significant risk factors of each procurement system to the client, contractor, and consultant is shown in Table 4. The black tabs depict the findings of Delphi Round 2: Part 2, during which the parties were not allocated any risks. Risk allocation percentages that are higher than 50% are shown in grey, while the percentages lower than 50% are shown in white.

The contract agreement, contract

conditions, specifications, preamble notes, and so on allot risk among the parties. Generally, according to contract conditions, the client and the contractor are the only parties to the contract. However, the client can allocate a portion of a risk that has to be borne by the client under the agreed contract to the consultant through a separate consultancy agreement. In this study, risks were allocated to all three parties, namely the client, contractor, and consultant. It is recommended to allocate all personal risk factors associated with labour, subcontractor, and contractor to the contractor.

#### 4.4. Risk response strategies for the significant risk factors (Delphi round 2: Part 3 and Delphi round 3: Part 2 findings)

Fifteen risk response strategies were identified from the literature (see Table 45 legend). Although the participants were free to list any additional risk response strategies during Round 3, they considered the 15 listed strategies vital. Table 5 presents the five most significant risk response strategies for each significant risk factor of the three

**Table 4.** Risk allocation of significant risk factors of procurement systems used in high-rise buildings among the project internal stakeholders.



*Table 5.* Risk response strategies for the significant risk factors of each procurement.

								Recomm	nended	<b>Risk Res</b>	ponse S	Strategy					
Taxonomy	Risk Sub	ub Risk	Traditional Method with LS T					Tr	raditional Method with M&P				D&B with LS				
	raxonomy	Factor	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
		R1	RR11	RR9			RR1	RR11	RR9			RR1	RR11	RR9			RR1
	4.4	R2	RR10	RR1	RR6	0.00	DD2	RR10	RR1	RR6	DDA	002	RR10 RR1	RR6	ő	DD2	
	1.1	R3	RR1	RR10			NN2	RR1	RR10			PUPUZ	RR1	RR10			RN2
		R4	. PP10	RR6	RR2	- runo	RR12	- PP10	RR6	RR2	- NNO	RR12	- RR10	RR6	RR2	- NNO	RR12
		R5	Turro	RR1			RR2	Takio	RR1			RR2	- RR10 -	RR1			RR2
	12	R6	RR2	_	R12 RR4		RR6	RR2	RR12 F	DD4		RR6	RR2		DD4		RR6
04	1.2	R7	RR10	RR12		RR1	RR8	RR10		10144	RR1	RR8	RR10	RR12	14144	RR1	RR8
01		R8	RR2			RR8	RR6	RR2			RR8	RR6	RR2			000	RR6
	1.3	R9											RR10	RR1	RR6	- RRO	RR2
		R10			RR10	RR7	RR8			RR10	RR7	RR8					
	1.4	R11 R12	RR12	RR3	RR11	RR8	RR7	RR12	RR3	RR11	RR8	RR7					
		R13	RR7	RR8	RR9	RR2	RR1	BB7	RR8	RR9	RR2	BR1	RR7	RR8	RR9	RR2	RR1
	1.5	B14	RR9	RR3	RR8	<b>RR11</b>	RR7	RR9	RR3	RR8	<b>BR11</b>	BR7	RR9	RR3	RR8	<b>RR11</b>	RR7
	2.1	R15											RR10	RR15	RR9	RR2	RR3
02		R16	RR9	RR2	RR3	RR1	RR8						RR9	RR2	RR3	RR1	RR8
	2.2	R17	RR11	RR9	RR12	RR2	RR3	RR11	RR9	RR12	RR2	RR3					
		R18													RR15	RR14	
03		R19											RR10	RR13	<b>RR14</b>	RR15	- KK9
04		R20											RR9	007	RR1	RR8	
04		R21	RR10	RR7	RR9	RR1	RR2	RR10	RR7	RR7 RR9	RR1 R	RR2	RR10 RRC/	- ROG	RR9	RR1	RR2
05		R22											RR9	RR8	RR1	RR3	
				_													
Code			Risk	Respons	se Strate	gy			Code Risk response methods								
RR1	Ten	dering a hig	h bid						RR9 Allocation of the contingency plan								
RR2	Inclu	ding condit		RR10 Education and training													
RR3	Pre	Pre contract negotiations as to which party should take the identified risks								R11	Enco	urage tea	am work o	culture			
RR4	Tran	Transferring the risk to the subcontractor									RR12 Use of the appropriate standard conditions of contract						tract
RR5	Tran	Transferring the risk to the insurance company								R13	Provis	sion of ph	nysical pr	otection	to reduce	the likel	ihood of
	-										TISK .						

procurement systems.

For the majority of risk factors/taxonomies, 'education and training' has been advocated as the optimal response method. 'Using appropriate standard conditions of contract' has been mostly recommended for personal risks under both the consultant and subcontractor. Usually, nonstandard contracts are used for both subcontract and consultant's contracts in Sri Lanka. As a result, it is strongly advised to employ standard contract terms in order to minimize/avoid hazards. For instance, FIDIC -Subcontract 2011 can be used for subcontracts and FIDIC white can be used for consultant's contracts.

It is also recommended that a contingency plan for unavoidable risks, such as 'change orders' and the 'need for a new technique, be established when no other option is available. It is also recommended that teamwork culture be encouraged for the risk factors such as 'frequent job changes made by skilled labour 'and 'delays in receiving information from the designers' to retain the labour gang. The findings suggest offering a high bid for the risk factor 'lack of unskilled labour' to avoid securing the project. For the risk factors such as 'inability to complete work on time 'and 'subcontractors' involvement in several projects ', it is recommended that appropriate conditions be included in the bid. For the inability to complete work on time, time for completion can be included as a condition and for a delay 'delay damages '(penalty) can be levied. It is recommended that the risk allotted to the client for risk factors such as the client's unnecessary interference be retained.

#### 5. Discussion

The procurement systems that were identified in this study as being common in high-rise building projects to correspond to the procurement systems identified by Rameezdeen & Silva (2002), while the findings on the significant risk factors of highrise construction correspond to the outcomes of San Santoso et al. (2003). San Santoso et al. (2003) found 130 country-specific risk factors of highrise building construction. Hiyassat et al. (2020) focused on Jordan. The

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focus of Ikediashi & Okolie (2020) was on contractors' cash flow projections in South-South, Nigeria, while Kamal et al. (2019) made a risk study on Pakistan building projects. Since this study did not focus on any specific country, country-specific risk factors are absent in the study findings. None of the risk factors identified is common to all three procurement systems. If the risk factors are significant in all three procurement systems, they would require special attention. Labour shortage and the inability of the parties to deliver the project on time and at the specified quality have been collectively identified as the leading cause of disputes in all procurement systems (Mashwama et al., 2019). When the contractor fails to deliver the project at the client's desired quality/standard with the unskilled labour available, dispute risks will be encountered, requiring costly dispute resolution (Bingham & Nabatchi, 2019). According to the questionnaire survey outcome, these two types of risks are interrelated and, if not addressed, will continue to have an impact on the project (Ahmed & Nassar, 2016). Similarly, when the risk of 'inability to complete work on time' surfaces, the prospect of a dispute will be very high, as the intended profit margin is linked to project completion time (Soni et al., 2017). Similarly, the client's interference and change orders cause conflicts leading to dispute risks (Balbaa et al., 2019). Perez et al. (2017) discussed the cost increases resulting from the failure to manage internal and/or external disputes that arise owing to the change requests made by the client and the unavailability of specialized labour. However, the risk factor 'requirement to use local labour, which can be present in any procurement system, has not been considered significant in the literature. It can be seen that some risk factors that are significant to high rise construction projects are absent in the above table ex: work accidents and natural hazards, including winds (Perera et al., 2020). This is because their significance is known to the stakeholders, and consequently, they lead to very few disputes among the parties.

In risk allocation, the risk should be allocated to the party that can best withstand and manage the risk. (Brunnermeier & Cheridito, 2019). When establishing a minimal expectancy for the consultant's role in the procurement system, no (or only nominal) risk allocation should be made (Surahyo, 2018). Likewise, a proportion of the risk should be allocated to other parties in the case of 'delays in receiving information from the designers', which should generally be completely borne by the consultant (Surahyo, 2018). The highest proportion of the construction risk should be allocated to the contractor since the contractor has to come up with innovative strategies (Thomas & Ellis, 2017).

Risk response strategies relating to the significant risk factors that were identified in this study had been mentioned by Motaleb and Kishk, (2014); Zhangand Zuo; (2016); Perera et al. (2020) as well. These risk response strategies can be categorized under risk avoidance, risk transfer, risk mitigation, and risk acceptance. Dispute risks can be avoided at the commencement of the project itself by accommodating standard conditions of contract together with an appropriate (this can be innovative) procurement system (Dixit, 2022). For example, FIDIC-Subcontract 2011 can be used for subcontracts, and FIDIC white can be used for consultant contracts, which allow for including conditions in the bid whenever necessary (for example, when the work cannot be completed by the project deadline) (Mante, 2018). Lam & Siwingwa (2017) have acknowledged that the strategy 'allocate a contingency plan for unavoidable risks' would help manage such risks using the funding plans included in the project cost estimate. Many causes of disputes, including the delays in receiving information, are found to be not due to the incapability of any party but due to a lack of teamwork culture. Thus, the best way to address dispute risks caused by delayed information, frequent job changes, etc. is to promote teamwork (Arditi et al., 2017).
## 6. Conclusions and recommendations

Dispute risks of procurement systems should be managed through systematic risk management to avoid negative consequences. Three procurement systems are frequently deployed in high-rise building projects: traditional method with M&P, traditional method with LS, and D&B with LS. One hundred and twenty-eight risk factors were found to lead to disputes in highrise building projects. However, only 22 of them were determined to be significant, and only 16, 15, and 18 of those 22 were found to be significant in the traditional approach with LS systems, traditional method with M&P systems, and D&B with LS systems, respectively. "Lack of skilled labour" and 'inability to complete work on time' are the two most significant risk concerns in all three procurement systems. Through the study, 15 risk response strategies suitable to highrise construction projects could be identified and for each risk factor, the five most appropriate strategies among the 15 strategies were identified. Risk response strategies were found to be common in all three procurement systems.

As high-rise building projects are unique, it is recommended that the most appropriate procurement system be selected before the project is commenced. The risk management framework should complement the chosen procurement system and identify the project participants who can best manage the risks allocated to them. Providing education and training to stakeholders is an economical and convenient strategy that will increase the awareness of the stakeholders about high-rise building projects. It is also recommended that standard conditions of contracts be used with subcontracts and consultant contracts with the consultants to minimize/avoid risks.

This study highlights the implications of dispute risk management on different procurement systems deployed in high-rise construction projects through risk identification, risk assessment, risk allocation, and risk response. It considered apportioning the risks to each contracting party. The study findings would enable the better management of dispute risks of different procurement systems, paving the way for more effective implementation of those systems. The theoretical contribution of this study was to provide a benchmark for dispute risk management in the different procurement systems deployed in projects other than high-rise construction projects, such as road construction and reclamation projects. Besides, it will theoretically integrate the dispute risks, procurement systems, and high-rise building projects, which future researchers will find useful.

Study findings can also be applied to the infrastructure projects of other countries and other types of buildings and to investigate their suitability. The study can be extended based on the findings of a thorough study of other procurement systems. In this study, buildings 30-60 m in height were considered high-rise buildings. The study was limited to procurement systems frequently deployed in high-rise building projects in Sri Lanka. Risk allocation was done only to the client, contractor, and consultant. The definition of the consultant was limited to the consultants who were appointed by the client and did not include the inhouse consultants appointed by the D&B contractor, while the definition of the subcontractor was limited only to domestic subcontractors. In addition, the findings can be applied to highrise constructions of other countries as high-rise constructions in any country possess some similar and common characteristics, specially during the initial stages. However, the ranking of the risk factors may vary from country to country. In addition, this study can be considered a benchmark for further studies in different countries.

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## Relationship between corporate social responsibility reporting and employee's environmental sustainability perception: The mediation role of mindfulness

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#### Abstract

The trend of publishing reports about corporate social responsibility (CSR) and sustainability activities has become a phenomenon that is getting more popular in the construction sector. The aim of this study is to discover the perception of employees, who are the ones that experience these applications first hand in a company. A pilot survey has been prepared and conducted for construction sector professionals. Factor analysis has been applied by SmartPLS 3.0 software after the elimination of key indicators. To define "Individual mindfulness," mediation effect has investigated between "Environmental sustainability" and "Environmental CSR" by using PROCESS macro on SPSS. The results indicated that individual mindfulness level has a positive effect on the relationship between environmental sustainability (ES) and environmental CSR. However, other values like experience, age, etc., have been found irrelevant to this relationship. Therefore, to explain more about control variables, correlation tests have been executed.

#### Keywords

Construction, Corporate social responsibility, Employee's perception, Mindfulness, Sustainability.

#### 1. Introduction

The construction sector is commonly recognized as one of the most significant contributors to the exploitation of natural resources. As such, firms operating in the industry are under increasing pressure to prioritize CSR and sustainability in their operations... Yet, construction organizations are facing difficulties in integrating their social, ethical, and environmental concerns into their operations and stakeholder interactions. Despite the importance of corporate social responsibility (CSR) activities in construction businesses, as well as their role in achieving sustainability (Zhao et al., 2019; Xia et al., 2018), to our best knowledge, constructionrelated CSR research is still in its infancy. Furthermore, while the link between CSR and sustainability has long been acknowledged, the study of CSR concerns in building contractors is still in its early stages (Zhang et al., 2019).

The main similarity between sustainability and corporate social responsibility reporting is that they have three major types: economy, social, and environment (Şimşir, ??). From the perspective of construction companies, sustainability is often linked with environmental context, and CSR is linked with social issues. CSR is about creating a positive impact on society by managing companies' business processes. Defining "Corporate Social Responsibility" goals should target the community, global economy, and effects of actions for nature as well as sustainability. This research aims to explore employees' perceptions of CSR, containing not only social and financial CSR activities but also environmental activities within the context of the construction industry.

At the beginning of the CSR reporting process in the construction industry, companies began to produce "social reports," which generally covered social issues such as humanitarian aid, scholarships, foundations, and so on. The emphasis then transformed from social to environmental reporting. The reason for this was the increasing importance of environmental aspects in production, as well as the growth of concepts of sustainable development (Habek & Wolniak, 2015; Xiao et al., 2018). The target of sustainability reports usually is to carry out measurements on subjects such as electricity, water, and heating-cooling for monitoring annual changes. These measurements create a setting for environmental targets objectives, and even publishing a public document. Besides reports, environmental policy can be adopted by companies; however, it requires high-level overarching missions and principles respecting environmental performance and management. Environmental policy can be a one-page document and make general statements of embracing a path for environmental management, but it also can be challenging in particular areas such as energy use, waste management, the reduction of pollution, nest practices and training, etc.... Therefore, companies can also adopt an Environmental Management System (EMS) such as ISO 14001 and prepare their sustainability reports ("EMAS," 2018). Sometimes, these reports can be seen as an integrated report that contains CSR and sustainability together.

On the other hand, the stakeholders, who are aware of environmental problems and support environmental protection, are increasingly showing concern and demanding the implementation of CSR from construction organizations. (Close & Loosemore, 2014; Griffith, 2011; Mayr, 2015; Myers, 2005; Cho et al., 2015; Xia et al., 2018). This heightened environmental consciousness may or may not translate into CSR in the construction industry, however, due to the industry's inherent uncertainty and project-based nature (Evangelinos et al., 2016). It's common knowledge that companies' actual CSR efforts don't always match their public declarations of those efforts. Measurements of water, waste, electricity, etc., are all a part of sustainability reporting, which in turn supports the implementation of CSR initiatives.

Sustainability reporting has been found to be relevant to gain internal efficiency achievement and to increase internal organizational awareness of sustainability topics (Lopez et al., 2015). Given the significance of environmental sustainability to the construction industry, investigating the relationship between environmental sustainability performance and CSR reporting practices is vital for the industry's long-term development. Previously conducted, many researchers did not have a consistent understanding of the link between sustainability performance and sustainability disclosure (Hummel & Schlick, 2016). This can also be told for CSR disclosure as well. Şimşir and Giritli's recent bibliometric study shows that, from 2005 to 2018, the number of searches for the keywords "environmental sustainability" and "corporate social responsibility" in the Scopus database increased dramatically, and the study also provides a visual representation of the research gap in these areas (2018). On the basis of the evidence currently available, it seems fair to suggest construction companies and developers can originate the proposed extended key indicators for environmental sustainability in their CSR activity reports according to employees' perceptions.

Additionally, the field of empirical CSR research conventionally has been limited by little attention to the current role of mindfulness in sustainability research. Mindfulness can be explained as a state of active, open attention and acceptance of the present (Psychology Today, 2016). Whether a company gives attention to reporting can be ignored by an employee. Thus, the question arises as to whether the concept of mindfulness also applies to the field of sustainability and CSR in the context of the construction industry.

Accordingly, the purpose of this paper is to set forth to expand a conceptual framework for explaining the relationship between employees' perceived sustainability performance and CSR Reporting. Along with this, we will also take into account the impact of mindfulness as a mediator in the aforementioned relationship.

The theoretical underpinning and hypotheses creation process for all of the selected variables are presented in the following sections, which serve as a background for the empirical investigation. Following that, the paper describes the methodology, data collection method, and analysis, as well as the results and the discussion and conclusion of the findings. The paper ends with the study's limitations and suggestions for future research.

#### 2. Literature review and hypothesis development 2.1. Environmental pillar of sustainability

The environmental, economic, and social pillars are usually regarded to be the three pillars that make up the notion of sustainability. The environmental part of sustainability entails lowering current environmental impacts in order to protect the environment for future generations. The economic aspect refers to ensuring that the economy grows in a positive direction, whereas the social aspect is concerned with firms' responsibilities to conduct business ethically. Some academics have suggested that the environment appears to have received more attention than the other two components in terms of sustainability efforts (Beheiry et al., 2006; Jones et al., 2010). However, this aspect of sustainability has received little attention, and it is the primary aim of the study presented in this paper.

According to the 2030 Agenda for Sustainable Development, 17 Sustainable Development Goals (SDGs) with related thematic issues, including water, energy, climate, etc., stipulate a shared pattern for people, companies, and the planet. SDGs are supposed to create a faithful commitment by all stakeholders to achieve global goals. These 17 SDGs are no poverty; zero hunger; good health and well-being; quality education, gender equality; clean water and sanitation; affordable and clean energy; decent work and economic growth; industry innovation and infrastructure; reduced inequalities; sustainable cities and communities; responsible consumption and production; climate action; life below water; life on land; peace, justice, and strong institutions; partnerships (European Commission, 2002). SDGs are adopted by many companies supporting sustainable development in all countries to create multi-stakeholder partnerships, which are crucial for

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sharing expertise, knowledge, technologies, and financial resources. Most companies give wide publicity to SDGs icons in their sustainability reports.

Sustainability reporting contains reporting on environmental, social, and economic outcomes on organizational performance (ACCA, 2004; Anggraini & Reni, 2006). Nowadays, it is influential for companies to redeem the sustainability of their operations and demonstrate a workflow to evaluate performance, set goals, and cope with change. For this reason, sharing a public document such as a sustainability report might be a key program for intercommunicating the positive and negative effects of sustainability performance and for tracing data that can inspire company policy, strategy, and operations on a regular process. According to Kamaliah, reporting on sustainability should be a high-level strategic document that places the issues, challenges, and opportunities of sustainable development into its core business and industrial sector (Kamaliah, 2020).

The construction industry differentiates itself from other sectors because the operation itself effect is based on consumption and waste production. Environmental sustainability is for humans and was established to preserve social rights by evaluating human health while preserving natural capital (Goodland, 1996). The United Nations Environment Programme (UNEP, 2015) Sustainable Buildings and Climate Initiative revealed that only the built environment is responsible for more than 40 percent of global energy use and one-third of global greenhouse gas emissions. In our cities and towns, it is measured that up to eighty percent of greenhouse gas emissions are produced by buildings. In this era, all countries are aware that reducing global greenhouse gas emissions in the built environment is the least expensive way.

However, in Turkey, there are no obligations or prerequisites about issues for reporting on sustainability. The reporting procedure is motivated by public relations and is up to the organization's will. How much of this reported content is consumed is an unknown area. Therefore, this research is aimed at discovering employee's perceptions of the company's ES activities.

## 2.2. Environmental pillar of corporate social responsibility

CSR did not intimately embrace the environmental dimension in its early definitions, and it mainly centered on voluntary activities, which were more closely related to philanthropic activities. However, as the conception developed and was stated in excessive depth, the environmental and social dimensions were specified as equal weight (Loew et al., 2004; Dahlsrud, 2008).

Ghobadian et al.'s (2016) statement about the trend of CSR has been increased by three critical changes in the business environment: escalating connectivity and information availability about the organization's impression on the public and environment; raising imparities between government welfare and environmental obstacles and increasing public awareness about climate change, sustainability and inequality in society.

The environmental pillar is widely regarded as a critical element of CSR (Uddin, 2008; Fallon, 2015). According to the International Institute for Sustainable Development (IISD), CSR's elementarily considerations are environment preservation and the health of employees, community, and civil companionship both now and in the future (Hohnen, 2007).

Corporate activity can have a variety of environmental effects. Typically, environmental collision refers to the detrimental effects that company practices have on the natural world. Overuse of natural, non-renewable energy resources, pollution waste, habitat degradation, climate change, and deforestation are examples of such effects.

In the construction industry, there is an expanding interest in CSR research; however, we have little understanding of how companies incorporate environmental issues into their CSR practices. CSR activities are typically founded on research into long-term business organizations. The construction business nonetheless operates in a project-based context, where the social, environmental, and economic requirements and challenges differ from project to project based on client goals and local community structures (Loosemore et al., 2018).

## 2.3. The link between CSR and sustainability

Leading organizations are aware that the consumer and investor markets have altered as a result of their capacity to read trends and changes competitive environment in the of operations. With the rise in environmentally conscious investors and stakeholders who closely monitor businesses' CSR and sustainability efforts, the leader businesses have started reporting and communicating about sustainability in order to meet this new business dimension, maintain reputation, and remain attractive to investors. Therefore, investors base their judgments on the data found on websites and in reports (Dawkins & Ngujiri, 2008, p.236).

Companies usually use Global Reporting Initiative (GRI) standards to prepare their sustainability and CSR reports. GRI recognizes that the construction and real estate industry has a critical role in responding to climate change. GRI standard's mission is to provide a template for organizations to be transparent and aware of their impacts through world widely used standards (GRI, 20092015).

Loosemore et al. (2018) summarizes the CSR-related ISO and GRI standards into leadership, vision and mission, CSR strategy focus, CSR workplace initiatives and activities, supply chain initiatives and activities, community engagement focus and initiatives, community initiatives and activities, environmental initiatives and activities, perceived benefits of CSR implementation, obstacles to CSR implementation. These items are also the same for sustainability reporting in GRI sustainability reports, and a strong connection is undeniable.

However, a comprehensive systematic review revealed that there are few researches made which are linking CSR and environmental sustainability keywords. According to the study made by Şimşir (?? year); there is a research gap between CSR and environmental sustainability (ES), although there is a substantial similarity in the way of reporting between CSR activities and sustainability.

The ES movement has to gain every actor's participation: government, companies, users, and the public. Companies are the second power in society, and cause pollution through their activities have to be voluntary for CSR and sustainability actions. The companies that are familiar with sustainable building design are taking actions of CSR activities without reporting. On the other hand, most of the construction companies do not even participate in any of these actions because all of these voluntarily reporting systems require the founder's vision to make a change. However, in the long term, all companies from all industries are responsible for their action's impacts, and because of globalization, a mutation in the way of working is inevitable. When a problem causes a change in the form of working, how the peculiar ways of a company's practices affect the unfolding context for inertia should be understood (Martin, 1993). Before customers, employees need to comprehend their company's life story. Therefore, in this research, employees' perception has a major part of being a good judge of published reports.

Environmental sustainability issues are already embedded in CSR activities, but construction companies and developers deal with only the limits of standards like GRI, Dow Jones, or ISO 14001. It should be extended because the construction industry requires more precautions than any other industry. This paper tries to link the relationship between sustainability and CSR by measuring the most exposed stakeholder's perception: employees.

#### 2.4. Mediating role of mindfulness

The quality of awareness known as mindfulness has long been thought to enhance well-being (Brown & Ryan, 2003). Due to the inherent characteristics of human nature, awareness and attention to present events and experiences can range from high degrees of clarity and sensitivity to low ones, such as automatic, habitual, mindless, or insensitive thoughts or actions (Wallace, 1999).

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Deci and Ryan note that, according to one theory, a key component of psychotherapy is to encourage mindfulness or awareness, which allows for introspective inquiry into needs and emotions as well as the formation of a more independent mindset (Deci & Ryan, 2008).

According to Langer's sociocognitive approach to mindfulness, people with high perceptual sensitivity and higher behavioral flexibility are better able to react to a variety of constantly changing stimuli (Levinthal & Rerup, 2006, p.505). Wamsler et al. (2017) maintained that it is essential to take into account a person's inner qualities, such as awareness while evaluating sustainability. The actions taken by organizational members, particularly those in frontline positions, determine how mindfully organized an organization is (Vogus & Sutcliffe, 2012).

Therefore, an employee's high level of mindfulness is expected to gain maximum awareness of CSR and sustainability activities.

#### 3. Research model and hypothesis

In accordance with Whetten (1989), it is proposed as a theoretical model established on a literature review, which aims to explain the interplay between employees' perceived corporate sustainability performance and their company's CSR disclosure. Figure 1 shows a depiction of the link between CSR and sustainability that includes both of their separate aspects as well as the awareness that affects the relationship.

Given the above theoretical framework, our research questions the following two hypotheses:

- H1: ESPP is positively associated with ECSR.
- H2: MFB mediates this effect (twoway interaction); that is, the relation between ESPP and ECSR would be higher when MFB is higher.

SmartPLS software for structural equation modeling (SEM) and IBM SPSS with PROCESS macro were used to analyze the provided conceptual model in order to gain a deeper understanding.

## 4. Research design and sampling method

This study aims to gather specific information on the current status of CSR engagement and the level of awareness, as well as highlight current practices in the field of CSR in the construction industry. To present more powerful results than single-country research, a multiple-country study was conducted. A questionnaire survey was conducted via online questionnaire processed by using ITU Veti. The questionnaire consisted of three parts. The first part covered sustainability questions, which were adopted from GRI (Global Reporting Initiative-G4 Sustainability Reporting Guidelines) and Dow Jones Standards (Dow Jones Sustainability Diversified Indices). 43 subjects were asked to assess the perceived environmental sustainability, and 6 subjects were asked to assess social sustainability. In the second part, corporate social standards were asked, consisting of 23 items for social issues and 8 items for environmental issues, based on ISO 26000 and GRI. Demographic information like age, gender, experience, occupation, position, company function, company size, department, country, types of published documents, and mindfulness were asked in the last part. Mindful Attention Awareness Scale was used to determine individual mindfulness. Individual variations in the frequency of thoughtful states over time are evaluated by the MAAS. The test consists of 15 items on a 1-6 Likert scale and measures dispositional (or trait) mindfulness (Miller, 2020).

The sample consists of organizations that are primarily based in Turkey or Europe, the United States, and England but have a branch in Turkey or are based in Turkey but work in Africa,



*Figure 1.* Conceptual model. \*ESPP: Employee's Sustainable Performance Perception \*ECSR: Environmental Corporate Social Responsibility \*MFB: Mindfulness Behaviour.

the Gulf Region, Russia, and the Balkans. The companies were chosen from where environmental sustainability was emphasized in written CSR policies. Participants were informed about the study's voluntary and confidential participation, and then we asked them to evaluate their company's environmental sustainability performance and CSR reporting practices. ITU Veti, a web-based form application created by the Computer Center of Istanbul Technical University (ITU), was utilized as a method for data collecting and analytics. Participants received the survey's site URL via email and the social network Linkedin.

Criterion - sampling as a purposeful sampling strategy was used since the study's setting allowed for such a small number of participants. Statistical tools and methods to be involved in carrying out the study were selected. Statistical tools were revised due to the data collected from the questionnaire.

When a specific criterion is followed to select a sample, it is called criterion purposeful sampling. This kind of sampling technique is useful in adding depth to even quantitative research. The criteria of sample selection should be in accordance with the topic and aim of the research (Patton, 1990). In this study, the point of criterion sampling is to be sure to understand participants who are likely to be information-rich because they may reveal employees' perceptions and attitudes to CSR practices.

The data were collected in the following steps. First, 10 well-known construction firms were selected for the survey, which are primarily based in Turkey or have a branch in Turkey but are based in Europe, the United States, and England. The responses from these firms were only 40 employees. Second, to increase the participation rate, we reached professionals from LinkedIn and checked their profiles for survey inquiries, which the respondent must have or had worked in a company that publishes CSR or Sustainability reports. After this step, the authors collected the responses from 70 participants. The respondent profile was: 17 female and 53 male; 25,7% architect, 47,1% civil engineer, 8,6% electrical and mechanical engineer, 18,6% other; 7,1% junior, 20% specialist, 15,7% chief, 57,2% manager and coordinator. It should be noted that the results of the study might represent managerial personnel's perceptions more than others.

#### 5. Data Analysis

Firstly, descriptive statistics and correlation tests were applied. Confirmatory factor analysis made up the second phase of the statistical study. Confirmatory factor analysis examined the fit of the three-factor model (ESPP, ECSR, and MFB) before testing the hypotheses.

A boundary value of 0.60 was chosen for factor loadings. Those indicators were not included in the measurement models if their factor loadings were less than 0.50. As a result, the model was updated, and new tests were run. Utilizing SmartPLS 3, partial least squares structural equation modeling (PLS-SEM) was performed to analyze empirical data. For scenarios with a limited sample size, the SmartPLS program, which employs a least-squares estimate method, is often advised (Wong, 2013).

Following the validation of the measurement models, Cronbach's alpha values were used to assess the internal consistency of the measuring instruments.

The updated structural equation model was rigorously validated using the SPSS PROCESS macro. An OLS and logistic regression route analysis modeling tool called PROCESS uses observable variables. The social, business, and health sciences frequently use it to estimate direct and indirect effects in single and multiple mediator models (parallel and serial), two- and three-way interactions in moderation models, simple slopes and regions of significance for probing interactions, and conditional indirect effects in moderated mediation models with single or multiple mediators or moderators.

An indirect assessment of the impact of a suggested cause (ESPP) on some outcomes (ECSR) through a proposed mediator was done using mediation analysis (ECSR). The relevance of mediation analysis comes from its capacity to provide knowledge of the interactions between variables that are more than just descriptive. A statistically and practically significant indirect impact is a need for mediation.

Furthermore, to explain more about key variables, Pearson correlation analysis was tested among these items.

#### 6. Results

#### 6.1. Smart PLS 3

In the first run of the reliability and validity tests, the values for the "average variance extracted (AVE)" are found undesired, as shown in Table 1.

Even the Cronbach's Alpha values are acceptable; AVE scores are under .50 for ESPP and MFB. Therefore, factor loadings examined and indicators having factor loadings lower than .50 were excluded from the measurement models. After the elimination, the considered values are shown in Table 1, and the model is presented in Figure 2.

The validity of all latent variables is again examined using Cronbach's alpha and AVE. The acceptable critical value of AVE is 0.5, and the Cronbach's alpha coefficient for all items of the same variable should be larger than 0.70 (Fornell & Larcker, 1981), which is obtained and shown in Table 2.

Path coefficients and bootstrap analysis were also examined, and p values have resulted under .05, as presented in Table 3.

For more validity of the results, the heterotrait-monotrait ratio of correlations (HTMT) analysis is applied. In partial least squares structural equation modeling, HTMT is a novel technique for evaluating discriminant validity. The Fornell-Larcker criteria and (partial) cross-loadings, which are typically unable to identify a lack of discriminant validity, are conventional ways to assess discriminant validity that is outperformed by the HTMT criterion. HTMT scores below 1 demonstrate that the precise correlation between the two constructs should be different (Alarcón & Sánchez, 2015). In Table 4, HTMT values for the related model are found to be lower than 1.

### 6.2. The mediation analysis (SPSS-process)

The hypothesis was tested through process macro with Model 4 (mediation

model), and the statistical model is shown in Figure 3.

Table 1. Reliability and validity test run 1.

	Cronbach's	rho A	Composite	Average Variance Extracted (AVE)	
	Alpha	nio_A	Reliability		
ECSR	0,923	0,929	0,922	0,601	
ESPP	0,976	0,984	0,972	0,477	
MFB	0,866	0,889	0,839	0,297	



Figure 2. Model in SmartPLS after factor analysis.

Table 2. Reliability and validity test run 2.

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
ECSR	0,917	0,922	0,917	0,613
ESPP	0,974	0,978	0,972	0,558
MFN	0,844	0,854	0,849	0,530

ECSR 01,02,03,04,05,06,08

ESPP 05,07,12,13,15,16,17,18,19, 20, 22, 23, 27, 28, 29, 30, 31, 32, 33, 34, 35,36,37,38,39,40,41,42

MAAS 03,08,10,13,14

*Table 3.* Path coefficients and bootstrap analysis.

	Original Sample	Sample Mean	Standard Deviation	T Statistics	
	(0)	(M)	(STDEV)	(O/STDEV)	P Values
ESPP->ECSR	0,556	0,554	0,092	6,037	0,000
ESPP->MFN	0,305	0,332	0,114	2,683	0,007
MFN->ECSR	0,323	0,336	0,102	3,155	0,002

Table 4. Discriminant validity (HTMT<1 RATIO).

	ECSR	ESPP	MFN
ECSR			
ESPP	0,638		
MFN	0,491	0,298	



Figure 3. Statistical model.

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The mediation analysis results are represented in Table 5. P values for ESPP (X) -> MFN (M), 0,032; MFN (M) -> ECSR (Y), 0,007; ESPP (X) -> ECSR (Y), 0,000 which are significant at the level of p<0.05.

In mediation analysis, the direct and indirect effects of the relation between variables were also tested and shown in Table 5. The level of confidence for all confidence intervals in output is considered 95.0000, and the number of bootstrap samples for percentile bootstrap confidence intervals is regarded as 5000.

Checking if zero is between the values of the lower level of confidence

Table 5. Process macro results.

		Coefficient	SE	t-value	n		ULCI 95%
		Coefficient	- JL	t-value	P	LLOI	02013370
ESPP (X) -> MFN (M)	H1	0,2348	0,1072	2,1900	0,0320	0,0209	0,4488
MFN (M) -> ECSR (Y)	H2	0,2553	0,0923	2,766	0,007	0,071	0,4394
ESPP (X) -> ECSR (Y)	H3	0,4422	0,0855	5,172	0,0000	0,272	0,6128
				Effect	SE	LLCI	ULCI
ESPP (X)> ECSR (Y	') (D	irect)		0,382	0,084	0,214	0,5507
				Effect	BootSE	3ootLLC	BootULCI
ESPP (X)> ECSR (Y	') (In	direct/MFB)	)	0,06	0,0390	5E-04	0,1474
ESPP (X)> ECSR (Y	0,065	0,042	5E-04	0,1571			
ESPP (X)> ECSR (Y	') (C	ompletely/M	IFB)	0,0720	0,046	6E-04	0,1754

Table 6. Key variables indicated in the correlation matrix.

interval (LLCI) or upper level of confidence interval is the second method for determining the significance (ULCI); in this case, the related model is achieved by the results in Table 5.

#### 6.3. Pearson correlation analysis

The linear correlation between two sets of data is measured by the Pearson correlation coefficient. It is effectively a normalized measurement of the covariance since it is the covariance of two variables divided by the product of their standard deviations. The outcome always falls between the range of 1 and 1. Key variables indicated in the correlation matrix and Pearson correlation test results are shown in Table 6 and Table 7.

After the elimination of non-correlated items, according to the correlation matrixes, the correlation between ESPP and ECSR indicators and control variables had significant relationships at the .05 level. The first significant positive correlation was between the ESPP07 indicator and the current job experience variable (r= .28) and po-

Divisions	Code	Sub divisions	Taken From
	ESDD 7		GRI, G4, Construction and
		Recording the energy used per unit (eg. Floor area, persons).	Real Estate Sector Disclosure
	ESDD 12	Recording the greenhouse gas emissions per unit (e.g., floor area,	GRI, G4, Construction and
		persons).	Real Estate Sector Disclosure
	ESPP 18	Taking actions to prevent or minimize, or remedy or mitigate, the effects of unacceptable risks associated with contaminated land.	GRI, G4, Construction and Real Estate Sector Disclosure
		Recording the total amount or weight or volume of materials that are	
Environmental	ESPP 19	used to produce and package the organization's primary products and	GRI, G4, Construction and Real Estate Sector Disclosure
aspects of		services	Real Estate Sector Disclosure
Sustainability	ESPP 20	Recording the percentage of recycled input materials used to	GRI, G4, Construction and
Sustantionity	2011 20	manufacture the organization's primary products and services.	Real Estate Sector Disclosure
	EGDD 22		GRI, G4, Construction and
	ESPP 23	Recording energy consumed outside of the organization.	Real Estate Sector Disclosure
	ESDD 24	Records the total weight / number / volume of hazardous and non-	GRI, G4, Construction and
	ESFF 54	hazardous wastes by disposal methods.	Real Estate Sector Disclosure
	ESDD 36		GRI, G4, Construction and
	2311 50	Environmental impacts of products and services have been mitigated.	Real Estate Sector Disclosure
	FSPP 30	Recording total waste disposal, emissions treatment, and remediation	GRI, G4, Construction and
	2511 57	costs.	Real Estate Sector Disclosure
	ECSR 1	Reduces waste by minimizing packing material and, if appropriate,	
	LODK I	offer recycling and disposal services	ISO26000
	ECSR 2	Eliminates or minimize negative health and environmental impacts of	
		products and services, such as noise or waste	ISO26000
Environmental	ECSR 3	Respects the traditional uses of natural resources by local populations,	
aspects of		especially indigenous people	ISO26000
CSR	ECSR 4	Prevents pollution; reduce emissions of pollutants into the air, water	
		and soil as much as possible	ISO26000
	ECSR 6	Uses sustainable, renewable resources whenever possible	ISO26000
	ECSR 8	Practices life-cycle approach(including disposal) – aim to reduce	77.00 (000)
		waste, re-use products or components, and re-cycle materials	18026000

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sition variable (r= .36). The ESPP07 indicator aimed to observe individuals' perceptions about "Recording the energy used per unit." While the ESPP07 indicator was more acceptable for respondents having more than ten years of service and more authorized, the agreement declined as the respondents' years of service and authorization of the position decreased. ESPP12 indicator (Recording the greenhouse gas emissions per unit) positively correlates with the current job experience. ESPP18 (Taking actions to prevent or minimize, or remedy or mitigate, the effects of unacceptable risks associated with contaminated land, r=.24); ESPP20 (Recording the percentage of recycled input materials used to manufacture the organization's primary products and services, r=.28); ESPP23 (Recording energy consumed outside of the organization, r=.30; ESPP34 (Records the total weight/ number/ volume of hazardous and non-hazardous wastes by disposal methods, r=.25) have found to be positive correlated with the position. ESPP19, ESPP36, ECSR1, and ECSR6 indicators try to identify the perception of "Recording the total amount or weight or volume of materials that are used to produce and package the organization's primary products and services," "Environmental impacts of products and services have been mitigated," "Reduces waste by minimizing packing material and, if appropriate, offer recycling and disposal services" and "Uses sustainable, renewable resources whenever possible." These indicators determined as positively correlated with company function (r=.24;.31;.29; .32), company size (r=.29; .14; .17; .12), company year (r=.26; .26; .22; .22), country (r= .32; .28; .23; .14) and individual mindfulness (r= .24; .14; .24; .31) and negatively correlated with publish of sustainability (r= -.20; -.11; -.09; -.13), publish of CSR (r= -.05; -.06; -.14; -.20), publish of any news (r= -.11; -.13; -.05; -.09), building operations (r= -.31; -.21; -.07; -.23) and environmental perception (r = -.19; -.01; -.20; -.05). Contractors and project management firms seem to care more about waste package details and usage of renewable resources. Also, the more enlarged companies, by means of size and year and work in international areas, the more sensitive the estimations of sustainable resources and waste management. People who are individually more mindful about themselves are found to notice waste volume and reusable instruments. Reverse numbering was used for "publish of sustainability," "publish of CSR," "publish of any news," "building operations," and "environmental perception" questions in the questionnaire; therefore, there is a positive approach to these issues that show a negative correlation (yes=1, no=2; no information=0). Companies who publish any news about sustainability or CSR or both and who operate and maintain their buildings positively influence recording the total amount of package waste and usage of sustainable resources. ECSR1 (Reduces waste by minimizing packing material and, if appropriate, offers recycling and disposal services) has the same trends as ESPP19,36, and ECSR6 only differs in published news (r=.05) and positively correlates. This difference in waste management indicates that some news can be found irrelevant (magazine, social media, etc.) or has no information about this item for the employee. ESPP39 (Recording total waste disposal, emissions treatment, and remediation costs) key variable positively correlated with a current job working years (r=.24) and position (r=.25). Due to expanded responsibilities with the position and experience in the same company could affect employee's perception of costs for environmental remediations. ECSR2 (Eliminates or minimize negative health and environmental impacts of products and services, such as noise or waste) and ECSR8 (Practices life-cycle approach (including disposal) - aim to reduce waste, re-use products or components, and re-cycle materials) positively correlates with age (r= .27; .26), experience (r= .27; .26), current job experience (r= .32; .27), company function (r=.37;.26), company size (r=.16;.08), company year (r= .26; .22), country (r= .11; .25) and individual mindfulness (r= .27; .38); negatively correlates with publish of sustainability (r = -.07; -.27), publish of CSR (r= -.10; -.31),

*Table 7. Pearson correlation test results (significant at p<0.05).* 

									PUBLISH				ENVIRONME	INDIVIDUAL
			CURRENT JOB	3	COMPANY	COMPANY	COMPANY		SUSTAINABI	PUBLISH CSR	PUBLISH	BUILDING	NTAL	MINDFULNES
	AGE	EXPERIENCE	EXPERIENCE	POSITION	FUNCTION	SIZE	YEAR	COUNTRY	LITY REPORT	REPORT	NEWS	OPERATION	PERCEPTION	S
ESPP07	0,18	0,21	0,28	0,36	0,05	0,28	0,19	0,03	-0,19	-0,06	-0,09	-0,08	-0,20	0,20
ESPP12	0,12	0,13	0,26	0,20	0,11	0,14	0,31	0,23	-0,13	-0,07	-0,22	-0,03	-0,02	0,15
ESPP18	0,15	0,13	0,16	0,24	0,12	0,19	0,40	0,31	-0,23	-0,01	-0,23	-0,08	-0,04	0,18
ESPP19	-0,04	-0,01	0,07	0,21	0,24	0,29	0,26	0,32	-0,20	-0,05	-0,11	-0,31	-0,19	0,24
ESPP20	0,07	-0,02	0,04	0,28	0,07	0,19	0,14	0,18	-0,20	-0,05	-0,14	-0,16	-0,16	0,17
ESPP23	0,16	0,09	-0,05	0,30	0,16	0,24	0,18	0,19	-0,35	-0,20	-0,23	-0,15	-0,09	0,26
ESPP34	0,12	0,03	0,23	0,25	0,15	0,31	0,26	0,37	-0,18	0,01	-0,24	-0,20	-0,09	0,28
ESPP36	-0,08	-0,13	0,11	0,06	0,31	0,14	0,23	0,28	-0,11	-0,06	-0,13	-0,21	-0,01	0,14
ESPP39	0,22	0,16	0,24	0,25	0,10	0,18	0,25	0,34	-0,27	-0,12	-0,22	-0,26	-0,13	0,27
ECSR01	0,10	0,07	0,17	0,12	0,29	0,17	0,26	0,23	-0,09	-0,14	0,05	-0,07	-0,20	0,24
ECSR02	0,27	0,27	0,32	0,22	0,37	0,16	0,26	0,11	-0,07	-0,10	-0,03	-0,13	-0,13	0,27
ECSR03	0,38	0,41	0,40	0,37	0,11	-0,06	0,07	0,24	-0,01	0,07	-0,05	-0,06	-0,05	0,41
ECSR04	0,35	0,33	0,25	0,26	0,36	0,08	0,22	0,27	-0,14	-0,09	-0,03	-0,24	-0,18	0,45
ECSR06	0,19	0,17	0,19	0,20	0,32	0,12	0,22	0,14	-0,13	-0,20	-0,09	-0,23	-0,05	0,31
ECSR08	0,26	0,26	0,27	0,22	0,26	0,08	0,22	0,25	-0,27	-0,31	-0,04	-0,27	-0,26	0,38
** Comal	** Considering is similar to the 0.01 local (0.4 sited)													

\*\*. Correlation is significant at the 0.01 level (2-tailed) \*. Correlation is significant at the 0.05 level (2-tailed)

> publish of any news (r= -.03; -.04), building operations (r = -.13; -.27) and environmental perception (r = -.13;-.26). As explained before; negatively correlated items were coded reverse; so mentioned key variable's perception remarks as age, experience, current job experience, company function, company size, company year, country, individual mindfulness and environmental perception increase; also supports the publish all kinds of reporting and build awareness on building operations and maintenance. ECSR3 (Respects the traditional uses of natural resources by local populations, especially indigenous people) indicator positively correlates with age (r = .38), experience (r = .41), current job experience (r= .40), and position (r=.37). The conversation instinct about natural resources construes with the increase of age, experience, and position. ECSR4 (Prevents pollution; reduces emissions of pollutants into the air, water, and soil as much as possible) is correlated with all control variables.

#### 7. Discussion

According to Buddhist theory, mindfulness has been shown to heighten one's attention to the actual world and improve awareness and while non-judgmental acceptance also increasing one's awareness of one's own psychological conditioning (Thiermann et al., 2020). Hanh (2013) indicates that the human race should cure the earth to heal themselves. Individual mindfulness has a key role in changing corporate actions, especially for sustainability implementations. On the other hand, corporate social responsibility reports are a company's display window and are supported by sustainability actions.

Individual mindfulness plays an important role in changing corporate actions, particularly for sustainability implementations. This study has highlighted importance the of understanding the relationship between employees' perceived sustainability performance and CSR reporting in a boundary condition for mindfulness. We presented an integrated approach to see if mindfulness influences this relationship.

Each of the findings is discussed. The results of the research accept the first hypothesis, which indicates that employee sustainability performance perception (ESPP) is positively associated with ECSR (Environmental Corporate Social Responsibility). In the questionnaire, we asked 43 items for environmental sustainability and only 6 items for environmental CSR because sustainability measurements require details of "how much." However, CSR measurements express the general preserves in reporting sentences. As we discussed before, sustainability disclosure usually includes measurements for recording; this action creates milestones of environmental CSR to talk about preserving natural sources. Employees who think sustainability disclosure items matters also think environmental CSR matters.

As theorized in Hypothesis 2, it is demonstrated the mediation effect of mindfulness is the relation between ESPP and ECSR, which would be higher when MFB is higher. A state of awareness known as mindfulness is innate (Brown & Ryan, 2003). Our daily awareness, perception, and focus are affected by our mindfulness level. For example, when a company attaches importance to waste separation according to paper, plastic, glass, etc., it can

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only be a service of the aware employee. If employees pay attention to waste separation, the company will boost its implementations in every corner. Therefore, to achieve sustainable development, organizations must volunteer, and employees should be open-minded to create two-way interaction. Mindfulness involves paying attention sensory-perceptual experiences to (Pashko, 2018). In this case, mindfulness activities stimulate the attention and awareness of the employee. Thus, Ericson et al. believe that promoting mindfulness in workplaces, schools, and other settings may be seen as a policy that yields a "double dividend" by promoting both more sustainable lifestyles and higher well-being (2014). Mindfulness has a key role in translating pro-environmental intentions into sustainable behavior. Human resource departments can originate their plan around mindful activities to achieve the goal of the organization's sustain-

able development. Besides the mindfulness, in the questionnaire, detailed descriptive questions were requested to be answered, such as experience, age, gender, etc.; though, disconcertingly, none of them was found effective on the model. Therefore, the Pearson correlation test has been applied to the eliminated key variables to understand the relationship of control variables.

Even though gender, occupation, department, and CSR event questions were asked in the survey, these control variables were neglected from the correlation test because none of them has any correlation with key variables; a considerable amount of key variables were found to not correlate with any control variables and also subtracted from table 6 and 7. GRI sustainability reporting presents a detailed reporting system for interested organizations. Therefore, the correlated key variables, as noticed, have the meaning of general statements like energy, water, waste, and greenhouse gas preservation. These variables can be noticed commonly in published reports.

According to the study's findings, large-sized and operationally aged construction organizations execute the environmental dimension of CSR more than small-sized ones. This is in line with the view that government rules and policies on sustainable development may not have been placed to include small and medium-scale firms' activities (Oginni & Omojowo, 2016) and that firm size is strongly correlated with CSR disclosure (Wang, 2011) and the number of years in business operations (European Commission, 2002). The size of the firm and its length of operation are both directly correlated with participation in such external community activities, according to a study done in Portuguese (Santos, 2011).

The environmental pillar of sustainability was highly emphasized by contractors, project management firms, and international companies. In order to assure the quality and safety of the architecture being built for the benefit of future users, the contractor must work hard to fulfill the needs, wishes, and ambitions of the customers (Zhao et al., 2012). Client expectations may require contractors to be proactive about CSR and sustainability objectives.

Another finding from the research is that as employees get older, the popularity of CSR draws attention due to the significant correlated results. Older employees have also spent a longer time in the sector; thus, this could be the effect of long-term exposure to CSR initiatives. Furthermore, these results are supported by another study conducted by Pereira et al., who found that the environmental dimension of CSR was explained positively by seniority (2015). Because this study focuses on employee perception, the seniority of an employee is essential in determining CSR absorption as well as position. This means that reporting is an external communication of sustainability information (Lopez et al., 2015); as the liability increases, so does the information claim from the top of the organizational chart, and employees near the top may encounter CSR and sustainability objectives more frequently than others. The information claim from the top of the organization chart rises, too, and high-level employees may be more exposed to CSR and sustainability goals than others.

Finally, reporting on both sustainability and CSR elements was found relevant to the same key variables from the perspective of the employees. This situation can be promoted with twoway interaction, which can create internal motivations for the company to boost its level of sustainable development. Recently, research showed that the presence of internal social responsibility motives appears to boost corporate sustainability management strategies (Lopez et al., 2015). Internal motivation is mostly related to employee awareness or can be called "selective perception," where an occasion is related to personal goals but also important for a wider community. (Dearborn & Simon, 1958). Individual mindfulness and environmental perception are concerned with selective perception, and as presented in the correlation test, a high level of perception brings a high level of awareness of sustainability and CSR objectives. Moreover, the same key variables also correlate with building operation, which states the companies that are operating their own buildings have a precipitous understanding of sustainability and CSR items.

#### 8. Conclusions

This article discusses the findings of a questionnaire study done in the construction industry. Analyzing development sustainable through the corporate social responsibility of the construction industry in Turkey provides intriguing evidence. The environmental aspect of CSR was examined to determine sustainable growth. The results indicate that sustainability actions are subsumed by CSR actions directly. Mindfulness undoubtedly mediates the effect of employees' sustainable performance perception (ESPP) on environmental corporate social responsibility (ECSR).

This pilot study reveals the importance of mindful individuals in the workplace increases the effectiveness of sustainability and CSR actions. Moreover, industries like construction, which are consuming energy and damaging ecosystems, can promote their mindful exercises for their employees, as well as for their stakeholders.

## 9. Limitations of the study and future work

The paper's conclusions should be interpreted cautiously. First, because the research was done in the Turkish construction industry, which works internationally and nationally, the findings are somewhat context-specific.

Secondly, this study is limited to the economic part of CSR and sustainability due to the uncertainty of economic variables. Additionally, the circular economy (CE) offers an alluring concept based on three fundamental principles: to design out waste and pollution, keep goods and materials in use, and regenerate natural systems by employing environmentally friendly renewable resources and energy. Despite applauding the goals of CE, many people have doubts about its viability (Mayers et al., 2021). In further research, the relationship between the environment and the economy can be investigated as a part of reporting, and ethics could be a new perspective on the concept. After all, the reason to create sustainability strategies is to sustain ethical conditions since the whole contribution is voluntary.

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## Analysis of behavioural processes in cultural centres through concepts of configuration and time: A three building comparison in Istanbul

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#### Abstract

Cultural centres have changed throughout history in terms of their configuration and usage. Changing design approaches, socio-cultural patterns, technical improvements, and user demands have also changed the usage, content, and function added resulting in changing the spatial configuration and architectural program. In Istanbul, some cultural centres still have some hard-programmed characteristics or strict rules in terms of architectural programming relating to the defined functions in everyday life and social interactions. Other cultural centres maintain flexibility in their architectural program to include various social activities. This study aims to syntactically demonstrate how the social interaction spaces of cultural centres tended to change from the period of 1938 to 2005 by the correlation between syntactic values of configuration and the frequencies of usage. As a result, it can be seen that the spatial configurations have determinants on spatial behaviour. In one centre that is examined, circulation space is more integrated and connective. Therefore, it is used as a social interaction area that supports random encounters. Hence, weak programming rarely has coherence between usage frequency and syntactical values. On the contrary, in the other centres that are examined, the users strictly follow the rules of spatial configurations. Strong programming also has more significant correlations between syntactic values and usage frequency. The crucial role of spatial morphology and user behaviour are highlighted to support social interaction in strong-weak programming. How the architectural program in cultural centres tends to change is argued.

#### Keywords

Cultural centres, Changing user's demands, Social interaction, Strong/weak architectural programming, Space syntax.

#### 1. Introduction

Cultural centres are public spaces where people can spend leisure time with many cultural and art activities. Over time, spaces and their usage have changed due to the direct effect of building technology, design approach, socio-cultural patterns, and user demands. Therefore, there is a connection between a cultural centre's configuration and a user's behaviour. A user's behaviour, demands, or perceptual, cognitive, social, and psychological needs can manipulate an architectural program, which changes a building's configuration (Figure 1). Therefore, the symmetry and asymmetry values of a building can change over time. Regarding cultural centres, there are shifts from a monocentre (single-hall) to a pluralistic system where additional functions are included, and sociopetal areas emerge.

Over time, users' demands and needs have altered the functions covered in the architectural program of cultural centres. In Turkey, cultural centres built with strong programming have gained flexibility when functions and areas for social interaction are added. This change is the main research topic of this study and will be syntactically examined through selected cultural centres.

## 2. Social interaction theories in the context of cultural centres

There are many theories about developing a design that regulates social interaction relationships among people. Behavioural settings and social interaction are two key concepts of social interaction theories. In Barker's theory (1968), the user refers to the concepts of milieu, synomorphy, and performance to understand the appropriate meaning of the behaviour. These components determine the nature of spatial behaviour. When analysing the environment, the spatial behaviour of the user becomes crucial in the process of usable information transfers of the environmental data.

An environment and behaviour in space are not independent. According to Itterson (1978), people experience the environment and affect change on it. And the very fact of the changing the environment also changes the user's experience of it. In general, people not only respond to their environment, but also people can create it. The study of the environment as a determinant or modifier of experience and behaviour is joined by the study of behaviour as a determinant and modifier of the environment described twofold relation between these two aspects. This reciprocal relationship between experience and action, between knowing and doing (Ittelson 1978).

According to Hillier (1996), the reciprocal effects of environment and behaviour on each other and multiple effects on both arise from patterns of land use and building frequencies, which are themselves influenced by the space-movement relation, that give buildings or cities their characteristic structure, and give rise to the sense that everything is working like a system to create the special kinds of well-being and excitement that we associate with cities or buildings (Hillier, 1996).

There are relationships between the morphological describability of space and how people use it. These elementary relationships between the form of space and its use suggest that the proper way to formulate the relation is to say that space is given to us as a set of potentials and that we exploit these potentials as individuals and collectives in using space. Thus, the relation between space and function is analysable, and to some extent predictable (Hillier,



*Figure 1.* Diagram exposing the relationship between user' behaviour, architectural programming, and configuration of buildings.

1996).

In environment-behaviour studies, built environment/arrangements can be defined with the terms "sociopetal" and ", sociofugal" which are defined as "unifying" (bringing people together) and "separative" (separating them apart). These two opposing concepts define the space's social interaction and physical characteristics of the spatial configuration. For example, the sociopetal order provides different positions for users within the residential arrangement placed within social interaction and social solidarity (Lang 1987; Ünlü et al., 2001). Sociofugal space, which inhibits conversation, like a train terminal, is essentially a place for waiting (Bechtel, 1997).

Sociopetal spaces are configured to enable people to focus on the center, thereby bringing them together in large, spacious, and open areas with bright lighting and high ceilings that encourage conversation. Whereas socio-fugal spaces, are configured with dim lighting and low overhangs which tend to drive people toward the periphery of a room, keeping them apart and discouraging social interaction (Sommer, 1969). In the examined cultural centres, linear seating elements are used for sociofugal seating, and mutual seating is an example of a sociopetal seating arrangement. However, some places needed both spaces because some people wanted to have intimate departure conservations while others wanted the anonymity of sociofugal spaces (Bechtel, 1997).

Furthermore, spatial behaviour interacts with parameters such as identity, the structure of thought and mental perception as part of the individual, or society, and the physical, social, and temporal aspects of the space in which it resides (Edgü, 2003). Also, users behave according to different features of the environment, users affect and are affected by the environment with adaptive and maladaptive behaviours.

As well as, behaviour related to internal and external issues, environments are defined by and experienced through actions (Ittelson, 1978), movement, or behaviors. For example, the built environment influence perception, and perception influences behaviour in the space (Fisher-Gewirtzma & Wagner, 2003). According to Montello (2007), the physical environment influences human experience and behaviour through allowing, facilitating, requiring, impeding, or preventing various mental and behavioural acts (Montello, 2007). Thus, the formation of the space character (sociofugal/ sociopetal) and the user can interfere with the weak/ strong program of configuration.

Hillier and Hanson (1984) first argued how buildings can be classified as having strong and weak programming. Before Hillier and Hanson, Levi-Strauss's (1953) mechanical and statistical models can be similar to this categorisation. In the mechanical (long) model, ritual is a set of behaviours in which rules specify all sequences and all relations; however, in the statistical (short) model, there is a generation of new relational patterns by maximizing the randomness of encounter through spatial proximity and movement (Hillier & Penn, 1991). According to Hillier and Penn (1991), "program" is the name of the spatial dimensions of an organisation, and the key element in any program is the interface, or interfaces, that the building exists to construct.

The configuration of the spaces will influence users' behavior by creating various communication and encounter patterns (Penn et al., 1999; Sailer & Penn, 2009; Sailer et al., 2013). The program of a building presents the spatial relation and the spatial configuration of the layout according to allowing or limiting some other behaviour. Depending on this, buildings have two types of programs classified as weak and strong (Hillier, 1984; Capille & Psarra, 2014; Sailer, 2015). According to Sailer et al. (2013), this classification of programming in space syntax theory suggests that in strongly programmed buildings, social life follows the rules of spatial configuration and strongly defined boundaries. There are strict rules and an internal hierarchical organisation (Hiller & Hanson, 1984). While in weak programmed buildings, the use of space is independent of the configuration. There are less rules, weak boundaries, and a lack of hierarchy (Hiller & Hanson, 1984). Space

Analysis of behavioural processes in cultural centres through concepts of configuration and time: A three building comparison in Istanbul and control level usage are related to inhabitants and strangers (visitors) in the building. Inhabitants are defined as users who have access to and control over space and who have social knowledge generated in the building. Visitors, on the other hand, are temporary users who have no authority over the building.

Different spatial configurations allow, support, or can complicate some behaviours and interactions among users. So, some buildings have had more strictly separate and differentiated the range of freedom and access for different actors for many different reasons (Koch, 2015). These are 'strongly programmed'; examples are prisons, hospitals, and courthouses.

In space syntax terminology, strong programmed buildings have low integration and connectivity, which restrict movement and unpredictable encounters, both at a global and local scale, thereby restricting opportunities for interaction. Whereas weak programmed buildings have high connectivity and integration, enhancing movement and providing more opportunities for interaction (Pachiloca, 2019). Also, the placement of attractors in the spatial configuration diverts the natural flow of users. To illustrate, in strongly programmed buildings attractors are placed in segregated areas without configuration logic, and there

is a dictated motion path. However, in weakly programmed buildings, attractors placed in integrated areas, depending on the configuration logic, there is a random motion path. Moreover, different times and usages are pointed out as variables that indicate the program of a building by limiting certain activities or allowing more activities. In strictly/ rigidly programmed buildings, there is a restriction on the use of space, but in loosely/ weakly programmed buildings, there are no restrictions on the use of space (Sailer et al., 2013).

In their research, Koch and Steen (2012), used the concept of spatial practice for spatial roles and tasks, which depict the interaction between spatial configuration, spatial behaviour, and users' itineraries, that "decompose" as a building program. In strong programming, space practices can be performed in space and time similarly because of the configuration logic of a strongly programmed building. While in weak programming, spatial practices can be carried out differently in space and time because of having more options on how and where to do things in weakly programmed buildings.

Another research by Capilla and Psarra (2013) suggested that the unequal distribution of activities across different spaces and functional areas of a building meant strong programming,

*Table 1.* Criteria for strong and weak program buildings as derived from Kerstin Sailer's study 2013.

	STRONG PROGRAM	WEAK PROGRAM				
	<ul> <li>More complex and segregated layout</li> </ul>	• Simpler and more integrated layout				
Penn	<ul> <li>Strong control of inhabitant-visitor interface:</li> <li>Separate non-interchangeable</li> </ul>	<ul> <li>No control of inhabitant- visitor interface:</li> <li>Same entrances for inhabitants and</li> </ul>				
/ ORIJIN , Peponis,	entrances Easily controlled spaces for visitors, shallow in the building- close proximity to visitors	visitors No control over visitors				
<b>THEORY</b> Hillier, Hanson,	<ul> <li>Strong control inhabitant- inhabitant interface</li> <li>Strong division of categories of uses by division of spaces used.</li> <li>Activities follow program</li> <li>Examples of building types courts, prisons, hospitals, airports</li> </ul>	<ul> <li>No control inhabitant- inhabitant interface</li> <li>No division of spaces, therefore categories of users are mixed.</li> <li>Activities follow configuration</li> <li>Examples of buildings type offices, museums, galleries</li> </ul>				
CONTRIBUTI ONS Sailer, Koch/Steen, Heo et al. Lu et	<ul> <li>Attractors placed in segregated areas without configurational logic.</li> <li>Activities follow program no influence of a spatial factor on different roles and tasks.</li> </ul>	<ul> <li>Attractors placed in integrated areas according to configurationally logic</li> <li>Activities follow configurational different spatial factors influence different roles and tasks.</li> </ul>				

whereas an equal distribution highlighted weak programming. In weak programming, integrate people and promote social encounters rather than keep people apart/ heavily used corridors and areas of movement flows thus giving rise to social encounters. Also, the diversity of spatial characteristics allowed for a diversity of usage patterns and accommodate different functions.

Moreover, Sailer et al., (2013) presented in their comparative hospital research that a strong programmed building can also show both strong and weak characteristics, as revealed in the functional and spatial analyses results. The classified weak and strong programming criteria from this literature can be seen in Table 1.

In conclusion of the research of Sailer et al., (2013) weak programmed buildings can indicate the characteristics of strongly programmed buildings, and strong programmed buildings can indicate the characteristics of weakly programmed buildings. For instance, a massive building becomes harder to maintain its "strong programmed" because it shifts socially over time. Because when the number of people in a building increases, the number of places to receive these people and encounters also increase.

In this strong and weak combination or transition situation, Capille and Psarra (2016) emphasized that a weakening of the organisational control of interfaces and activities, and can be understood as a transition from a "strongly programmed" to a "weak programmed" environment. In a "weak programmed building" patterns of occupation and movement are influenced more by the configuration of spaces than by programmatic labels assigned to each space (Capille & Psarra, 2016).

As a result, the number of un-programmed contacts increases as a by-product of operationally defined movement (Sailer et al., 2013).

As well as in Sailer's (2015) research, a library can also show both strong and weak programming; movement flows only partially followed spatial configuration, and the interface the building constructed kept people apart rather than bringing them together. In addition, significant variations in user activities existed in some parts of the library, all of which point toward strong programming. At the same time, however, certain activities showed clear spatial preferences and significant differences in local and global patterns, which illustrates weak programming.

#### 3. Cultural centres between 1938-2005 in Istanbul and their changing process

To openly discuss spatial morphology and differences in social interaction areas in cultural centres, some essential information about cultural centres found in the books and articles has been involved. With the emergence of cultural centres, the formation of typology and morphological changes over time have been classified into three-time frames that occurred between the 1930s and 2000s. Social, political, and cultural incidents in this period will be mentioned through the cultural centres.

When we look at the process of change in the fundamental cultural and social trends of Turkey in terms of socio-cultural centres in Istanbul, this process can be separated into three main periods; 1930-1960, 1960-1990, and 1990- to the 2000s. The first period is between 1930 and 1960. Starting from the declaration of the Republic of Turkey, the first community houses (halkevleri) took place as a publicly constructed environment. Eminönü Halkevi (1937), Kadıköy Halkevi (1938), and Fatih Halkevi (1945) were the first examples of community centres in İstanbul. The Kadıköv Halkevi is a community building constructed in 1938 due to a competitive bid project. Inside the building there is a multi-purpose hall, library, gymnasium, cafeteria, and some classrooms, which are still used today. The building was divided into two separate parts for seventy years (1943-2013): a cultural centre and a courthouse. Today the building still has two doors on the same side. It is used as a cultural centre called the Kadıköy Public Education Centre.

From the young Republic until today, changes in a cultural centre's configuration have depended upon multiple socio-political and socio-cultural dynamics. When scrutinizing the process between specific times in Turkey since the founding of the Republic, the initial cultural building is community centres (Bayram, 2016). Between 1930 and 1950, centres were built with a rational-functional attitude which is reflected in the powerful programming of the building programs with a strong directive attitude of pre-defined spaces and functions.

In 1951, community centres were locked during the progress of the multi-party era. The state's strength and influence were decreased in the design of cultural centres. It then reemerged in the private sector with the foundation of summer cinema in the 1950s. With the foundation of the State Planning Organization in 1961, the planning period passed on the examination of the culture and education policy conditions; instead, measuring investments and targets (Bayram, 2016).

Television, which has a lot of social influence, enters houses. In the 1960s, 1970s, and 1980s, military interventions against governance influenced the cultural centres where the people gathered. The effects of these social events led to the cultural centres being delayed in finishing the buildings. The cultural centres remained in our country until the end of the 1990s as intermittent interventions in the design and construction process.

Following the planned periodical transitions is the second period we will examine. Apart from the Ataturk Cultural Centre (1969) and the Pendik Atatürk Cultural Centre (1985), there were not any other buildings established in the years between 1960 and 1990 in Istanbul (Şahin, 2008). The first cultural complex, the Atatürk Cultural Centre (ACC) originally called İstanbul Culture Palace was designed by Feridun Kip and Rüknettin Güney in 1946 and they started constructing it in 1953. However, after three years of budget deficiency, in 1956 construction was resumed by Hayati Tabanlıoğlu who completed the project in 1969. ACC was burned in 1970 and renovated in that year. After thirty-eight years, the building was closed for renovation in 2008. The original building was demolished in 2018 and then it was reconstructed in 2019 by Murat Tabanlıoğlu. The new contemporary building opened to the public as a



Figure 2. Three periods of culture centers construction between 1930 and 2016 in Istanbul.

state-of-the-art cultural complex with an opera house, concert halls, theatre halls, cinemas, libraries, design shops, cafes, and restaurants after thirteen years (URL 1). Pendik Atatürk Cultural Centre, which was designed by Sedat Hakkı Eldem in 1984, has a central multi-purpose hall, a foyer, a few classrooms, and service spaces that are used today. However, the building was reconstructed in 2018.

The establishment of the Department of Cultural Centres in 1976 started the construction of cultural centres throughout the country. Until the 2000s, buildings designed through bidding, competition, or re-functioning type of projects, were not built until much later due to budget constraints.

In the period up to the present day, Cultural Centres have come to be known as Public Education Centres, Neighbourhood Mansions, Art Centres, Culture Houses, Culture Palaces, Cultural Sites, Life Quality Upgrade Centres, Community Centres, Culture and Arts Centres, Culture and Performing Arts Centres and Performing Arts Centre which are all very different names (Figure 2). One of them is Caddebostan Cultural Centre, which was built in 2005. There are a few cinema halls, a theatre hall, cafes, shops, an atelier, an exhibition area, and social spaces for resting in the circulation areas.

In brief, in the cultural centres, discussed between 1932 and 1952, sequences of spaces reflected a strong programmed configuration. After 1950, with the emergence of the private sector, the establishment of summer cinemas and the influence of the state on the cultural centre's architectural program began to decrease slightly. With functional privatization, cultural centres and their users, as a matter of fact, were no longer in the city; since they no longer needed large multi-purpose halls and were designed with the flexibility of solving them in all their functions with computer technology.

In the scope of this study, we examine and compare three different cultural centres constructed in different time periods. All three are approximately the same size and can still be used today. Kadıköy Public House (1938) is selected for the analysis of strong programming in the period between 1930-1960. The Pendik Atatürk Cultural Centre (1985) was selected for weak programming in the period between 1960-1990, and Caddebostan Cultural Centre (2005) was selected for also weak programming in the period between 1990-the 2000s. The selected buildings used for comparison, which each have a different typology, reflect their design ideas according to the relevant time period.

The weak/strong architectural programming in cultural centres with different construction years, to which period and configuration comparisons were made, is the focus of the study to compare the frequency of high/low social interaction frequency and deep/ shallow syntactic values of social interaction areas. In order to provide data on these focal points, the development of the cultural centres in Istanbul was examined and the infrastructure for the case study was established.

#### 4. Method of case study

Themain purpose of this study is to reveal how through spatial configuration, architectural programming, level of social interaction, and space-use relation, a tendency shift in cultural centres' configurations within а selected time frame exists. Space Syntax as a spatial theory and method has been preferred in the study due to the three main factors. The first is that the province allows for comparing social structure and physical structure in cultural centres through the mutual relationship between social structure and physical space (Hillier & Hanson, 1984). Second is that cultural centres with different construction years, and programming can be analysed to examine how people and construction era affect their social behaviour on a morphological basis. The third is that the interior recognizes the level of visual stimuli and gives certain point that also reflect the level of social interaction within the environment. Also, space syntax, used as a method in many academic studies, allows for the analysis of space in a two-dimensional mathematical way through the plan.

First of all, space syntax was termed by Bill Hillier, Julienne Hanson, and

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their colleagues at the University College London (UCL) during the early 1980s as an instrument to contribute to architects and urban planners in order to describe layout in terms of the pattern of connections between spaces (Hillier & Hanson, 1984; Askarizad &Safari, 2020).

According to Hillier and Hanson (1984), space syntax is an analysis of spatial patterns, with emphasis on the relationship between local morphological relations and global patterns. Space syntax focuses on how the spatial structures of complex buildings and urban areas become a recognizable part of a culture, reflecting and creating patterns of use and encounter. Also, space syntax gives an analytic definition of layouts' properties involved with how people locate themselves and circulate in buildings (Peponis et al., 1990).

Hillier and Hanson (1984) suggest that, from the point of view of the social use and cultural meanings of layouts, the relation of each space to the rest of the system is of far greater significance than its connectivity. Hillier and Hanson have proposed that the poverty of "integration" describes how a system's parts are linked into a whole (Peponis et al., 1997). Space syntax scrutinizes the state of perceiving the space in fragments by people who experience a space by bringing those fragments together in the brain, narrating them into representation, and revealing them as cognizable, measurable expressions (Hillier, 1996; Şalgamcıoğlu, 2021).

Space Syntax has preconditions for all further analysis, beginning with identifying a "unit" of space (Peponis et al., 1990). So, the unit is defined with a grid initialization basis onto a drawing such as a plan or section drawing imported from vector base drawing software, which is "Autocad" software (2D architectural drawing program licensed by Autodesk) (Şalgamcıoğlu, 2021).

A configurational plan or section constituted by grids can be approached as a system of syntactic relations and can be syntactically analysed by software. Computer analysis layout with most basic principles, relations such as similarities- differences, symmetry-asymmetry, distributednessnon-disributedness has this meaning. Depth, integration, connectivity, isovist area, and perimeter, are crucial parameters of space syntax derived from visibility and the configurational relationship between sequences of spaces. Among these concepts, depth also stands out as an important concept in the asymmetric plan systems that move by passing from one cell to another (Bafna, 2003). Assessment of space as deep or conversely shallow spaces as a result of the analyses involve important data regarding the interaction or integration of space (Salgamcioğlu, 2021).

The integration value of a space in a configuration is calculated by first representing the space complex as a graph according to one of several representational conventions: space defied boundaries, fewest and fattest convex spaces, fewest and longest straight lines, then calculating the total number of spaces that intervene between each space and every other space in the configuration. This calculation gives a series of numerical values that express how this particular configurational property is distributed in the complex (Hillier & Penn, 1991). As well as, integration shows which spaces are shallow or not within the whole configuration, and connectivity enables the interpretation of the neighbourhood size. Also, connectivity is a "local" measure that does not describe how each space relates to the rest of the system (Peponis et al., 1997). We can interpret which spaces gradually lie out within the overall relations in the impact field analysed, i.e., which spaces are deeper, or on the contrary, which spaces and fields attend more to the interconnecting area between spaces (Şalgamcıoğlu, 2021).

The Isovist area is about 360° visible area (polygon) from a vantage point (Benedikt, 1979). The perimeter is the boundary of the visible area that rises from becoming indented. Isovist is calculated from a visible polygon, and also perimeter is calculated from the boundary of the isovist's polygon. Perimeter data can describe the state where the dimensions of the perceived space are or are not loner and thinner (Şalgamcıoğlu, 2021).

In this research, isovist area, perime-

ter, integration, and connectivity are selected for graphical and numerical data analyses acquired by using the Space Syntax by way of Syntax 2D to compare and interpret different configurations. These syntactical values are obtained from two-dimensional layouts of the configuration (AutoCAD drawing) by using "Syntax 2D" software licensed by Michigan University. Syntax 2D analyses the layouts through 1x1m2 grid initialization, which is arranged in the same layout for the configuration to be compared by researchers. Syntax 2D also analyses spatial configuration through a 2D plan of the building that is divided by wall, boundary, and reference line types according to blocking the line of sight for evaluation.

In the third part of this research, 1930-1960, 1960-1990, and 1990-the 2000s are the three periods mentioned due to forming effects as a result of the social changes in the world of architecture in Turkey. The cultural centres still in use today are selected for the case study. Selected culture centres belong to the aforementioned time periods and whose years of construction are thought to represent the different period and configuration in which they reside and can be observed on site. For this reason, the Kadıköy Public Education Centre (KPEC)\ built in 1938, was used for the first analysis sample; the Pendik Atatürk Cultural Centre (PCC), built in 1985, was used for the second analysis sample; the Caddebostan Cultural Centre (CCC), built in 2005, was used for third analysis sample. The different plan typologies of the cultural centres, their functions, their use status, and their location were also influential in the selection of examples of cultural centres to be analysed. Although this case study does not claim the period analyses, time is one of the concepts used to analyse changing of spatial programs in configuration.

In order to understand the spaces of the configurations, an observation method is executed at selected cultural centres on the weekends between 12:00 a.m. and 7:00 p.m. through a selected route on the floor of the main hall. In three cultural centres, five observation points were selected from the entrances to the hall (in circulation areas) and almost the same nodes were determined in the research (Figure 3). The entrance, informational/ ticket desk, foyer, sitting areas, and main hall entrance(s) are five analyzing points. In observation, the technique is used to determine how many people are in the selected route and count these people who are moving or static and what they do on the same route in three configurations. This observation represents the behaviour modes and usage frequencies of the interactions between users using different spatial configurations at every hour of the selected intervals (five minutes per hour 12:00 a.m.-1:00 p.m.-2:00 p.m.-3:00 p.m.-4:00 p.m. - 5:00 p.m. - 6:00 p.m. and 7:00 p.m. during the one weekend day). Observation day was selected on week-



**Figure 3.** The analysis areas/points determined at the selected Cultural Centres; KPEC (left), PCC (middle), CCC(right).

Analysis of behavioural processes in cultural centres through concepts of configuration and time: A three building comparison in Istanbul ends because of using more people in buildings than on weekdays.

The empirical data collected concerns snapshot studies of different types of behaviour and occupancy; movement flow at thresholds or entrances, and counting of the users in selected nodes in the main route in the cultural centres. These five points are important for comparison of observation and syntactic analysis values.

As seen in figure 3, the selected route from the entrance to the hall is spread and gets length with time because KPEC has a narrow route, PCC has a medium route, whereas CCC has a long route from the entrance to the hall.

In the three examples of space syntax values, frequency of usage (individual and together behaviour modes) and frequency of social interaction (only together behaviours mode between two or more people) were obtained separately for overlapping observation values with syntactic values. Furthermore, observation data and space syntax values were crosschecked with the "SPSS (Statistical Package for the Social Sciences)" statistical analysis program. These analysis methods were organized into two types of comparison between three cultural centres: the syntactic values- usage frequency and the syntactic values- social interaction frequency.

During the comparison stage, correlation values were formed by overlapping usage frequency (individual and together behaviour modes) data acquired with the Observation Method and syntactic parameters' value (isovist area, perimeter, integration, and connectivity) acquired with the "Syntax 2D" (licensed by Michigan University) were then interpreted within the context of the hypothesis. Eight correlations were obtained by overlapping the data from the space syntax and the observation method (Figure 4).

## 5. Syntactic analysis and results of social interaction areas in cultural centres

The case study aims to syntactically analyse the hypothesis: that over time the spatial formation for social interaction changes due to weak or strong architectural programming according to space syntax values of social interaction areas of cultural centres and user-space interaction.

In the scrutinized cultural centres' isovist area, perimeter, integration, and connectivity data were measured by comparing the changes between five nodes (entrance areas, foyer, consultation/booking office, and sitting areas) of circulation and social integration areas of the selected spaces within three predefined terms. Isovist area, perimeter, integration, and connectivity values are used to show if the configurations' social interaction spaces match up with users' behaviors and if there is a considerable change related to the configuration of the circulation spaces. In the initial stage, changes in spatial morphology between the selected terms were examined based on graphical and numerical data.

In graphical data, as seen in figure 5, isovist area analysis graphs with visual fields (isovists) from selected five analysing nodes shows visibility graphs for three buildings. The red colour represents integrated, shallow, and highly visible areas, while the blue represents deep areas. The colour range between red to blue in the graph show integra-



Figure 4. Compared data for analyzed relationships.

tion and visibility from high to low. Also, the black colours in figure 5 show the isovist polygon from the five selected nodes for comparison in each configuration. There is the big isovist polygon (visible area) on the multi-purpose hall's threshold in KPEC and PCC due to one big multi-purpose hall in the configuration. In comparison, the foyer in CCC has a bigger isovist polygon than the threshold of the hall.

While KPEC has more divided and depth areas, PCC and CCC have shallow and integrated areas. In KPEC, the front garden has the highest integration value, and the entrance is deep due to having two separate entrances and a linear building typology. In PCC, the multi-purpose hall has the highest integration value because of the compact building typology. In CCC, the circulation area has the highest integration value because of radial building typology and more integrated circulation areas.

three different cultural centres were analysed based on syntactic values;

KPEC was built in 1938 and had solid and divided areas that also have deeper spaces; PCC was built in 1985 and has solid and compact areas; and CCC was built in 2005 having integrated and more shallow areas.

When we look at the numerical syntactic values, due to the linear configuration of the KPEC, the analysis areas remain deep, and their syntactic values are low. The average syntactic values, such as isovist area, perimeter, integration, and connectivity of the entrance, informational desk, foyer, and hall entrance, which are the analysis areas due to the central and simple construction of PCC, are higher than with the KPEC. In CCC, due to the radial configuration, the entrance, fover and encounter areas are higher than the other two configurations due to the integrated configuration of the layout (Table 2).

According to "Syntax 2D" (licensed by Michigan University) software's numerical results from all analysis areas (average value of five nodes); • KPEC's average isovist area value is

1 (entrance) 2 (information desk) 3 (exhibition) 4 (foyer) PCC 1 (entrance) 2 (information desk) 3 (foyer) 2 (foyer) 3 (information hall) 4 (snack bar) 5 (entrance hall)

Figure 5. Syntactic Graph Analyses of KPEC (top), PCC (mid) and CCC (bottom).

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First, the spatial configurations of



Table 2. Syntactic data.

	KPEC	2		PCC		CCC			
Obs. Areas	Ave. Usage Fre.	Ave.Social Interaction Fre.	Obs. Areas	Ave. Usage Fre.	Ave. Social Interaction Fre.	Obs. Areas	Ave. Usage Fre.	Ave. Social Interaction Fre.	
1	307	91	1	273	57	1	386	196	
2	216	71	2	61	17	2	687	256	
3	148	34	3	266	61	3	432	92	
4	77	25	4	301	58	4	399	99	
5	150	66	5	323	30	5	50	17	
Σ	898	287	Σ	1224	223	Σ	1954	660	

Table 3. Observation data.

KPEC					РСС				CCC					
Obs Areas	Iso. Area Value	Iso. Perimeter Value	Integration Value	Connectivity Value	<b>Obs Areas</b>	Iso. Arca Value	Iso. Perimeter Value	Integration Value	Connectivity Value	<b>Obs Areas</b>	Iso. Arca Value	Iso. Perimeter Valuo	Integration Value	Connectivity Value
1	327696	10074	183236	329	1	292304	15319	143848	292	1	353533	35680	249807	351
2	185863	14665	96763	193	2	111008	9126	58851	111	2	393613	34933	276838	397
3	154668	11987	70194	162	3	182558	13778	97939	183	3	391526	34589	274699	396
4	133204	9747	59819	138	4	332207	21712	193029	342	4	236049	16858	177626	236
5	174625	10159	71446	179	5	352579	22355	201648	386	5	119756	9393	80308	120
Σ,	195 211,2	11 326,4	96 291,6	200,2	Σ,	253 991,9	16 419	138 940,4	262,8	Σ/5	298 895,4	26 290,6	211 855,6	300

195 211,2 PCC's average isovist area value is 253 991,9; and CCC's average isovist area value is 298 895,4.

- KPEC's average perimeter value is 11 326,4; PCC's average perimeter value is 16 419; and CCC's average perimeter value is 26 290,6.
- KPEC's average integration value is 96 291,6; PCC's average integration value is 138 940,4; and CCC's average integration value is 211 855,6.
- KPEC's average connectivity value is 200,2; PCC's average connectivity value is 262,8; and CCC's average connectivity value is 300,0.

The average values are measured by the sum of each grid value divided by the grid's number. This reduction of numerical expression can make easier the comparison of three buildings. Thus there is a linear increase when comparing selected nodes in social interaction areas of the building's average isovist area, average perimeter, average integration, and average connectivity values (Figure 6).

Observation is another method used to determine behavioural modes that reflect the frequency and duration of the use of space and users' social interaction. The sum of all of the users' collective, individual and social interaction modes, either passing by, waiting, or sitting, which is the first value extracted, is counted in the observation period and gives the frequency of use from the observation method. The numerical sum of modes of conversation (standing chat and sitting chat) between two or more people counted in the observation period constitutes the frequency of social interaction, which results in the data obtained from the second observation (Table 3). Moreover, in KPEC sum of 898 people are observed, and 287 people have social interaction with other people. In PCC, a total of 1224 people are observed; 223 people have social interaction with other people. In CCC, a sum of 1954 people are observed; 660 people have social interaction with others. Usage frequency has a linear increase in comparing configuration subsequently, whereas social interaction frequency has not a linear increase.

When the social structure change that constitutes the research's subject is analysed through the cultural centres, the existence of the relationship between the Space Syntax and use values obtained in the selected cultural centres was analysed by the Statistical Program of Statistics (SPSS).

The existence of this relationship will provide an assessment of how the cultural centres still in use today and selected from three different periods of construction year have changed. Average/mean integration, connectivity, isovist area, and perimeter values of the three buildings are taken out, compared and how the change of tendency between the periods is revealed.

The change between periods has some commonalities and differences in the three cultural centre's design configurations. The differentiation in the spatial configuration or the same remains is discussed in more specific places such as the entrance, foyer, consultation/ ticket entrance, and hall entrance.

In the case study, statistical data has been obtained by observation and space syntax methods. The relevant data is as follows: the frequency of use which includes all modes of spatial behaviour in the environment, as well as the frequency of social interaction resulting from behavioural modes involving social interaction (talking, standing, and sitting between two or more), isovist area, perimeter, integration, and connectivity value. Cultural centres with different typologies and three different built years can be compared to usage and configuration with this data. Binary correlations analysis of frequency and syntactic values were performed with the "SPSS" statistical program to explain whether the spatial behaviour of configuration and user are working together or not.

In order for simple regression correlation results to be related, the value of "r" must be close to 1 between +1 and -1 (whether the sign is positive or negative), and the value of "p" must be below 0.05. "p" value determines the degree of relationship when p is equal to zero, it means that there is no relationship. If the "p" value is below 0,02, the relation is more significant. The regression values obtained by observation and space syntax in KPEC, PCC, and CCC, which are the three samples, are tabulated in Table 4. Significant findings are shaded. The increasingly irrelevant usage frequency- syntax data correlations indicate that the cultural centre design evolved from strong programming to weak/ flexible programming. In addition, there was no significant correlation between the frequency of social interaction and syntax values.

At the second stage of the analysis, the correlation between syntactic values and the frequency of the use of buildings were acquired from the





Figure 6. Syntactic Value Change of All Analysis Areas.

Analysis of behavioural processes in cultural centres through concepts of configuration and time: A three building comparison in Istanbul

CULTURE CENTER	SYNTAX DATAS OBS. DATA	Isovist Area Value	Perimeter Value	Integration Value	Connectivity Value
КРЕС	Usage Frequency	r=0,933; p=0,020*	r=0,193; p= 0,756	r=0,939; p=0,018*	r=0,940; p=0,017*
	Social interaction frequency	r= 0,847; p=0,070	r= 0,129; p=0,837	r= 0,817; p=0,091*	r= 0,850; p=0,068
РСС	Usage Frequency	r= 0,871; p=0,055	r=0,858; p= 0,063	r= 0,851; p=0,067	r= 0,859; p=0,062
	Social interaction frequency	r= 0,358; p=0,566	r= 0,290; p=0,636	r= 0,290; p=0,636	r= 0,277; p=0,651
ССС	Usage Frequency	r= 0,854; p=0,065	r=0,765; p= 0,132	r= 0,874; p=0,054	r= 0,856; p=0,064
	Social interaction frequency	r= 0,765; p=0,132	r= 0,776; p=0,123	r= 0,769; p=0,129	r= 0,758; p=0,137

Table 4. Correlations of frequency and syntactic values of spaces.

building's physical and social structure respectively. KPEC's correlation value between the isovist area and frequency of usage (r:0,933; p:0,020) is more significant than CCC (r:0,854; p:0,065) and PCC (r:0,871; p:0,055) where a positively correlated tendency are found. Also, KPEC's correlation between the user's frequency and integra*tion* (r:0,939; p:0,018) is more significant than PCC (r:0,851; p:0,067) and CCC (r:0,874; p:0,054) where a positively correlated tendency are found. Similarly, KPEC's correlation between the user's frequency and connectivity (r:0,940; p:0,017) is more significant than PCC (r:0,859; p:0,062) and CCC (r:0,856; p:0,064). Nevertheless, correlations between user's frequency and perimeter values in KPEC, PCC and CCC have no significance.

By elaborating the morphology of circulation and social integration areas in cultural centres and their usage, the interrelation between the space syntax values and the social interaction frequency between two individuals or more are also obtained and overlapped. But, there is no meaningful correlation between syntactic values and social interaction frequency. Also, the correlation between usage frequency and syntactic values can give clues about how the circulation and gathering spaces in cultural centres tended to transforming over time and which configuration or typology is stronger than others and why.

The correlations between syntactic values and the frequency of the users were acquired in the buildings' physical and social structures. KPEC's correlation between syntactic values and the users' frequency is more considerable than CCC's and PCC's correlation rates. These correlation values show the spreading of social interaction in building over time. This is because KPEC users have emerged with strong programming and positive correlation (correlation). This correlation, over time, has been altered by the change of the syntactic values of buildings. The sequence of spaces in KPEC is more distributed and has deep and predefined spaces. KPEC is strongly programmed because users follow the sequence of spaces, so spatial values and usage frequency have significant relation. In PCC, the sequence of spaces surrounds the main hall, spaces are more compact and shallow than in KPEC. PCC tends to correlate with configurational values and usage frequency. CCC has more
integrated spaces with radial configurational typology, circulation spaces have visual accessibility between sequences of spaces. There is no significant correlation, but there is a tendency between syntactic values and usage frequency in CCC and PCC which can be classified as weak programmed. The spatial morphology of cultural centres has more segregated spaces with defined functions before more shallow and integrated spaces with more functions added.

Consequently, it is seen that cultural centre's building typology and design program tended to change over time based on the social interaction areas from highly regulated and limited social interaction spaces to layouts that act generatively and enable a random pattern of encounters. In the context of the article, the transforming building program of the cultural centres that have shifted with various functions is confirmed by space syntax theory and methodology. Cultural centres which is built many years ago with strong spatial/ architectural programming tended to gain flexibility compared to two other relatively new built counterparts.

#### 6. Discussion and conclusion

In cultural centres with multiple functions, the change of architectural programming over time can be analysed and interpreted by space syntax theory. It emphasizes how the cultural centres come from the program within the publicity context and how they tended to change. It is shown that the strong programming of the building typology tended to soften over time based on the context of the user's behaviour and spatial configuration.

Also, the culture centre's linear configuration typology (has an early building time) is a non-distributed building, and social interaction does not spread in the building. Compact configuration typology (has a middle building time) is a symmetric building, but social interaction does not spread in the building because of being stuck. Radial configuration typology (has the last building time) is more distributed, and asymmetrical building value and social interaction are spread in the building. interaction spread into the buildings of the different cultural centres. In the context of this paper, the transition of the architectural or building program of the cultural centres that have various functions has been described by space syntax methodology, in which programs in the situation of commonality and how they have a tendency to change are analysed. The change in the use of space, building symmetric-asymmetric values and function added, has been examined from 1938 to 2005 and depends on many behavioural, sociocultural, and political dynamics.

Continuous population growth, changes in user demands, popular culture, technical improvement, etc., change a cultural centre's program needs with new approaches and functions added. With the use and diversity of social interaction points within new functions added, new design and relation approach tended to change the strong building program by softening it over time.

This suggests that the planning scheme has changed from strong programming to increasing cultural centre buildings with varying functionalities. It is revealed that when cultural centres in Turkey constructed in the 2000s were evaluated, additional functions were added as a consumer culture contributed flexibility to the building's strong program. The architectural program can change socially. As more people used the spaces simultaneously, more functions were added for the more users and more behaviour modes. This has enabled the user to have different modes of behaviour with various functions in a cultural centre design which also changes the building's asymmetrical and symmetrical values.

The intention of this work is not to criticise the cultural centres' typology for changing the original role before and now. Instead, we seek to understand how architectural programming relates to the association and formation of social interaction in the cultural centre's buildings. We try to understand the differences between built different periods' sociocultural life and different configurations of architectural programming as a social instrument

From the 1930s to the 2000s, social

of representation and as an actual field of social interaction.

In this paper, there are three different configurations built in a different year and a set of variables of potential interest have been discussed. Also, this paper does not claim to analyse the period, instead an architectural programs and configurations which were built in different periods in Turkey.

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# Evaluation of the effects of Covid-19 lockdowns and strict restrictions on İstanbul's air quality

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#### Abstract

The Covid-19 pandemic, which started in Wuhan, China, led to several strict restrictions and lockdowns in Turkey, like many other countries. Although lockdowns have had a socially and economically negative impact, they have affected the air quality in a positive way. The aim of this study is to examine the spatial impact of lockdowns on air quality in Istanbul and to determine the correlation of polluting indicators. In line with the determined purpose, PM10, SO2, NO2, CO and NOx parameters were spatialized with ordinary kriging method in 5 different time intervals and the relativity levels between meteorology, transportation and particles that cause pollution were examined with the Pearson correlation method. As a result, lockdowns caused an increase on CO and SO2 by up to 28%, while other particles decreased by 2% to 23%. Compared to 2019, a decrease of up to 60% in all particles except CO and SO2 has shown that lockdowns have a positive effect on air quality. It was observed that the pollution, which was concentrated in urban areas before the pandemic, spread to rural areas with the precautions taken. Temperature, number of vehicles and traffic index were found to play an important role in the emission of particles, while wind speed and direction played an important role in the displacement of pollution. It has been observed that finding a positive correlation between pollutants and the factors that trigger pollution has rapidly changed the ecosystem of the city along with the policies affecting air quality.

#### Keywords

Air quality, Covid-19 Lockdowns, İstanbul, Urban pollution.

# 1. Introduction

The Covid-19 pandemic, which started with the record of the first case in Wuhan, China on December 27, 2019 and affected the whole world, reminded again the importance of the relationship between public health and air quality. Pre-pandemic studies, which indicates that people who are exposed to long-term air pollution, especially in megacities, have a higher risk of chronic diseases, have been accepted by WHO (WHO, 2013). Studies conducted since the beginning of the COVID-19 outbreak have emphasized that there is a positive relationship between air pollution and the rate of spread of the virus (Comunian et al., 2020). Therefore, it is vital to define the effect of atmospheric particles in metropolitan cities with overpopulation during the epidemic period.

With the declaration of a pandemic by the WHO on March 11, 2020, many countries have tried to take measures with lockdowns or restrictions (WHO, 2021). Although the lockdown in the fight against the epidemic has caused a decrease on the global economic activities, it has helped to improve air quality on a large scale. It has been analyzed that air pollution has decreased significantly, especially in many countries that have become the center of the pandemic. A study conducted in Wuhan, China, analyzed significant decline in PM2.5, NO2 and O3 pollution types. It has also been emphasized that air quality tends to improve faster in regions with the highest population density (Lian et al., 2020). In a study conducted in Shanghai, China, a decrease of 31,3% to 77% was observed in PM2.5, PM10, SO2 and NO2 types in lockdowns compared to 2019 (Peterson & Filonchyk, 2020). In Barcelona and Madrid, Spain, NO2 concentrations decreased by up to 62% (Baldasano, 2020). Research in Gujarat, India, showed that PM2.5, PM10, SO2, CO, NO2 and O3 pollution types improved by up to 58% compared to 2019 (Selvam et al., 2020). In a study conducted by Chowdhuri et al. in Kolkata, India, it was observed that there was a 40% to 60% decrease in PM2.5, PM10, CO, O3 and SO2 parameters as a result of the

lockdowns (Chowdhuri et al., 2021).

In a study using satellite data from 27 countries, it was analyzed that air pollution decreased by about 20% in the first two weeks of the lockdown (Venter et al, 2020). Apart from Antarctica, NO2, SO2, CO, O3, PM2.5 and PM10 particles were investigated in the 20 largest cities in the world, which were most affected by the epidemic. At the end of the study, SO2, NO2 and CO showed a significant decrease. While a significant decrease was also detected in PM2.5 and PM10 levels, it was observed that O3 increased in many cities (Fu et al., 2020). By using PM10, SO2 and NO2 parameters in Morocco Sale City, a different rate of reduction in pollutant determined was determined during the Covid-19 lockdowns (Otmani, 2020). Table 1 shows some of the studies examining the effect of Covid-19 lockdowns on air quality. When the studies are examined in detail, it is seen that restrictions and lockdowns have a positive effect on air quality in many countries, especially in

*Table 1.* Previous studies examining the effect of Covid-19 lockdowns on air quality.

Author(s)	Case Study City/Country	Air quality parameters	Outputs	
Sharma et al, 2020	India	PM2.5, PM10, NO2, O3, SO2, CO	A decrease was observed in air quality values except for O3 parameter.	
Zhu et al, 2020	China	PM2.5, PM10, NO2, O3, SO2, CO	It has been analyzed that lockdowns contribute to air quality in the short term.	
Mahato et al, 2020	Delhi, India	PM2.5, PM10, NO2, O3, SO2, NH3, CO	There was a decrease in PM2.5, PM10, NO2, CO levels.	
Fattorini et al, 2020	İtaly	PM2.5, PM10, NO2, O3	It has been determined that there is a positive relationship between Covid-19 cases and air quality parameters.	
Dantas et al, 2020	Rio De Janeiro, Brazil	PM10, NO2, O3, CO	Except for the O3 type, a decrease was observed in other parameters.	
Shrestha et al, 2020	40 Cities worldwide	PM10, PM2.5, O3, SO2, CO, NO2	While there was generally a decrease in PM10, PM2.5 and NO2 values, variable results were obtained in other parameters.	
Donzelli et all, 2020	Florence, Pisa, and Lucca, Italy	NO2, PM10, PM2.5, O3	While there was a decrease in NO2 level, no change was observed in other pollutant types.	
Xu et al, 2020	Central China	PM2.5, PM10, SO2, CO, NO2, O3	A significant decrease was recorded in the lockdown process in all parameters.	
Freitas et al, 2020	Sao Paulo, Brazil	NO2, SO2, CO, O3, PM2.5, PM10, NOx,	Partial restrictions contributed to the improvement of air quality.	
Kerimray et al, 2020	Almaty, Kazakhstan	NO2, SO2, CO, O3, PM2.5 and BTEX	Pollutant types have contributed significantly to the development of air quality as a result of the lockdowns.	
Aydın et al, 2020	Turkey	PM2.5, O3	While PM2.5 decreased, an increase was observed in O3.	
Çelik & Gül, 2021	İstanbul, Turkey	PM10, SO2, CO, NO2, NO, NOX, O3	While there was a decrease in PM10, NO2, NO, NOX values, the results of SO2 and CO pollutant types varied according to the different stations.	

countries with the highest number of Covid-19 cases and death tolls.

With the first case seen in İstanbul, Turkey on March 11, 2020, gradual restrictions started to be implemented throughout the country. In a study including PM2.5 and O3 particulate matter in Turkey, a 34,5% decrease in PM2.5 pollutant type and an increase of up to 28% in O3 particle was observed by comparing the values with 2019 (Aydın et al., 2020). In the study examining PM10, PM2.5, O3, SO2, CO and NO2 parameters in 40 cities worldwide, high SO2 concentration but low values in other pollutants were observed in İstanbul in March 2020 compared to the same month of 2019 (Shrestha, 2020). In the study, which included 20 major cities worldwide, it was analyzed that there was a decrease in NO2 particle by up to 38% and O3 particle by up to 43,6% in Istanbul from 2017 to 2020, while there was an increase in SO2 by up to 29,3%. In addition, PM10, PM2.5 and CO were significantly reduced (Fu et al., 2020). In another study conducted by Celik and Gül in İstanbul, the hourly values of PM10, SO2, CO, NO2, NO, NOX, O3 particles from 19 air monitoring stations (AMS) were taken into account. When the findings were examined, a significant decrease was observed in PM10, NO2, NO, NOX levels compared to 2019. However, while there was an inhomogeneous increase and decrease in SO2 and CO pollutant types compared according to the stations, there was a partial increase in O3 value (Çelik & Gül, 2021). In the air quality literature for Turkey and İstanbul, comparisons were generally made with the year of 2019. Findings clearly indicated that a significant decrease was observed in parameters other than O3, CO and SO2 values.

Lockdowns and strict restrictions in the fight against Covid-19 have had a positive effect on the improvement of air quality. However, there are very few studies examining the spatial distribution of polluting particles and the relationship of other polluting urban elements with these particles. The main purpose of this study is to analyze in detail the spatial distribution of PM10, SO2, NOX, NO2 and CO pollutant types in Istanbul in the global epidemic period, and to investigate the effects of meteorological conditions, particles and other pollutant urban elements affecting the air quality of the city on air quality.

Based on the determined purpose, this study provides methodological contributions to the literature. In addition to the methods in the literature, particles were spatialized with ordinary kriging, which is one of the geospatial methods. In addition, indicators that have an effect on air quality such as wind, humidity, temperature, number of vehicles, average traffic density, which are not commonly included in particle studies, are also included in the study. Thus, the addition of new indicators to the measurement of air quality and the analysis of the spatial distribution of particles contribute to the literature by strengthening the outputs of the study with a multiple methodological approach.

# 2. Materials and methods 2.1. Study area

Istanbul is the fastest urbanized metropolitan city in Turkey. With 39 districts, İstanbul, where 18,49% of Turkey resides, is the most crowded city with a population of 15.462.452 and a population density of 2.975 people/km2 (TSI, 2021). However, it is the most important city developed in the services sector and industry of the country. İstanbul's rapid urbanization and intense urban mobility cause air pollution to increase. According to 2020 TurkStat (2021) data, the number of 4.388.118 road vehicles in İstanbul corresponds to the total population of 21 medium-sized cities in Turkey. In addition, Istanbul has been the city with the highest number of deaths due to air pollution in Turkey since 2017 (Karababa et al., 2020). According to the 2018 Air Pollution Report, 9 out of 10 people in İstanbul are directly exposed to air pollution (TMMOB, 2019). The first Covid-19 case in Turkey was also seen in Istanbul. According to the figures announced by the Ministry of Health of the Republic of Turkey (2021), İstanbul is one of the cities with the highest number of deaths and cases. However, it has been stated in

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the literature that the government has started to take measures against the pandemic with strict restrictions and lockdowns, and that it has contributed to the development of air quality, especially in a densely populated city such as İstanbul. For this reason, İstanbul was selected as a case to investigate the effect of lockdowns and lockdowns on the air quality of the city during the Covid-19 pandemic.

## 2.2. Data collection

The data set necessary to examine the impact of lockdowns and strict restrictions on air quality was obtained from the websites of two different public institutions with open access. First data on the measurement of air quality were obtained from https://www. havaizleme.gov.tr/ website. Hourly concentrations of PM10, SO2, NOX, NO2 and CO pollutant types were reached from the data set accessible by the Ministry of Environment, Urbanization and Climate Change. PM 2.5 and O3 parameters could not be included in the study because there was no information about them in some stations. There are a total of 38 air monitoring stations in İstanbul. Data were collected from 31 of these stations. As the 4 of these stations has been built very recently, data set could not be reached. In 3 stations, pollutant types were not included in the study area due to the inability to access data at certain intervals.

The distribution of the stations included in the scope of the study by settlement types is shown in Figure 1. The figure shows that the stations in the city are mostly located in urban areas and the suburban and industrial areas developing around it. In addition, of the 7 stations that were not included in the study area, 4 were located in the urban area, 2 in the suburban area, and 1 in the industrial area. Figure 1 also shows the locations of the air monitoring stations in İstanbul. 12 of the stations on the European Side located to the west of the map are located in the city center. 3 are located in suburban areas, 3 in rural areas in the north and north-west regions of the city and 3 other stations are located in industrial areas. In the Anatolian side of the map,



Figure 1. Spatial distribution of the air monitoring stations in istanbul.

stations were distributed in different spatial use types; 6 in the city center, 3 in suburban, 1 in rural area and 1 in industrial area.

Secondly, data on urban and meteorological factors that have a direct effect on air quality were obtained from https://data.ibb.gov.tr/ website. At the urban scale, daily counts of 7 indicators, namely average temperature, humidity, average wind speed, wind direction, amount of precipitation, average traffic index and number of vehicles, which are accessible by İstanbul Metropolitan Municipality, have been reached. According to the Phases, the average values of the relevant indicators were calculated and compared with the year of 2019.

All datasets used in the study were collected between 9 and 15 January 2021 from the websites of relevant public establishments. Characteristics of the emissions were based on both primary pollutant types, which were directly emitted to the atmosphere, such as PM10, SOx, NOx, NO2, CO, and secondary pollutants ones, which formed in the atmosphere or emitted from a reaction between primary pollutants, such as temperature, humidity, traffic, and other artificial pollutants. The data source was the locations of air

**Table 2.** Classification of lockdowns and strict restrictions for the COVID-19 pandemic in İstanbul (Source: It was created with the help of the announcements and news published by the Ministry of Health of the Republic of Turkey, the Ministry of Interior of the Republic of Turkey, the Governorship of İstanbul and the İstanbul Metropolitan Municipality).

Phases	Time Interval	Lockdowns and Restrictions
Phase-I	February 16, 2020 March 15, 2020	Pre-Covid-19 Pandemic Period
Phase-II		<ul> <li>Education was suspended on March 16. All schools switched to distance education. Many different activities in different sectors, from leisure activities such as theater, cinema, indoor playgrounds and restaurants to the activities of many industrial enterprises were suspended.</li> </ul>
	March 16, 2020	<ul> <li>On March 21, a lockdown was imposed on people over the age of 65 and for people that have chronic conditions. Borders were closed to 16 countries.</li> </ul>
	April 10, 2020	<ul> <li>On 27 March, intercity travel was subject to a governor's permit. All overseas flights were suspended.</li> </ul>
		All trains except Marmaray were stopped on 28 March.
		On March 31, it was started to record those that were travelling in the entry and exit points of the cities.
		• On April 3, a lockdown was declared for citizens under the age of 20.
		<ul> <li>On April 6, it was decided that subway services in İstanbul would be in service until 21:30.</li> </ul>
		<ul> <li>On 10 April, restrictions were imposed on IETT (Istanbul electric tramway and tunnel establishments) services.</li> </ul>
		A lockdown was declared on 11-12 April.
Bhase III	April 11, 2020	On April 18-19, a lockdown was declared.
Phase-III May 3, 202	May 3, 2020	A lockdown was declared between 23-26 April.
		A lockdown was declared between May 1 and 3.
		On May 4, the gradual normalizing process was announced.
Phase-IV M		A lockdown was declared on 9-10 May.
	May 4, 2020	On May 11, the activities of the shopping mall and some production facilities were allowed.
	May 31, 2020	A lockdown was declared between May 16 and 19.
		A lockdown was declared between May 23 and 26.
		A lockdown was declared on 30-31 May.
Phase-V	lune 1 2020	<ul> <li>It was announced that the normalizing process began on June 1.</li> </ul>
	June 30, 2020	After Covid-19 Pandemic Period

monitoring stations, which measured primary and secondary pollutants at regular intervals. In order to get reliable information, spatial datasets were used partially spatial coverage by taking into account the distance of the station points to each other, as shown in Figure 1.

#### 2.3. Lockdown and restrictions

When the lockdowns in Turkey are compared with other countries, no long-term lockdown has been declared. As shown in Table 3, lockdowns across the country were organized to cover official national holidays, religious holidays, and weekends. Apart from that, the measures taken were carried out in a way that would gradually restrict urban mobility. For this reason, determined threshold days were considering lockdowns by and restrictions, and the study was carried out in 5 different time intervals. Phase-I covered the period between February

16 and March 15, 2020. This period has been called the "pre-pandemic time" due to the lack of any restrictions. Phase-II includes the period from March 16 to April 10. On March 16, it was decided to close many businesses and educational institutions at all levels due to the pandemic. On 31 March, 3 and 10 April, restrictive decisions were taken regarding the use of urban public transportation for İstanbul. Since the decision taken on April 10 was the last measure restricting urban mobility in terms of transportation, phase-II covered the period until this time period. The time period between April 11th and May 3rd formed the Phase-III. This period was the first time that the most intense lockdowns were imposed due to the pandemic. Phase-III was declared a constant lockdown on weekends. On 4th of May flexing decisions were taken and the bans were removed completely on 1st of June, the 4th Phase was between 4 and 31 May. Although official and religious holidays were declared as lockdowns during this period, restrictions on some sectors were also lifted. Phase-IV was the longest period under lockdowns. As the restrictions were removed in between 1-30 June, it was examined as 5th Phase and called "post-pandemic period".

#### 2.4. Statistical and spatial analysis

There are many methods for studying the relationship between public health and particles, as well as methods for analyzing the spatial distribution of pollution. The literature provides good examples of techniques such as geospatial interpolation, regression models, and dispersion models that combine time and space data (Haworth, 2020). This study has been formed as three stages based on the latest statistical methods frequently used in the literature.

In the first stage, the mean PM10, SO2, NOX, NO2 and CO values of the specified time intervals for all stations were calculated and spatialized by kriging method. There are many kriging methods such as simple, ordinary, universal, block, etc. In this study, ordinary kriging method was chosen. The ordinary kriging method, which provides the opportunity to interpolate the measured values and the spatial relations of the values, was preferred in this study because it makes it possible to determine the weights according to the condition that the estimation error is minimum and to evaluate the magnitude of the error term (Isaak & Srivastava, 1989). The most basic feature that distinguishes the Ordinary kriging method from the others is that it allows to estimate an unmeasured

value in the location by calculating the weighted sum of the observations with the assumption that the variables are stable, and the mean is fixed in determining unknown values. Journel and Huijbregts (1978), Isaaks & Srivastava (1989), Cressie (1993), Skøien et al. As it was proven by the studies of (2006), Archfield and Vogel (2010) and many other studies, the ordinary kriging method offers more accurate and reliable results. The Ordinary Kriging Formula is as follows (Tyagi & Singh, 2013):

$$Z_{(s0)} = \sum_{i=1}^{N} \lambda_i Z_{(si)}$$

Where:

 $Z_{(si)}$  = the measured value at the ith location  $\lambda_i$  = an unknown weight for the measured value at the ith location (s0) = the prediction location N = the number of measured values

In the second stage, meteorological conditions, transportation indicators and levels of pollutant parameters, which had an effect on the increase in pollution, were compared with the average data of 2019 at the same time intervals. Thus, the effects of lockdowns and strict restrictions on pollutants and pollutant elements, which are the main purpose of the study, were examined in detail.

In the third stage, the Pearson correlation coefficient, which is one of the statistical methods used to define the relationship between all pollutant types (PM10, SO2, NOX, NO2, temperature, humidity, wind speed, wind direction, amount of precipitation, number of vehicles, traffic index) affecting air quality, was used. This method helps to measure the quantitative dimension of the relationship between all pollutant types. In the method that creates values between +1 and -1, a value close to +1means a strong correlation and strong relationality between the two pollutant types, while a value close to -1 indicates a weak relationship or a negative relationship between the variables. A value of 0 indicates that there is no relationship between the two particles.

$$r = \frac{n(\Sigma(xy)) - (\Sigma x)(\Sigma y)}{\sqrt{[n \Sigma x^2} - (\Sigma x)^2][n \Sigma y^2 - (\Sigma y)^2]}$$

Where, r = Pearson Coefficient n = sample size  $\Sigma(xy) = \text{sum of the paired variables}$   $\Sigma x = \text{sum of the x valiable}$   $\Sigma y = \text{sum of the y valiable}$   $\Sigma x^2 = \text{sum of the squared x valiable}$  $\Sigma y^2 = \text{sum of the squared y valiable}$ 

# 3. Results3.1. Carbon monoxide

CO concentration occupies an important place among the air quality parameters. CO, a harmful gas type in the atmosphere, negatively affects human health and environmental quality due to its ability to remain in the air for 2 to 4 months. As it is the type of pollutant that usually occurs in cities due to reasons such as domestic heating, industrial fuels and traffic, its levels can be quite high in densely populated cities.

When the hourly CO concentration in İstanbul was examined during the pandemic period, it was observed that there was an increase of 53,29% between Phase-I and Phase-II. The CO level tended to increase substantially compared to the period before the measures restricting urban mobility were taken. CO showed an 8,25% reduction between Phase-II and Phase-III. Thus, it means that lockdowns imposed in Phase-III phase positively affect the CO level. In Phase III-Phase IV stages, CO decreased by 5,57% and in Phase IV-Phase V, it increased by 12,13%. Despite the decrease in domestic fuel consumption during these time intervals, the tendency of the pollutant types to increase is based on the removal of restrictions. When the overall change in CO level was eval-



Figure 2. Spatial distribution of CO emission.



Figure 3. Spatial distribution of NOx.

uated, it was found that there was an increase of 66,49%. Therefore, it is seen that the biggest reason for the spread of CO level in Istanbul is based on vehicle emission.

When the spatial distribution of the CO particle is examined, Phase-I and Phase-V are a time period in which there are no restrictions and economic activities take place intensively. In these intervals, İstanbul's urban areas, industrial zones and sub-urban areas are the places where CO concentration is most intense. Although the manufacturing industry is not active in Phase II, CO emissions are concentrated in urban areas. CO distribution in Phases III and IV had a positive effect on air quality thanks to lockdowns

and restrictions. However, with the removal of the measures, it was observed that the CO value was highly concentrated in urban areas compared to the pre-pandemic period.

#### 3.2. NOx

The main source of NOx increases due to high vehicle emissions in large metropolitan areas such as İstanbul. The hourly NOx level in İstanbul decreased by 65,42% with the measures taken in Phase I-II. Restriction measures in Phase-II have greatly contributed to the improvement of air quality. It showed a 22,52% decrease in Phase II-III and 1,38% decrease in Phase III-IV. An increase of 7,97% was observed in the Phase IV-V range. However, in general, NOx contributes very positively to air quality with a 71,47% decrease.

The spatial change of NOx concentration in İstanbul generated unexpected results. While NOx spreads in urban areas and sub-urban areas around it before the pandemic, it is seen in Figure 3 that it is highly concentrated especially on the eastern side of the city with the restrictions and lockdowns. This situation has been associated with the intense traffic flow that occurs during service circulation between other cities of Turkey and İstanbul.

#### 3.3. NO2

The main reason for the spread of NO2 is based on the fact that the heat generated as a result of burning fossil fuels such as coal, oil and natural gas increases the average temperature. While the NO2 value in İstanbul decreased by 60,21% in Phase I-II and 14,81% in Phase II-III, it increased by 4,89% in Phase III-IV and 24,12% between Phase IV-V. Within the time period included in the study, there was a 59,98% decrease in NO2 change.

When the spatial distribution of the pollutant particle was examined, the period when the pollution spread the least was Phase-III. This period constitutes the first time period when lockdowns and restrictions are most intense. The general distribution of NO2 was analyzed to spread from urban areas to sub-urban areas.

## 3.4. PM10

PM10, which caused a significant decrease in the quality of life in cities, showed a significant decrease in İstanbul with the lockdowns. Particulate matter diffusion decreased by 37,69% in Phase I-II, 1,93% in Phase II-III and 8,87% in Phase III-IV. Between Phase IV and V, an increase up to 13,31% was seen. However, when the overall change was evaluated, the PM10 value decreased by 36,90%.

When the spatial distribution of the PM10 concentration in İstanbul is analyzed, it is observed that the spatial spread of the parameter decreased compared to the pre-pandemic period. It has been analyzed that the relevant particle is more concentrated in urban, suburban and rural areas on the western side of the city in general. Also noteworthy is the decrease in the spread of pollution, especially on rural areas, during lockdowns and strict restriction periods.

## 3.5. SO2

SO2 is as important as other parameters in determining air quality. The gas produced as a result of vehicle emissions and burning of fossil fuels has direct negative effects on human health. According to the Greenpeace 2018 report, Turkey ranks 7th among the top 10 countries with the highest SO2 parameter. (Greenpeace, 2021). However, it has been determined that 3000 premature deaths in the same year in the country have a positive relationship with SO2 emission (TUİK (Turkish Statistical Institute), 2021).

When the SO2 change in İstanbul during the pandemic period was examined in detail, an increase of 30,86% was observed in Phase I-II and 4,76% in Phase II-III. It was analyzed that it decreased by 3,79% in Phase III-IV and by 2,99% in Phase IV-V. When the rate of change was examined in general, an increase of 27,96 was observed. SO2 increased during the periods of lockdowns and precautions. The reason of it is based on weather conditions, domestic heating and vehicle emissions.

Figure 6 shows the spatial distribution of the SO2 parameter in İstanbul and supports that the emission spread



Figure 4. Spatial distribution of NO2.



Figure 5. Spatial distribution of PM10.

is dependent on domestic heating. Because while the SO2 parameter was intense in urban and industrial areas in Phase I, it changed direction towards sub-urban areas with the restrictions. The continuity of the increase in SO2 levels as a result of the increase in vehicle mobility after the removal of restrictions is shown in Phase V.

# 3.6. Comparison of indicators affecting air quality

In evaluating the effects of Covid-19 lockdowns on air quality, it is not enough to examine only the particles. Factors such as meteorological conditions, traffic density, and the number of motor vehicles that play a



Figure 6. Spatial distribution of SO2.

role in the change of emission values on air quality also have a significant impact. Table 3 compares the change rates of the indicators affecting air quality compared to 2019.

Average temperature values have an important place in air pollution. When the air temperature drops below 18 C degrees due to the season, it causes the domestic fuel consumption to start. The amount of fuel burned during the season directly affects pollution (TÜ-CAUM, 2021). When we look at the average temperature values and the changes of pollutant types in Table 3, we see that CO and SO2 increased up to 71% in the Phase-II and Phase-III periods when the temperature decreased, while pollution decreased up to 35% in the phases in which the temperature increased. With the effect of temperature, the humidity rate also had the highest rate of change with 9,97%, especially in Phase-IV. The change in humidity rate has been one of the indicators contributing to the reduction of SO2 release by up to 15% compared to 2019.

Average wind speed and wind direction are another factor to consider in terms of carrying pollutant particles. In Istanbul, the dominant wind direction blows from the north to the south-west. In Table 3, while wind helps disperse light gases such as NOx, PM10 and NO2, it causes condensation and displacement of gases that remain in the air for a long time such as CO and SO2. Based on this assumption, when we look at the Table 3, we see that the de-

*Table 3.* Comparison of indicators affecting air quality for 2019 and 2020.

Years	Indicators	Phase-I	Phase-II	Phase- III	Phase- IV	Phase-V
2019	Average Temperature	11,36	9,01	14,98	16,01	20,8
2020	(°C)	11,74	7,98	13,47	15,87	21,81
C	Thange (%)	3,35	-11,43	-10,08	-0,87	4,86
2019	Average	78,09	80,03	64,65	83,63	74,26
2020	(%)	76,28	79,39	65,20	75,29	73,13
C	Change (%)	-2,32	-0,80	0,85	-9,97	-1,52
2019	Average Wind	2,50	3,90	2,50	0,99	2,56
2020	(m/sec)	2,43	3,50	2,69	0,81	4,12
C	Thange (%)	-2,80	-10,26	7,60	-18,18	60,94
2019	Direction of	155,32	115,04	130,36	165,0	148,36
2020	wind	156,02	112,13	140,79	155,30	152,68
C	Change (%)	0,45	-2,53	8,0	-5,88	60,94
2019	Precipitation	0,96	0,65	0,89	1,35	1,0
2020	(mm/hr)	0,88	0,67	1,06	1,52	1,07
C	Thange (%)	-8,33	3,08	19,10	12,59	7,0
2019	Average	26,53	25,27	27,13	23,62	26,03
2020	Traffic Index	30,66	13,07	10,69	26,85	30,43
С	Thange (%)	15,57	-48,28	-60,60	13,67	16,90
2019	Number of	76.653	84.441	80.100	86.528	94.818
2020	venicie	97.999	63.691	51.249	59.336	87.758
C	Thange (%)	27,85	-24.57	-36,02	-31,43	-7.45
2019	со	541,830	517,09	451,26	499,90	479,64
2020		388,59	595,69	546,54	576,97	646,987
Change (%)		-28,28	15,20	21,11	15,42	34,89
2019	SO2	5,81	2,5	3,79	5,10	3,58
2020		3,27	4,28	4,49	4,32	4,19
Change (%)		-43,72	71,20	18,47	-15,29	17,04
2019	NO2	35,84	47,14	48,90	49,87	36,10
2020		101,83	40,52	34,52	32,83	40,75
Change (%)		184,12	-14,04	-29,41	-34,17	12,88
2019	NOx	158,19	100,46	95,19	92,11	62,30
2020		287,88	99,55	77,13	76,07	82,14
Change (%)		81,98	-0,91	-18,97	-17,41	31,85
2019	PM10	44,06	44,76	38,57	45,53	36,94
2020		54,61	34,03	33,37	30,41	34,46
Change (%)		23,94	-23,97	-13,48	-33,21	-6,71

creasing average wind speed in Phase II and Phase IV has played a significant role in the dispersion and reduction of light gases such as PM10, NO2 and NOx. Since the average amount of precipitation can absorb pollutants in the air more easily, it is an effective factor in cleaning the air. The increase in the amount of precipitation during the time intervals when the precautions were taken helped nitrogen oxides especially to dissolve with rain. Thus, a decrease of up to 34% in NO2 and NOx values was observed.

Traffic density is one of the important factors that increase vehicle emission according to the type of vehicle used. Increased emission causes an

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increase in the amount of particles in the air (TÜCAUM, 2021). Compared to 2019, the average traffic density in Phase-I increased by 15,57% and the number of vehicles by 27,85%. With the beginning of the restrictions, the average traffic index and the number of vehicles in Phase-II decreased significantly, while the average traffic index and the number of vehicles decreased by 60,60% and 31,43%, respectively, in Phase-III, in which lockdowns were announced. In Phase-IV and Phase-V periods, with the removal of lockdowns and steps taken towards normalization, the increase in traffic density compared to 2019 was analyzed, while the number of vehicles in the city decreased rapidly.

When the distribution of the particles examined within the scope of the study was reviewed according to 2019, positive effects were observed between 1% and 35% in PM10, NO2, NOx values in the phases in which measures were taken, while air quality was negatively affected between 12% and 185% in the phases in which measures were not taken. Although the SO2 and CO parameters decreased by up to 44% compared to 2019 before the pandemic, they increased between 15% and 71% with the measures taken. Despite the decrease in traffic density and the number of vehicles during the lockdowns, the reason for the increase in CO and SO2 is based on the fact that the values vary according to the type of motor vehicles in traffic and the type of fuel. However, changes in temperature, humidity, wind, and precipitation have a direct effect on the increase and distribution of pollutant particles.

# 3.7. Co-relationship between air quality parameters

The correlation between different pollutant parameters in İstanbul during the study period covering 16 February 2020 to 30 June 2020 is shown in Figure 7. It has been determined that there is a strong and moderate positive correlation relationship between hourly average NO2 value and NOx, PM10, Number of Vehicles and Traffic index values at 0.996, 0.990, 0.784 and 0.483 values, respectively, and a negative correlation relationship with



*Figure 7.* Co-relation between pollutant types affecting air quality.

CO and SO2 at 0.877 and 0.756 values, respectively. There is a moderate positive correlation between SO2 and CO with a value of 0.824, and between CO and temperature with a value of 0.446. There is a moderate positive correlation between the wind direction and the temperature with a value of 0.671, the precipitation and the traffic index with a value of 0.574. A positive correlation was observed between wind direction, precipitation, (0.666), traffic index (0.770) and the number of vehicles (0.432). No non-relational parameters were observed except for the low positive correlation between wind speed, number of vehicles and CO. However, the strong negative correlation of SO2 and CO particles with NO2, NOx and PM10 was analyzed.

# 4. Discussion

This study not only examined the effect of lockdowns on air quality through many different indicators, but also estimated the locations where pollutant particles are concentrated. For this purpose, PM10, SO2, NOX, NO2 and CO concentrations, meteorological factors (such as average temperature, precipitation, humidity, wind speed) and transportation indicators (traffic index, number of vehicles) were examined in 5 different time periods from mid-February 2020 to the end of June 2020, when measures were taken due to the pandemic in Turkey. Phase I and V were a time period when measures were not present or removed, Phase II was a time period when pandemic measures were taken, and Phase III and IV were a time period when lockdowns and measures were intensified. However, the study was completed by obtaining meteorology and transportation data from 31 air monitoring stations and from İstanbul Metropolitan Municipality from the website of the Ministry of Environment, Urbanization and Climate Change within the scope of the study.

Inclusion of other pollutant factors as well as airborne particles in the study area and examination in 5 phases were consciously preferred. Thus, many factors selected played an important role in explaining the decrease in pollution. In Istanbul, air pollution has decreased the most in lockdowns. When the lockdown periods were compared with the pre-pandemic (Phase-I) period, a decrease of up to 73% in other particles except SO2 and CO, 65% in the average traffic index and 48% in the number of vehicles was observed. Thus, while the decrease in urban circulation greatly reduces the release of particles, it has been observed that wind direction and wind speed accelerate the spatial distribution of pollution. SO2 and CO increased up to 40% in phase III and IV, in which air quality improved positively. These particles also had a strong positive correlation with average temperature. While the relevant pollutants had the highest values in the time intervals when the temperature decreased, they showed a decrease in the times when the temperature increased. When the data set is compared with 2019, air pollution increased by up to 184% in terms of other polluting particles, traffic index and the number of vehicles for pre-pandemic period except for SO2 and CO, while it decreased by up to 60% in lockdowns. In SO2 and CO, just the opposite occurred. It caused SO2 and CO to increase up to 21% due to the increase in domestic fuel consumption and traffic density with the decrease in average temperature. Thus, in the examinations made on the change in air quality, it has been revealed that it is essential to examine transportation and meteorological indicators as well as pollutant particles.

It is just as important to determine the urban distribution of polluting

types in Istanbul by stations as to examine the short-term development of air quality with various indicators. For this purpose, the city is divided into 4 different types according to the locations of the weather observation stations. These are urban areas, suburban areas, industrial areas and rural areas. Prior to the pandemic (Phase-I), the highest levels of all pollutants except PM10 were observed in Aksaray, Alibeyköy, Şişli MTHM (Marmara Fresh Air Directorate), Mecidiyeköy MTHM, Beşiktaş, Kağıthane MTHM and Maslak stations on the west side of the city (European Side). When the data in the relevant stations in the urban area were compared with 2019, an increase of 112% to 215% was observed. In the same period, the stations where all pollutants on the eastern side of the city (Anatolian Side) increased were Ümraniye MTHM, Göztepe, Kadıköy and Üsküdar. Pollution levels in the relevant stations in the urban area increased by 70% to 119% compared to 2019. These results show that pollution spread rapidly in the city within a year if there was no pandemic, but also emphasize that pollution spreads mostly in urban areas. In this period, similar results were obtained in many particles in order of minimum from the places where pollution was observed the most. It has been observed that the distribution of pollution level is especially in urban areas, sub-urban areas, industrial areas and finally in rural areas, respectively.

During the pandemic (Phase-II, Phase-III, Phase-IV), a decrease in particles other than CO and SO2 was observed in all stations. Pollution in these phases decreased in stations in urban areas mostly. The stations where pollution intensified were urban areas such as Kadıköy, Kandilli, Üsküdar and Selimiye on the Anatolian Side and suburban areas such as Sultanbeyli and Kartal. Compared to 2019, PM10, NO2, NOx parameters in these stations decreased between 48% and 73%, and CO and SO2 increased up to 21%. During the pandemic process, regions where pollution was spatially concentrated started to change as well as decreases in the release of pollution. In particular, it was observed that CO and SO2, which increased during this process, increased by up to 61% in the rural areas of the city compared to 2019. The fact that such heavy gases, which can remain in the air for up to 4 months, increase in rural areas reveals the possibility of long-term ecological imbalances. It has been observed that the distribution of pollution level is especially in urban areas, sub-urban areas, industrial areas and finally in rural areas, respectively.

Although particulate emission was mostly seen in urban areas after the pandemic, the pollution spreading to rural areas during the pandemic period (especially on the European Side) continued to show its effect during this period. The stations where pollution was most intense were Yenibosna, Şirinevler MTHM, Bağcılar, Aksaray, Alibeyköy, Kağıthane, Maslak, Ümraniye MTHM, Göztepe and Kandilli. Pollution recorded at these stations, excluding SO2, increased by 8% to 14% compared to 2019. The stations with the least spread of pollution were Sultanbeyli, Kartal, Sancaktepe and Kumköy and an improvement of up to 49% was observed in particles other than SO2. SO2 was concentrated in Silivri, Arnavutköy and Kumköy and increased up to 21%. In this period, pollutant density is listed as urban areas, sub-urban areas, industrial areas and finally rural areas, respectively.

As a general assessment, pollution in the city is concentrated mainly in urban areas and suburban areas. Although measures and lockdowns reduced the emission of pollution at all stations, the most intense pollution has again been seen in highly populated urban and suburban areas. The interruption of economic activities in industrial areas has reduced the level of pollution in the stations in these regions and has had a positive effect on air quality. In addition, the increase in release of SO2 particles in rural areas started with lockdowns and strict restrictions, and their distribution in rural areas continued after the pandemic due to the particle structure.

This study comprehensively discussed the effect of Covid-19 lockdowns on air quality. The findings contributed to the development of air quality in many other countries and cities examined in the literature, as well as in İstanbul. However, the rapid differentiation of the spatial distribution of pollution in a short time causes the ecosystem to change and the air circulation to be negatively affected in the long term. Our research includes many factors related to air pollution and it both reveals the causes of pollution in more detail and is useful in determining the types of places where pollution spreads and intensifies.

## 5. Conclusion

The Covid-19 pandemic has restricted economic and social activities in İstanbul as well as almost anywhere else in the world. Pollution from industrial and urban mobility has greatly decreased in this period. While the largest decrease was 71% in NOx, 60% in NO2 and 28% in PM10, the largest increase was 67% in CO and 28% in SO2, respectively. Even if improvement in air quality to a large extent is analyzed, the spatial change of particles in a short time poses a long-term threat to İstanbul's rural settlements and green areas. The study also found that the decrease in average temperature led to increases in the level of heavy gases such as SO2 and CO. In addition, it has been shown that wind speed plays an accelerating role in the spatial change of particles, and NO2, NOx and PM10, the traffic index and the number of vehicles, are among the factors that cause the increase in pollution in metropolitan İstanbul. If pollution continues to spread uncontrollably in the coming years, it will cause the regional climate to change rapidly and negatively affect the quality of life of urban residents. Therefore, decision-makers should raise awareness of air pollution among urban residents and take new longterm measures to reduce air pollution. In our future studies, we will focus on the relationship between the measures and policies taken against pollution in İstanbul so far and the change rates and spatial effects of pollution, and examine the deficiencies in policies and practices.

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# Accessibility in intensive care units: A qualitative study on exploring architects' perspective

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# Abstract

This study addresses healthcare designers' perspectives concerning the architectural features within the Intensive Care Unit (ICU) environments that can impact visual and physical access to patients. In line with patient-centered approaches, providing accessible environments in ICUs is becoming increasingly critical for healthcare providers. The existing literature suggests various architectural features to influence levels of access to patients. How architects prioritize these features and translate them into the configuration of ICU environments has not been explored extensively. A series of semi-structured interviews were conducted to understand the perspectives of healthcare architects in the context of Turkey. The interviews were conducted with twelve participants with recent experiences in ICU design. The research followed a thematic analysis to link the qualitative data with the participants' drawings that emerged during interviews. Five essential themes emerged, including: "Unit Model," "Unit Layout," "Unit Size," "Bed Position," and "Transparent Material." The participants implied configurational models, including "open ward" and "single-patient room," to facilitate high levels of accessibility. Beyond the key decisions concerning layouts, the participants also emphasized the strategic use of transparent materials, which was considered critical in establishing visual access within units. The findings suggest that healthcare architects mostly favor open wards as a suitable model to provide high levels of physical access by decreasing nurses' walking distances during shifts and visual accessibility by enhancing nurses' capacity to supervise the patients within ICU environments. The findings can advance our understanding of how the issue of access is formulated and implemented in ICU settings.

# Keywords

Expert interviews, Intensive care unit, Thematic analysis.

# 1. Introduction

The Intensive Care Unit (ICU), throughout the decades, has evolved as a unit for providing care by offering immediate and quick access to patients without unnecessary impediments to the care protocols. The ultimate aim was, obviously, to improve patient safety and staff efficiency in the ICU. A well-designed ICU environment can have numerous benefits, including reducing staff walking, enhancing time utilization, facilitating easier visibility, as well as improving worker satisfaction and patient safety (Hamilton & Shepley, 2010; Rashid et al., 2016). In this way, the architectural features need to be carefully considered to facilitate conditions of physical and visual access (Hamilton et al., 2018; Leaf et al., 2010; Pachilova & Sailer, 2020; Rashid et al., 2016). ICUs provide critical care for critically ill and injured patients, which requires more special demands than other nursing units. Therefore, the ICU employs properly trained medical specialists and uses highly advanced equipment when necessary. Patients are observed directly by these specialists 24 hours a day and can receive quick access to them (Berthelsen & Cronqvist, 2003).

There are two main zones in ICUs, namely the patient zone and staff zone, and the physical relationship between these zones could impact staff accessibility to patients. The patient zone in an ICU is an important area to include the patient's bed and medical equipment in close proximity (Rashid, 2014). Marshall et al. (2017) state that ICU beds must be accessible from all sides to facilitate effective care. Staff zone in ICU is identified as an area for staff teamwork to primarily serve as a nurse station (Hamilton & Shepley, 2010; Rashid, 2006; Rashid, 2014). This zone involves patient monitoring, charting, and providing support (Hamilton & Shepley, 2010; Rashid, 2006; Rashid, 2014). Staff zone should be structured to elevate patient care by suggesting appropriate workspaces for staff (Hamilton & Shepley, 2010). Consequently, the nurse station must have a direct view of the patient's bed in the ICU as it is located at the center of the staff zone (AusHFG, 2016; Facility Guidelines Institute, 2014; Sağlık Bakanlığı, T. C., 2010). Accessibility in ICUs means designing an accessible environment by eliminating barriers that inhibit physical and visual accessibility between staff and patient zones.

Visual accessibility in the ICU refers to having a sightline to patients and intervening rapidly with patients in critical situations (Apple, 2014; Hamilton et al., 2018; Harvey & Pati, 2012; Pachilova & Sailer, 2020; Rashid, 2014). High visibility helps nurses intervene rapidly with patients in critical situations, improving patient safety and staff efficiency in the ICU (Apple, 2014; Harvey & Pati, 2012; Pati et al., 2015). If patients are not immediately visible, patient safety may not occur or be seriously impacted (Rashid et al., 2016). For example, Leaf et al. (2010) studied the association between patient mortality and ICU architecture. The study suggested that the mortality rates increased for patients assigned to ICU rooms with low visibility levels from the nurses' station. Physical accessibility includes the capacity to get close to the patients' beds and interfere with them in critical situations. The distance between patients' beds and staff can directly affect patients' physical accessibility in the ICU. A better physical environment in the ICU can reduce staff walking, allow for better time use, and provide quick access to patients (Rashid et al., 2016). Specific barriers within ICU environments that prevent patients from being approachable would be removed to provide visual and physical accessibility in the ICU.

Due to the developments of the patient-centered approach (Frampton & Guastello, 2010; Stichler, 2011), patient demands are getting significant in the design of a safe and efficient environment in the ICU. Thus, the patient-centered approach has provided a new design movement toward decentralized units or single-patient rooms that offer direct and clear visual and physical access for patients. In contrast, the centralized unit or open ward model was a popular design idea for many decades (Ritchey & Pati, 2008). It was through this approach that healthcare architects were encouraged to devel-

op decentralized ICUs to create safer and more efficient ICU environments by reducing nurses' walking distances and increasing the amount of time that nurses could spend with patients in the ICU (Hamilton & Shepley, 2010; Rashid, 2014; Verderber & Fine, 2000; Zborowsky et al., 2010). In contrast to the centralized unit model, a decentralized unit model refers to several nurse stations that are decentralized inside ICUs to assist in the observation of one or two patients' beds separately from one another (Hamilton & Shepley, 2010; Ritchey & Pati, 2008; Schweitzer et al., 2004).

The body of research conducted during the Coronavirus Pandemic (COVID-19) also emphasized the importance of accessibility to patients in the ICU. The results suggested that low visual and physical accessibility to patients' beds was related to a more significant proportion of COVID-19 deaths in the ICU (Arabi et al., 2021; Bauer et al., 2020; Shang et al., 2020). During COVID-19, there were a number of patients who needed critical care due to the high number of patients requiring critical care in the ICU environment (Shang et al., 2020). Arabi et al. (2021) also stated that there was limited access to patients within ICUs during COVID-19 due to the overwhelming amount of people found in the ICUs. In light of technological medical advancements and the growing patient-centered approach, an increasing number of studies have examined the relationship between ICU architectural features and accessibility issues. Concerning this literature, some architectural features have been identified as having significant impacts on the interrelationships between staff and patient zones as follows:

#### 1.1. Unit model

The existing literature characterizes three types of ICU design models, including an open ward, a single patient room, and a hybrid unit, which are all known to have significant effects on accessibility in the ICU. Florence Nightingale was one of the first to suggest a nursing unit with an open ward plan, namely the Nightingale Ward. She implied the relation between the unit design model and the accessibility to patients where patients were observed and approached by nurses in one open space (Hamilton & Shepley, 2010; Verderber, 2010). It also makes sense that the open ward model positively impacts the levels of coawareness from the clinician's vantage point (Rashid et al., 2016). There has also been discussion of the singlepatient room or decentralized model with charting alcoves to enhance the visibility of two rooms and ease of access to the patient (Hamilton et al., 2018). Patients can be monitored from a close distance from the monitoring station due to a window between them and the monitoring station (Rashid, 2014). Similarly, the hybrid ICU can enhance the efficiency and safety of nurses by providing a flexible work environment. It is the mix of centralized and decentralized nurse stations that allowed nurses to select a space that worked best for their needs or tasks in the ICU (Apple, 2014).

#### 1.2. Unit layout

According to studies, the unit layout is related to the arrangement of spaces and connections between different spaces inside the unit and has significant impacts on staff access to patients in ICU (Durham & Kenyon, 2019; Fay et al., 2017; Keys & Stichler, 2018; Shpuza & Peponis, 2008). There are seven kinds of unit layouts (Cai, 2013; James & Tatton-Brown, 1986) specified in hospitals that can employ to shape ICUs in hospital settings. However, the layout of the ICU should support staff by minimizing travel distances between patient and staff spaces. In units with a longer distance between the patient rooms, there might be a lower level of visual and physical accessibility for patients (Hadi & Zimring, 2016). According to Hamilton and Shepley (2010), a recognizable and simple layout can facilitate physical accessibility for patients by placing equipment and medications close to them. Moreover, he discussed the circular layout of the ICU, which includes a central nurse station surrounded by rooms that provide access to supplies and medications. In another study, Keys

and Stichler (2018) suggested that U-shaped units can enhance the visual accessibility of staff. A double corridor layout is another kind of layout that could reduce the walking distance of nurses by locating patient beds around the central nurse station (Rashid, 2006). Almost, some studies have suggested the relationship between corridor width resulting from unit layout and accessibility issues in ICUs (Hamilton et al., 2018; White et al., 2013). For example, Hadi and Zimring (2016) stated that wider corridors give nurses a better view of patients.

## 1.3. Unit size

Several studies mentioned relations between accessibility issues and overall unit size. The number of beds in the unit determined the unit size in ICUs. According to Seo et al. (2011), large nursing units may improve nurses' walking distance to the patient room. Otherwise, smaller nursing units reduce walking distance and provide better patient sightlines (Ferri et al., 2015; Ritchey & Pati, 2008). Generally, large units with more than nine beds could not provide sufficient visual accessibility and should be divided into clusters of seven or eight beds to provide better visual access to patients (Hamilton & Shepley, 2010). Dutta (2008) also suggested a multi-hub approach in which each central station serves a cluster of not more than 6-8 rooms, reducing walking distances to achieve better visual access to patient rooms.

# 1.4. Life support system

There is literature that discusses the life support system as a patient space feature that affects the interior design of the room in different ways in order to gain access to the patients' beds and amenities (Hamilton & Shepley, 2010; Rashid, 2014). These systems assist the ICUs' patients in critical situations and are presented in five different types, including headwall, power column, overhead, pendant-mounted and bridge system (Hamilton & Shepley, 2010; Rashid, 2014). In the ICU, life support systems are selected based on their characteristics that affect access to beds. The headwall system is a

kind of system that fixes the medical gases, vacuum, and electrical outlets behind the patient's head (Hamilton & Shepley, 2010). There is limited flexibility in bed positioning with this system and limited ability to reach the patient's head from behind (Hamilton & Shepley, 2010). A power column is another kind of life support system that allows the installation of all equipment on the column fixed to the ceiling and floor of the room (Hamilton & Shepley, 2010). It allows access to the patient's head from behind the bed, and beds can be arranged around a column in various positions (Hamilton & Shepley, 2010). A pendant-mounted system also connects utilities to the mounting system's suspended cable from the ceiling or wall. The pendant-mounted system is the most flexible life support system in ICUs and allows for wide variations in bed position (Hamilton & Shepley, 2010). A bridge system extends on the head of the patient's bed by attaching to the floor or hanging from the room's ceiling allowing physical accessibility to patients' beds from all sides (Hamilton & Shepley, 2010). However, this system has difficulties related to the height of the crossbar (Hamilton & Shepley, 2010).

# 1.5. Material

Some studies have shown that elements of the patient room, such as the door, should be made of transparent materials to provide patients with accessibility and visual physical accessibility. Opaque material may hinder visibility between patients and staff in the ICU. It is preferred that breakaway glass doors be used in ICUs so that patients and monitors can be viewed as clearly as possible (Hadi & Zimring, 2016; Hamilton & Shepley, 2010; Keys & Stichler, 2018; Rashid, 2006, 2014). According to Hamilton and Shepley (2010) and Rashid (2006), designers emphasized providing visual and physical accessibility to patients in single-patient rooms by using transparent walls between the observation station and patient rooms (Hamilton & Shepley, 2010; Rashid, 2006). Furthermore, healthcare design guidelines emphasize the importance of using transparent materials as part

of ICU design in order to provide adequate access to patients (AusHFG, 2016; Sağlık Bakanlığı, T. C., 2010).

The mentioned review introduced above suggests that various architectural features impact accessibility issues in the ICU. Through improving the patient-centered approach and considering patients' demands in hospital design, providing access is becoming essential in the design of healthcare environments. Given the importance of accessibility issues in ICU, healthcare architects have a vital role in finding suitable solutions to design an accessible environment by consolidating or redefining their concepts through the design process. However, there is not enough research to provide a picture of architects' knowledge concerning various dimensions of accessibility in ICUs. For instance, how the published empirical studies inform healthcare architects' knowledge base is not profoundly investigated. Consequently, it is imperative to maintain awareness of the relationships between the architectural features of an ICU and issues associated with accessibility in order to ensure a safe and efficient environment for patients and staff. In order to evaluate architects' concerns regarding accessibility issues, the three essential aims of this research can be summarized as follows:

- Examining the ICU design process from the perspective of architects.
- Investigating how architects provide accessibility in ICU.
- Understanding how architects articulate the issues concerning accessibility verbally and through drawings.

Thus, the primary research question is formulated as follows: "How do healthcare architects conceptualize and articulate the issues of accessibility in ICU design?" Understanding the nature of architects' knowledge has the potential to improve the issues of how related research is communicated and translated into practice. In this research, we have conducted semi-structured interviews to inquire about accessibility through designers' own expressions and their specific reference to precedents.

#### 2. Methodology

The techniques of semi-structured interviews (Edwards & Holland, 2013; Merriam & Tisdell, 2015) were employed to learn about architects' perspectives on accessibility issues. We interviewed twelve healthcare architects in the context of the healthcare design community in Turkey. Snowball sampling (Parker et al., 2019) was used to identify participants who have specified criteria as follows:

- To be an expert in their profession and familiar with the hospital design process and hospital design guidelines in Turkey.
- To Contribute to the design of major "City Hospitals" in Turkey, especially the "Intensive Care Unit" design.
- To Have contributed to the mentioned design fields over the past five years.
- To agree to share their experiences related to ICU design voluntarily and to record their voices.
- To accept signing the consent form before starting the interview.

The qualitative data set was transcribed and analyzed using thematic analysis (Braun & Clarke, 2006; Vaismoradi et al., 2013) to explore participants' insights. Data saturation was attained after finishing the twelfth interview when new information was not yielded about the study's aim. The participants were between 25 to 54 years old and held bachelor's or master's degrees in architecture. The participants' level of work experience in healthcare design varied from 3 to 20 years.

#### 2.1. Data collection instruments

In order to explore the participants' conceptualizations and insights, we have focused on a set of data, including verbal and visual components (Comi et al., 2014; Denzin & Lincoln, 2011; Pain, 2012). The combination of the visual and verbal data helped to better understand participants' formulations on the subject. Table 1 presents the twelve open-ended questions on four distinct topics, which rely on the existing literature on ICU design. The first section of the interview started

with a few basic and straightforward questions. This part enables participants to introduce themselves to the interviewer and establish a connection with the interviewer. In this way, three questions were designed to capture information about the participant's age, work experience, and educational level. In section 2, two primary questions were designed to determine architects' general knowledge and opinions about an ICU. These two questions have been developed based on the literature review described on pages 1-3. Question (a) was intended to determine architects' views on the role of intensive care units in hospitals. In question (b), architects were asked to provide their opinions about the physical relationship between an intensive care unit and other nursing units in a hospital. The following section of questions aimed to find out what architects know about the architectural features of the ICU in terms of architectural features.

Three essential questions were developed based on the literature mentioned on pages 4-7 as a data source to gather architects' knowledge of the ICU's design features. Questions started with asking about ICU spaces and moved towards asking about the ICU's general architectural features and equipment. Lastly, the participants were asked what type of architectural layout they preferred for the design of the ICUs. Finally, to elicit further information on participants' formulations of accessibility in the ICU, four questions were developed in the last section of the interview questions. In order to design the questions in this section, the literature review mentioned on pages 4-7 was employed as a data source. Questions (a) and (b) of this section were designed to determine architects' opinions about the nurse station and patient room properties. In the following, questions (c) and (d) were considered to discover architectural features which provide physical relations between patient and nurse's space in ICU.

Also, participants were asked to explain their opinions or experiences through simple sketches in sections 2, 3, and 4. Using these sketches could enhance the validity and quality of the collected data. Additionally, some examples were included in the questions of sections 2, 3, and 4 to assist participants in understanding the questions quickly. The order of twelve open-ended questions was followed throughout the interviews, with the freedom to change the order, time, and wording allotted to questions in each interview. Before conducting the interviews, we conducted a pilot study (Edwards & Holland, 2013; Kvale, 2007; Merriam & Tisdell, 2015) with two participants to test the formulation and legibility of questions and the flow of the interview sessions. The pilot interviews informed the field strategies on how to ask questions to participants, what questions could be suitable to ask participants, and how much time was necessary to complete the interview. The analysis of pilot study interviews suggested changes in questions to eliminate ambiguity and to keep participants focused on the subjects investigated. This study was also approved by the Institutional Ethics Committee of Middle East Technical University before conducting the interviews.

All interviews were conducted in the participants' offices and natural work settings. Each participant was given a consent form before the interview began. The interviews were recorded on an audio device. After conducting the interview, each participant was given a debriefing form describing the interview's goals and hypotheses. In order to enrich the verbal data acquired during the interview sessions, the participants were given blank papers, if needed, to better explain their thoughts by drawing sketches for the six open-ended questions, including 2(b), 3(c), 4(a), 4(b), 4(c), and 4 (d) questions (See Table 1). Eventually, recorded interviews were transcribed into Microsoft Word and saved in specific folders, each with its code. Participant sketches were also attached in JPG format to each transcript. The obtained data's validity was confirmed by member checking (Birt et al., 2016; Candela, 2019) to endorse the content of transcribed data.

#### 2.2. Data analysis

The set of interviews was analyzed using Braun and Clark's (2006)

Section	Topics	Questions
1 To arc per info	To achieve architects'	<ul> <li>(a) How old are you?</li> <li>(b) How many years of experience do you have in the</li> </ul>
	personal information and	healthcare design field?
	their working experiences.	(c) What is your level of education in architecture? (For example, Bachelor, Master, or, Ph.D.)
2	To find out the general approach	(a) Could you tell me about the specific issues and roles of the ICU in the hospital?
and architects' opinions about l in hospitals.	and architects' opinions about ICU in hospitals.	(b) In your opinion, what kind of physical relations must there be in ICU in the hospital? (For example, relations with other nursing units, location of ICU in hospital, etc.) Please indicate them in simple diagrams or sketches.
3 To find out architects' approach to ICU' architectural features.	To find out architects' approach to ICU's	<ul> <li>(a) What types of architectural spaces do you specify in ICU? (For example, patient's space, nurse's space, etc.)</li> </ul>
	architectural features.	(b) Could you tell me about the general architectural features and equipment of ICU spaces? (For example, technical and medical equipment, furnishing, etc.)
		(c) What types of architectural layout do you prefer in ICU's design? (For example, rectangular, circular, etc.) And, why? Please indicate them in simple diagrams or sketches.
4 To find out architects' approach to providing accessibility ICU.	To find out architects' approach to providing accessibility in	(a) In your opinion, what is a nurse station/ nurse workplace in ICU? And what are the properties of the nurse station? (For example, size, shape, location in ICU, type. doors, etc.)? Please indicate them in simple diagrams or sketches.
	ICU.	(b) In your opinion, what is a patient room in ICU? And what are the properties of the patient room? (For example, size, shape, location in ICU, type, equipment, etc.) Please indicate them in simple diagrams or sketches.
		(c) To provide physical relations between patient and nurse's space in ICU, what architectural features do you consider in the design process? (For example, entrances of areas, the distance of spaces, size of spaces, relations between spaces, etc.) Please indicate them in simple diagrams or sketches.
		(d) To provide physical relations between patient and nurse's space in ICU, what furnishing/equipment do you consider in the design process? (For example, door, window, bed, medical equipment, technical equipment, etc.) Please indicate them in simple diagrams or electrops.

thematic analysis technique in five essential steps, including familiarizing with data, generating initial codes, searching, reviewing, and defining themes. In the first step, we read and reread acquired data to give better contact and greater awareness about the gathered data and determine an explicit understanding of participants' responses. At the end of this stage, a thorough understanding of the pattern within the collected data was obtained. In the second step, the preliminary coding was conducted using a deductive approach to summarize the raw data into meaningful units in an iterative process. The codebook was used for initial coding and provided formalized coding to repeat the coding process and test the reliability of the coding process. Codes were described by code label, definition, descriptions, and an example quote from participants to avoid ambiguity in specified codes. Initial codes were generated in two cycles, including reviewing the initial codes, revising the codes, and evaluating the inter-rater reliability of codes (McAlister et al., 2017). In the third step, all initial codes were organized in groups to extract the theme or sub-themes. After that, they

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were reviewed to achieve the viability of each theme. All the refined codes were grouped into groups to extract the theme or sub-themes. In the fourth step, we reviewed extracted themes regarding the purpose of the interview to remove repeated or unrelated codes for the ultimate refinements of themes. Extracted themes were associated meaningfully, while clear and identifiable distinctions were among them. The consistency of findings also enhanced the reliability of the analyzing process. Finally, we have inductively extracted five critical categories, including unit model, unit layout, unit size, bed position, and transparent material. A summary of the key findings from each category was included in Table 2 to explain

Table 2. Categorization of the findings.

Category	Sub- Category	Key Findings
Unit Model	Open Ward	<ul> <li>Improving observation of all the patients at the same time without any obstructions by locating the nurse station in the central part of the unit.</li> </ul>
		<ul> <li>Providing a high level of staff efficiency by accessing the bedside of patients in a short time.</li> </ul>
		• Linking the support area to the nursing station and reducing the total distance covered by a single nurse in a given shift by locating the nurse station beside the open ward.
	Single- Patient Room	<ul> <li>Providing close observation to patients through a nurse observation desk outside the patients' room.</li> </ul>
		<ul> <li>Enhancing patient safety considerably through the proximity of nurses' workplace to patients.</li> </ul>
		Allowing staff members to perform critical interventions efficiently by providing enough space for each patient.
		Allowing the utilization of necessary equipment to improve patient care processes through the clearances in the unit organizations.
Unit Layout	Simple Layout	<ul> <li>Saving multiple trips between patients and nurse stations and avoiding wasting time by decreasing the number of corners or unrecognizable spaces inside the unit.</li> </ul>
	Rectangular Layout	Decreasing the nurses' walking length and improving the visibility     of patients by:
		<ol> <li>Organizing beds around the perimeter.</li> </ol>
		<ol> <li>Locating various spaces close together,</li> </ol>
		<ol> <li>Using the floor plan sufficiently and providing proper relations between the patient and nurse spaces.</li> </ol>
		<ol> <li>Decreasing the number of corners and unrecognized spaces within the unit.</li> </ol>
Unit Size		<ul> <li>Providing high surveillance of patients within open ward and single-patient room units with eight patient beds.</li> </ul>
		<ul> <li>Decreasing trips between patients and nurse stations within open ward and single-patient room units with eight patient beds.</li> </ul>
Bed Position		<ul> <li>Providing three sides of access to the patient with the exception of the patient's head by putting the patient's bed against the same wall of two single-patient rooms.</li> </ul>
		<ul> <li>Controlling two patients from the nurse observation desk located outside the room by putting the patient's bed against the same wall of two single-patient rooms.</li> </ul>
Transparent Material	Glass Door	Allowing nurses to see the patients while sitting at the nurse observation desk outside the room.
		<ul><li>Allowing nurses to see the patients while crossing the corridor.</li><li>Facilitating the interaction between patients and nurses.</li></ul>
	Transparent Wall	<ul> <li>Improving patient observation by decreasing obstacles such as walls that prevent visual accessibility.</li> </ul>
	OF THINGOW	Facilitating patients' control without entering the patient room.

#### 3. Findings

This section introduces the various dimensions of the themes identified through thematic analysis. The descriptions below elaborate on the meaning of the extracted themes and sub-themes by describing the theme and sub-themes and their importance. Almost the descriptions are linked to the authentic expressions and drawings that emerged during interviews with participants.

#### 3.1. Unit model

As participants suggested, the unit model to configure patient beds, nursing stations, and support areas emerged as one of the significant architectural features to facilitate access in ICU settings. The participants mainly addressed two kinds of ICU unit models, which were also recognized in the literature, namely open wards and single-patient rooms.

a. Open ward: The open ward is one unit model, including a centrally located nursing station to control multiple patient beds organized following the room perimeter. According to Hamilton and Shepley (2010), "critical care began in the tradition of the surgical post-anesthesia recovery room, an open bay containing multiple beds. Critical care units most often were based on this open bay model in which multiple patients could be observed simultaneously, allowing caregivers to rapidly support each other as they cared for a group of patients" (p.72).

Regarding their design experience, most participants mentioned employing an open ward as the suitable unit model for providing high accessibility to ICU patients. For example, P6, an architect with eight years of professional experience in healthcare, emphasized a model with the nursing station at the very core of the unit as a valid configuration to help nurses observe all the patients simultaneously and access the bedside in a short time. Similarly, as shown in Figure 1 below, P5, a junior-level healthcare designer, identified the open ward with a nurse station in the center and eight patient beds located around the perimeter on a drawing produced during the interview. He emphasized that "two nurses are assigned in the nurse station, and each nurse must monitor and control four patients." According to P5, an open ward with a centralized station has a high level of staff efficiency because nurses can observe patients' beds easily without any obstacles and can access patients in a short time.

In another interview, P2 explained the importance of relationships between the patient and nurse areas within the ICU and emphasized another configuration in which the nursing station was located at the edge of the unit close to the support area. This organization (Figure 2) that links the support area to the nursing station hypothetically reduces the total distance covered by a single nurse in a given shift.

Similarly, P4 mentioned the significance and value of direct observation



**Figure 1.** This sketch (left: unchanged; right: coded for explanation) drawn by P5 shows an open ward (1) with a central nurse station (2) and eight patient beds (3) arranged around the perimeter of the unit. He shows that two nurses (4) are assigned to the central nursing station (2), and they are responsible for monitoring and controlling four patients each.

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*Figure 2.* In this sketch (left: unchanged; right: coded for explanation), P2 depicts an open ward (1) with patient beds (4) placed on two sides of the unit and a nurse station (2) located beside the unit close to the support areas (3). She noted that in this layout, support areas (3) are linked to the nursing station (2), reducing the total distance that a single nurse must cover in a shift.



**Figure 3.** This sketch (left: unchanged; right: coded for explanation) presented by P4 depicts the open ward (1) with patient beds (2) located around the unit, a central nurse station (3) at the edge of the unit, and two isolation rooms (4) in this sketch. He emphasized that placing a nurse station on one side of the unit takes less space than putting it in the middle of the open ward and facilitates nurses' movement inside the ICU.

and physical access to patients in the ICU and explained the open ward (Figure 3) with a nurse station to the edge of the open ward. He stated, "placing a nurse station on one side of the unit takes less space than putting it in the middle of the open ward and facilitates the nurses' movement inside the ICU."

b. Single-patient room: The single-patient room comprises private rooms with a decentralized nurse observation desk between two rooms and the central nurse station to independently monitor one or two patients' beds (Hamilton & Shepley, 2010). According to Hamilton and Shepley (2010), "decentralized workstations allow the caregiving staff to remain near the patient. Windows along the corridor from these decentralized stations maximize the staff's ability to see into the room" (p.93).

During interviews, ten out of twelve participants expressed their thoughts about the single-patient room and how this unit model affects patient access in ICU. The participants stressed the importance of an observation station between two rooms in the single-patient room and providing quick access to patients in the single-patient room. For example, P1 (Figure 4) shared her opinions by stating that "the single-patient room provides close observation to patients through a nurse observation desk outside the patients' room." She implied the proximity of nurses' workplace to patients as one of the essential characteristics of this model that can enhance patient safety considerably. She also said nurses could constantly observe patients from small stations and easily approach patients inside the room.

Several participants also remarked on the significance of having enough space for each patient in the single-patient room, allowing staff members to easily perform critical interventions. The participants also expressed concern that the clearances in single-bed organizations allow the utilization of necessary equipment to improve ICU patient care processes. For instance, P10 stated, "the single rooms are suitable for convenient access to patients, pro-



**Figure 4.** This sketch (left: unchanged; right: coded for explanation) presented by P1 shows a single-patient room model (1) with the main nursing unit (3), support areas (5), patient rooms (2), the decentralized nurse stations (4), two isolation rooms (6), and mechanical/ electrical/ plumbing systems (MEP) and UPS zones (7). She suggested that this unit model would increase patient safety by continuously observing patients from small stations and quickly accessing patients within the room.

viding enough space for each patient, and nurses can enter the room easily and interfere with patients quickly." In general, participants recommend an open ward and a single-patient room organization as prominent ICU unit models to cover issues of access based. The Turkish healthcare design guideline (Sağlık Bakanlığı, T. C., 2010) also describes open ward and single-patient room models for ICU, recommending a single-patient room as a suitable ICU unit model. Despite this recommendation, participants primarily recommend an open ward to improve nurses' visual and physical accessibility by allowing them to observe all patients at the same time and access patients quickly. Accordingly, nurses may observe patients' beds properly without any obstructions. They can access patients in a short period in an open ward with a centralized station, which has a high level of staff efficiency. The participants underlined the nurse station's proximity to the open ward, which increases accessibility by reducing the distance that nurses need to walk.

## 3.2. Unit layout

The unit layout is an important architectural feature of ICUs that organization determines space and connectivity between different places inside the unit (Rashid, 2014). Concerning this theme, several participants in this study addressed the connections between kinds of ICU layout and accessibility issues. They shared their experience related to mainly two types of layouts, including a simple and rectangular layout, which have positive effects on the accessibility

between patient and nurse space in ICU as follows:

a. Simple layout: A simple layout is a unit with simple geometry and few corners in the floor plan. Five out of twelve participants mentioned the necessity for employing simple layouts structured in easily recognized and simple geometries. According to participants' statements, nurses could save multiple trips between patients and nurse stations and avoid wasting time within simple layouts. In contrast, complicated configurations make more corners in the floor plan and consequently cause more problems in the movement and communication of nurses when they want to approach patients inside the unit. For example, P2 shared that "designing an ICU based on a simple floor plan provides good interaction and communication between patients and nurses by decreasing the number of corners or unrecognizable spaces inside the unit."

b. Rectangular layout: The participants mentioned the benefits of rectangular layouts that follow an orthogonal perimeter to include ICU services. Four participants introduced rectangular layouts with a low depth which hypothetically decreased the nurses' walking length and improved the visibility of patients by organizing beds around the perimeter. For instance, P2 explained that "a rectangular floor plan could be used to locate various spaces close together, significantly decreasing nurses' walking distance. In other words, we can use floor plan sufficiently and provide proper relations between the patient and nurse spaces." Participants suggested simple

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and rectangular geometries to promote visual and physical access, as well as uncomplicated geometry and fewer corners in the floor plan to reduce multiple walks between patients and nursing stations and waste time within the unit. They stressed the potential benefits of these designs on accessibility difficulties, citing improved engagement and communication between patients and nurses and a reduction in the number of corners and unrecognized spaces within the unit.

#### 3.3. Unit size

The patient spaces commonly include patients' beds, which eventually determine ICU unit size. Three of the twelve participants emphasized the critical decision of determining the unit size based on the number of patient beds. Suggested as a norm, the architects introduced open ward type units with eight patient beds, where two assigned nurses provided the care. In Figure 5, for instance, P4 introduced an exemplary ICU layout with eight patients and two nurses assigned. According to his statements, an ICU with more than eight patient beds requires an elongated layout, eventually increasing nurses' distance from patients. He stated that "a unit with eight patients can easily be controlled by nurses and other staff. The large units with more than eight patient beds need large space and more nurses to control patients."

P7, as shown in Figure 6, drew an ICU with eight patient rooms during the interview and emphasized staff efficiency by ensuring appropriate physical accessibility without additional walking. She noted that "efficiency of the ICU is directly related to the unit size determined by the number of the patient's bed. ICUs with more than eight patients may increase the unit size and disrupt accessibility issues by increasing walking distance."



**Figure 5.** This sketch (left: unchanged; right: coded for explanation) drawn by P4 shows an open ward ICU (1) with patient beds (2) located on two sides of the unit, a central nurse station (3) with two assigned nurses (4), and a support area (5). He stated that a unit with eight patients could easily be controlled by staff. Large units with more than eight patient beds need larger spaces and more nurses to control patients.



**Figure 6.** In this sketch (left: unchanged; right: coded for explanation), P7 presented a singlepatient room (1) with the main nurse station (4;5), eight patient rooms (2), a decentralized nursing station (3) located between two patient rooms, and two isolation patient rooms (6). She stated that the ICU with eight patients could improve staff efficiency significantly, while ICU with more than eight patients might increase the unit size and disrupt accessibility issues by increasing walking distance.

In both open ward and single-patient unit models, participants suggested an ICU with eight patient beds as an appropriate unit size to allow physical and visual accessibility without additional walking and impediments inside the unit.

#### 3.4. Bed position

Bed position can define the nature of accessibility to patients in ICUs. In the current study, five of the twelve participants implied that putting a bed against the same wall of two rooms provides high visibility and accessibility to the patients in the single-patient room. This bed position provides three sides of access to the patient except for the headwall. For instance, P3 (Figure 7) stated that putting a patient's bed against the wall is more suitable than in the middle of a single-patient room because nurses could efficiently observe and control two patients from the nurse observation desk outside the room.

According to Figure 8 below, P12 also emphasized the efficiency of this location of the patient bed and discussed that "putting a bed against the same wall of two rooms does not restrict the visual and physical accessibility to the patient's head and does not take much space inside the room."



**Figure 7.** In this sketch (left: unchanged; right: coded for explanation), P3 represents the patient bed (4) against the wall in a single-patient room (1) and outdoors (3). He emphasized the efficient observation of patients from the nurse observation desk (5) located outside the room and the corridor (2). He also emphasized the unsuitability of the patient bed (6) located in the middle of the patient room in the ICU.



**Figure 8.** This sketch (left: unchanged; right: coded for explanation) drawn by P12 shows a single-patient room (1) with a decentralized nurse station (4) located between two rooms, a family zone (5), and WC (6) beside the family zone. She noted that putting a patient bed (3) against the wall help nurses to see patients from the decentralized nurse station (4) and the corridor (2) efficiently and does not take much space inside the room.

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According to participants, patients' beds against the same wall of two rooms improve accessibility in a single-patient room unit model. The participants stated that placing a patient bed in this area would allow access to the patient from three sides, except for the patient's head. They provided this type of bed for efficient surveillance and control of two patients from the nurse observation desk outside the room.

## 3.5. Transparent material

Employing transparent materials can increase the possibility of direct observation between patients and nursing spaces in the ICU. Seven out of twelve participants implied an application of a glass door and a transparent wall or window to provide continuous observation of patients in the ICU.

a. Glass door: P4 shared his experience in the single-patient room and said glass doors should be used to easily observe the patients from the nurse observation desk outside the room or while crossing the corridor. He said that "using glass doors in single-patient rooms allows nurses to see the patients while sitting at the nurse observation desk outside the room or crossing the corridor. This can enhance patient safety within ICU." Similarly, P6 mentioned that employing sliding glass doors in ICU can increase nurses' efficiency by improving visual accessibility to patients. She mentioned that "we use sliding glass doors to enhance the visibility in a single- patient room. Glass doors add transparency to patient space and increase the nurse efficiency by facilitating the interaction between a patient and nurse in ICU."

b. Transparent wall or window: A transparent wall or window is mainly used between a patient room and a corridor or nurse observation desk in a single-patient room. Some participants described that the transparent wall or window between a patient room and a nurse observation desk can provide visual accessibility between patients and nurses in ICU. For instance, P8 stated that employing transparent material, such as windows between the patient and nurse spaces, can decrease obstacles such as walls that prevent visual accessibility and facilitate patients' control without entering the patient room in the ICU. Participants recommended that transparent materials be used in the ICU, particularly glass doors and windows between the patient and nursing areas, to improve accessibility issues. They prioritized improving patient observation by removing impediments like walls and employing transparent materials in the ICU.

#### 4. Discussion

This study aimed to understand architects' perspectives on accessibility issues in ICU environments. The insights provided by the participants have the potential to advance our understanding of how the issue of access is formulated and implemented in ICU settings. As a result of these insights, five main features, such as unit model, unit layout, unit size, bed position, and transparent material, have been identified that impact accessibility in ICUs. According to the findings, although single-patient rooms have been demonstrated to significantly improve access to ICUs (McCullough, 2010; Rashid, 2007; Rashid, 2014) and the Turkish healthcare design guideline (Sağlık Bakanlığı, T. C., 2010) recommended using the single-patient room model, a majority of architects offered open ward configurations as better solutions for visual and physical accessibility in ICUs due to two main concerns.

The first issue mentioned by architects is the ability to immediately access patients in an open ward since the beds are organized in one space with limited or no separators to prevent rapid movement inside the unit. Also, the participants mentioned that a support area near the central nurse station decreases nurses' walking distance in an open ward.

The architects also implied the disadvantage of a single-patient room by suggesting that nurses need to travel long distances to enter a single-patient room to interfere with patients in critical situations. Another issue mentioned by architects is the limited number of nurses assigned to intensive care services in Turkey. The architects stated that an open ward generally needs fewer nurses than the single-patient room model. The single-patient room model needs one nurse in a nurse observation desk placed between two patient rooms (Rashid, 2007; Rashid, 2014). The architects we interviewed stated that providing patient safety in the single-patient room model primarily depends on providing sufficient nurses to control patients, which is one of the main problems in Turkey.

Among various kinds of unit layouts suggested in healthcare design literature (Cai, 2013; James & Tatton-Brown, 1986), the architects implied a simple and rectangular layout in the ICU with minimum obstacles and corners to facilitate better accessibility in the ICU. Rectangular units provide various spaces in a compact form, locate patient beds in observable places, and decrease the nurses' walking distance in ICU environments (Hamilton & Shepley, 2010). The participants also mentioned eight-bed formations in ICU as the optimum configuration to provide high visual and physical accessibility. According to the participants, organizing large units with more than eight patient beds could not offer suitable visibility to patients. The unit should be arranged with clusters to accommodate seven or eight beds (Rashid, 2014).

The findings show that architects considered the patient's bed position concerning circulation to provide maximum accessibility to the patients' heads in the ICU. The Architects we interviewed emphasized placing the patient bed in a mirrored- organization to allow better visibility. The participants explained that nurses could efficiently observe patients' heads from the nurse observation desk and corridor in a mirrored organization. On this particular topic, the literature does not suggest definitive evidence to employ mirrored or same-handed models in organizing ICU environments. Finally, the participants discussed utilizing transparent materials in the ICU to decrease visual obstacles and improve accessibility to patients. For instance, a glass door or glass wall and windows between the nurse observation desk and the single-patient room can significantly enhance visual accessibility to patients in ICU (Hamilton & Shepley, 2010; Keys & Stichler, 2018; Rashid, 2006; Rashid, 2014).

#### 5. Conclusion

According to the importance of accessibility to patients in the ICU, this study is cutting-edge research that aims to examine the ICU design process from the perspective of architects, investigate how architects provide accessibility in ICU, and understand how architects articulate the issues concerning accessibility verbally and through drawings. In Turkey, the architects' voice is even weaker in a context where a largescale healthcare facility development program has been progressing in the last decade. Consequently, the study presents authentic drawings and statements from architects with recent experience in designing and building intensive care environments in order to contribute to the growing literature.

In this way, a qualitative interview method was employed, and twelve architects were interviewed in semi-structured interviews utilizing twelve open-ended questions. A snowball sampling method was used to select twelve healthcare architects who are experts and contributed to the design of major "City Hospitals" in Turkey, especially the "Intensive Care Unit" design over the past five years. The qualitative data was analyzed by thematic analysis. Five essential themes were revealed, including unit model, unit layout, unit size, bed position, and transparent material. According to the findings, the open ward of the ICU is frequently referred to by architects as the appropriate ICU model to facilitate visual and physical accessibility. Arranging the patient beds around the open ward and providing visual accessibility without obstacles is an advantage of the open ward in providing patient safety in the ICU from the architects' perspective. Also, placing the support areas close to the central nursing unit can decrease nurses' walking distance and improve staff efficiency in ICU. These findings provide significant evidence regarding the architects' perspectives on the accessibility issues in ICU.

Accessibility in intensive care units: A qualitative study on exploring architects' perspective

Generally, architects' opinions on accessibility issues were parallel with the Ministry's design guidelines (Sağlık Bakanlığı, T. C., 2010) which are required to be followed in the design process. We found some essential conflicting ideas about the single-patient room unit model stated in the discussion section. Although approachability and observability to patients in the single-patient room are recently suggested as an appropriate unit model in ICU, the architects offer the open ward as a suitable unit model. However, the topic requires further investigations to

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explore the emerging dimensions.

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## An assessment of population decisions on territorial plans in Türkiye<sup>1</sup>

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#### Abstract

Accurate determination of the future population of a settlement to be planned is important for optimal use of public resources, and land as a scarce resource. In this paper, the calculations for population projections, which are among the main determinants of spatial plan decisions, were questioned through the Territorial Plans. The population decisions of a total of 62 provinces were examined over twenty 1/100,000-scale Territorial Plans approved by the Ministry of Environment, Urbanization and Climate Change, together with their planning reports. The basis for this consisted of: (1) population projections and forecasts, (2) average annual population growth rate calculations, and (3) population sizes. Results have shown that the extrapolation techniques used were applied incorrectly, and the population forecasts on which the plans are based were made independent of the projection calculations. In the examinations conducted over the average annual population growth rates, it was observed that the plans for each province were assigned extremely high populations without taking their current trends into account. For the 33 provinces where a comparison can be made with the projections of TURKSTAT (Turkish Statistical Institute) for the year 2025, it is found that among all the provinces only one could achieve the forecast results. Findings indicate that the following adjustments are needed: (1) more advanced population projection techniques, including demographic data, should support the extrapolation techniques, (2) the territorial plans should be revised, and (3) decisions on plans should be based on appropriate techniques and realistic population forecasts.

#### Keywords

Population forecast, Population projection, Provinces/regions, Territorial plans, Türkiye.

#### 1. Introduction

Planning is the task of rationally arranging the appropriate tools to achieve a desired goal within a specified time period. In the case of spatial planning, the aim of planning is to create the spatial form and structure that a settlement will need in the future. Since what is expected from a plan is provision of the necessary physical/ spatial infrastructure for people who will be in that settlement (to live, work, visit, recreate, etc.), it is an important planning task to detect what kinds of needs must be met, and for how many people. Therefore, predicting the future population is among the substantial operations of the planning process. In case the future population is not determined accurately, the aim and goals of the outcome of the entire planning process may not be achieved.

In the literature, and in practice, the concepts of "estimate", "forecast", and "projection" are often used interchangeably despite their significant differences in terms of meaning, methodologies, and implications (see Pittenger, 1976; Isserman, 1984; Berke et al., 2006; Park & LaFrombois, 2019). Population forecast, an inseparable part of planning at any scale (Lingaraj & Runte, 1975), is the basis on which land use decisions are formulated and public resources are allocated (Rayer, 2008; Wilson & Rowe, 2011; Renski & Strate, 2013; Wilson et al., 2018; Park & LaFrombois, 2019). The forecasting of the future population of a settlement has a central role in the early stages of land-use planning, such as analysis and synthesis (Isserman, 1984), as well as in final stages such as determining future land uses. As noted by Park and LaFrombois (2019, 237) "[t]o create plans, planners must understand past demographic trends and future projections, and these data must be accurately applied in order to make sound planning decisions."

The future population that forms the basis for planning is determined in two stages: mathematical projection of population, and population forecasting based on different scenarios. For the purposes of the first stage there are different techniques that cover either direct or indirect methods of projection. The direct methods mainly involve (1) comparative forecasting, (2) ratio and correlation methods, (3) growth composition analysis, and (4) extrapolation techniques (Isard, 1960; Atalık, 1989). Related to the last three of these methods, three types of techniques are widely utilized in planning practice because they do not require advanced data and modeling skills (Alho, 1990; Ahlburg & Land, 1992; Rayer, 2008; Athukorala et al., 2010; Park & LaFrombois, 2019). First, the structural models, which "rely on observed relationships between demographic and other variables (e.g., land uses, employment) and base population changes on projected changes in those other variables" (George et al., 2004, 5), utilize regression models and are covered by the types of techniques in (2). Second, the cohort-component technique, being a more precise variation of the growth composition analysis (Isard, 1960), "divides the population into age-sex cohorts and accounts for the fertility, mortality, and migration behavior of each cohort." (George et al., 2004, 5). Third, the "trend extrapolation" techniques, in which the future population is calculated merely as a function of time, use historical data and simple regression. With this method, a statistical model that best describes current trends, by using official census data in the form of a time series, is sought (Çubukçu, 2015). Different mathematical functions are compared via graphical and quantitative evaluation (such as error calculations,  $R^2$ and F-tests for coefficients). From this comparison, models that best describe the current trend, and whose error has an acceptable range, are selected. With the parameters obtained from these models, different projection values are obtained, which define the upper and lower limits. This range of different population values means that 'if current trends continue in a similar way, the population of the settlement will be at least as much as the lower limit, at most as much as the upper limit'.

Surely, the mathematical calculation is not the mere input for population forecasts. It should be articulated with subjective evaluation of the planning environment. This upper-lower limit argument, therefore, is a search for a balance mechanism between positivistic and interpretive approaches. In parallel with this viewpoint, it is found that the current population projection results are overlooked in Türkiye because population forecast methodology is based on an overwhelmingly subjective interpretation. For this reason, the present authors think that an upper-lower limits question is an important debate to take place within the planning circles.

Since extrapolation techniques are based merely on data observed in past years, they are closed off to any current external data. However, the effects of social, economic, political and other dynamics, unforeseen events, or the possibility of interfering in the current trends with plan decisions, are always at stake (Kocaman, 2002). Therefore, an integration of statistical calculations and evaluation of real life dynamics are necessary procedures. In the aforementioned second stage, to this aim, the planning team will make a population forecast on the assumption that some possible externalities might have an effect on population increase/decrease. For example, the migration rate might be expected to accelerate more than the past trends, resulting from some recent transportation infrastructure investments. In such situations, the population size that the plan will be based on is the "forecast", obtained by interpreting external factors, following the condition of staying within the projected population range. In sum, as George et al. (2004, 2) noted:

A forecast reflects a judgment and it can be proven right or wrong by future events (or, more realistically, it can be found to have a relatively small or large error). Projection is a more inclusive term than forecast: All forecasts are projections but not all projections are forecasts. Projections and forecasts sometimes refer solely to total population, but often include information on age, sex, race, and other characteristics as well.

In the present study, territorial plans (TPs) were examined regarding their population calculations. It was found that the future population sizes were determined as 'extremely high' in all of them<sup>2</sup>, and both the population projection calculations and population forecasts deviated from methodological principles. Findings call for an urgent revision of population projection figures in these plans by using appropriate data and methodologies.

## 2. Errors in population forecasts and the case in Türkiye

It is a common fact that every decision concerning the future involves some degree of uncertainty and assumption. Hence, the selected projection calculations are forecasts involving some degree of error. The accuracy of the forecasts depends on population size, and is highly sensitive to geographical extent, the time horizon for the projection, and the base years, the stability of the growth rate, fertility rate and life expectancy, and volatility of net migration. In the case of smaller population size and area, the error is likely to get larger. The larger time horizon reveals the same impact on error and thus decreases the precision. On the contrary, the slow and positive growth rates, lower levels of migration, lower fertility rate, and higher life expectancy produce higher precision (see Wilson, 2013; Wilson et al., 2018; Raver & Smith, 2010; George et al., 2004; Dai et al., 2022).

On the other hand, as stated by George et al. (2004, 84) "[t]he choice of projection method has no consistent impact on forecast accuracy. No single method uniformly produces more accurate population projections than all other methods.... [while] expert opinion ... can contribute to higher precision". There are some studies showing that increasing the number of projection techniques, and their use in combination, improves the forecast accuracy. The studies that inspect population projection practices involve, but certainly are not limited to, analyzing the error structure of projection techniques, and focusing on the impact of their choices when (1) producing projections (Rayer, 2008), (2) comprehensive assessment of errors of population forecasts, (3) exploring the potential benefits of using a combination of forecasts instead of a single technique (Rayer & Smith, 2010), and (4) examining and testing a particular method (Hamilton-Perry) that is used in population forecasting (Swanson et al., 2010).

As Rayer (2008, 417) stated: "[p]lanners and other practitioners that produce population forecasts are faced with making decisions regarding the choice of methods, input data, assumptions, treatment of special populations, and so forth." Athukorala et al. (2010) produced a list of the main methods used in population forecasting, and showed that they can be carried out in a definite and transparent manner, while excluding externalities in population estimates. In their particular case, that was for the provision of essential services, based on reliable population data, in two regional Councils of Queensland (Australia). Wilson (2019) proposed a guide, providing an overview of projection methods, of where to find projection data and related information, and comments on the results of population projections of Australia. Studies, in the body of literature, on developing projection model proposals are quite common. Some examples involve developing a simulation model for regional population trends (Lingaraj & Runte, 1975), a probabilistic model for population and household forecasts for large subnational regions (Wilson, 2013), or multiple (autoregressive integrated moving average, ARIMA) time series models for states (Tayman et al., 2007).

An operational way to examine the accuracy of population forecasts is to compare the population estimates made in the past with the observed population data (see Wilson & Rowe, 2011; Renski & Strate, 2013; Wilson et al., 2018; Rees et al., 2019). Park and LaFrombois (2019) analyzed past population estimates of cities with increasing and decreasing populations, and investigated how cities utilized population projections in guiding their future plans. The results showed that population projection errors exist in all cities, independent of their population trends. However, it was found that growth was expected for most cities, despite the actual decline in their population. Since "[a] declining or shrinking population is considered unhealthy and undesirable .... local policymakers and planners may avoid mentioning population decline or they may choose

the most favorable population projection results" (Hollander et al., 2009; Pallagst et al., 2017 cited in Park & La-Frombois, 2019). Isserman (1984, 208-209) argued that:

... for basic changes in the way population forecasts are made and used in the planning process [and discussed the need for] the systematic analysis of factors not considered by today's formal models, and a new generation of research methods and skills must be developed to study the future and planning's ability to shape it. .... [In laying out his main hypothesis, he noted that]: At worst, analysts prepare projections knowing that they will be used as forecasts, but remain unable or unwilling to evaluate the underlying assumptions that will determine whether a projection is a good forecast; and users adopt the projections as forecasts without understanding their conditional nature and the need to evaluate the underlying assumptions.

Skaburskis and Teitz (2003) based their discussion on their US experience, and explained the possible underlying reasons for why 'technical' forecasts turn into exaggerations. In searching for the possible reasons for the tendency to accept and use the exaggerated results they related the possible reasons (2003, 431, 439-440) to:

our own interests and to institutional concerns, to the way social, political and economic processes react to change, and to the way we gain knowledge of these processes .... [all of which range] from the most individual and subjective, to the most systemic and uncontrollable.

This critical position is also in line with what some scholars consider as the ethical dimension of forecasts. For instance, Flyvbjerg (2005, 57) states that "many forecasters deliberately manipulate costs and benefits to help projects get approved .... [in so called] .... pursuit of public good .... even if it is not especially useful from a public point of view". Furthermore, Flyvbjerg et al. (2005, 142) noted that "[i]ndeed, accurate forecasts may be counterproductive, whereas biased forecasts may be effective in competing for funds and securing the go-ahead for construction" (see also Wachs, 1990; 2016).

In some countries, the population

projections are made by demographers who belong to a specific professional domain, and mainly perform their works in official institutions. For example, in Australia, projections at national regional levels are made by the Australian Bureau of Statistics (ABS), while the projections for local and small areas are carried out by the State and Territory Governments (Wilson & Rowe, 2011; Wilson, 2019). Similarly in the US, the U.S. Census Bureau's Population Estimates Program is responsible for this, in addition to providing the control for other data series, such as the American Community Survey and the Current Population Survey (Renski & Strate, 2013).

In Türkiye, TURKSTAT is responsible for the production of national level population projections based on Address Based Population Registration System (ABPRS) since 2007. Before this time, general population censuses (GPCs) were used. In 2012, for the first time; for the year 2023 province-based, and for the years 2050 and 2075 country-based population projections were calculated by TURKSTAT (2013).Those first-time provincial-level projections were subsequently repeated for the following two years, i.e., 2024 and 2025, the latter being used for one of the examinations in the present paper. National level population projections are primarily used for national policy-making projections. Regional and local level spatial planning practices, on the other hand, produce independently their own population projections. In other words, TURKSTAT's population projections and planners' population projections are two separate fields of policy making, which needs to be coherent with each other.

The level of error in population forecasts in planning studies in Türkiye has been high since earlier times. Between 1930s and 1960s plans were commonly prepared for 50 years-period by the rule of the very first law on planning in the 1930s (Law No. 2290), population projections fell below the actual numbers. For example, the population of Tekirdağ (on the north coast), which was projected to be 24,000 in 1997, the population of Nevşehir (Central Anatolia Region), which was projected to be 15,000 in 1996, and the population of Simav (to the west), which was projected to be 15,000 in 1994, were exceeded or approximated in 1965 (Yavuz et al., 1978, 210). The population forecast made in 1929 for a 50-year period for the capital city of Ankara (Central Anatolia Region) was between 250 and 300 thousand, which had already been exceeded within 20 years. The Izmir (on the Aegean coast to the west) Land Use Plan, approved in 1955, forecasted that the population in 2000 would be 400 thousand, yet it already passed 500 thousand in the 1970s. In short, population forecasts in early planning studies have generally fallen far below the growth level of cities. Since the 2000s, the error level is still high, but in the opposite direction. For the last decades, future population figures have somehow been determined as much higher than the observed figures. This conversion resembles the situation half a century ago in Great Britain, where the population projections were calculated too low between 1955 and 1965, and too high after the 1970s (Hall, 1981). Regarding Türkiye, the previous period was characterized by low forecasts and high actualization. By way of the present calculation, the results show high forecasts and low actualization. Errors in population forecasts bring their own problems in terms of successful planning and urbanization. High population decisions result in more development areas, urban sprawl, and/or higher density than required.

#### 3. Materials and methods

The hierarchy of the spatial planning system in Türkiye consists of spatial strategic plans (SSP), territorial plans (TP), land-use plans (LUP), and implementation plans (IP) from the topmost level to the lowest. In the present study, the TPs were examined (i.e., they are the top-level spatial plans currently in effect as there is no spatial strategic plan approved to date).

A total of twenty 1/100,000-scale TPs, approved as of 2020, covering 62 provinces were examined. Regarding the study period, there are no TPs in effect for the remaining 19 provinces countrywide. All of the examined plans, revisions and amendments, and

their reports are accessible on the website of the Ministry of Environment, Urbanization and Climate Change (MEUCC) (Figure 1).

The planning reports (PRs) of the TPs showed that each province was managed independently from other provinces covered by the same plan. Populations, economic and social conditions, land use situations, and planning decisions were all based on provincial boundaries with strict administrative separation. In other words, each province in each plan could be examined individually because they were analyzed and planned separately by the planning authority.

A summary of the typological examination of the TPs (which include the provinces and time horizon (in years), population forecast, and classification of projection productions/methods used in their PRs) is presented in the Appendix. Among all 62 provinces covered in these plans, target years differ as follows: 2023 for one plan (3 provinces), 2035 for one plan (3 provinces), 2043 for one plan (2 provinces), 2045 for one plan (3 provinces), 2026 for three plans (10 provinces in total), 2040 for six plans (21 provinces in total), and 2025 for seven plans (20 provinces in total).

In the present study, first, the content of typology is explained. Subsequently, all 62 provinces were examined in terms of their calculated annual average population growth rates (AAPGRs). Finally, the population forecasts of 33 provinces in 11 TPs having the same or approximate (by 1-2 years) target year as 2025, which is the province-based projection year of TURKSTAT, were compared with TURKSTAT data. The reason for the comparison with these projection data was due to the fact that the population projections produced by TURKSTAT were largely consistent with the observed data over the years.

#### 4. Results and discussion 4.1. Typological investigation in the context of population projections and forecasts

The population values of twenty TPs in total were examined in two stages: "Projections" and "Forecasts". It was observed that the PRs did not include a comprehensive assessment of demographic characters and population projections for the first stage. They also did not include any assessment of the population change in the past, household size, migration, and mortality rates, birth etc. concerning the demographic structure of settlements in the planning area. Additionally, necessary elements of projection methodologies, such as assessment of the years used in the projection, time periods, techniques(s) used in obtaining the data for missing years, projection calculations (and their graphical analysis and R<sup>2</sup>, *F*, *t* statistics), and their significances concerning the population projection were not



*Figure 1.* Twenty 1/100,000 scale TPs approved by the Ministry of Environment, Urbanization and Climate Change as of 2020. Source: Prepared by using the TP data obtained from the MEUCC website.

presented in the reports. Finally, it was observed that the second stage was carried out completely independent of the results of the first stage.

The technical analysis of projection calculations for the first stage resulted in four different types: (1) non-technical, (2) incorrect/incomplete use of the technique, (3) improper use of the technique, and (4) technique without content. The term 'non-technical' in type 1 refers to non-use of any projection technique. The 'incorrect/incomplete use of the technique' in type 2 refers to fundamental methodological mistakes in the projection processes. The expression 'improper use of the technique' in type 3 refers to some manipulated procedures that distort technical validity. Finally, the expression 'technique without content' in type 4 refers to performing irregular and contradictory procedures together.

In the second stage plans were associated with the groups they belong to. Type 1 covers TPs, in which only overall forecasts are made without any population projection process. Type 2 covers TPs, in which forecasts based on only one single projection result without explaining the data. Forecasts were made independently from the TURKSTAT population growth rate, despite the fact they were claimed to be made accordingly. Type 3 covers TPs, in which data consistency and content are not disclosed, and the population forecast is undertaken by averaging the results of projections corresponding to improper use of the technique. Type 4 covers TPs, where the forecasts were made using projection techniques whose content was not deemed logical. Some non-clarified coefficient calculations were made and then improperly averaged with each other. These types (summarized in the Appendix) are described below, respectively.

- 1. Type 1 (Non-technical): The nine TPs of this type (see Appendix) have their population with no projection calculation and no supportive information. For example, only a one-sentence non-technical claim about population forecast was provided in the PR of the Adıyaman-Şanlıurfa-Diyarbakır Planning Region TP (Figure 2), and urban, rural, and total population forecasts were given at the provincial and district levels in tables (see ÇŞİDB, 2013a). In these types of TPs, for which the term 'projection' was used in their PRs, no explanation about population projection techniques, or their data, results, and evaluations were provided. In fact, population forecast was considered as population projection, despite the fact that the two are distinct processes.
- 2. Type 2 (incorrect/incomplete use of the technique): There are two plans of this type (see Appendix). As for the Kırşehir-Nevşehir-Niğde-Aksaray Planning Region TP, total population projections were produced for years 2005, 2010, 2015, and 2025 by exponential extrapolation only, and 'population forecast' was made for 2025. The population projections and forecasts for 2025 are quite different from each other. In PR under the section titled "Development Areas and Spatial Decisions", there is a statement run-

5.3. POPULATION FORECASTS									
The 2010 populations and the expected populations of the provinces in the Adıyaman-Şanlıurfa-Diyarbakır Planning									
Region 1/100,000 Scale Territorial Plan in 2045, which is accepted as the target year, are given in the tables below.									
	2010								
	Frovinces	Urban	Rural	Total					
	Adıyaman	392,574	198,361	590,935					
	Şanlıurfa	1,021,382	641,989	1,663,371					
	Diyarbakır	1,124,305	404,653	1,528,958					
	Planning Region Total	Planning Region Total 2,538,261 1,245,003 3,783,264							
	Dravinas 2040								
	Trovinces	Urban	Rural	Total					
	Adıyaman	832,500	227,500	1,060,000					
	Şanlıurfa	2,110,000	1,075,000	3,185,000					
	Diyarbakır	2,207,500	535,000	2,742,500					
	Planning Region Total	5,150,000	1,837,500	6,987,500					

**Figure 2.** The only explanatory statement for the population forecasts in the PR of the Adıyaman-Şanlıurfa-Diyarbakır Planning Region 1/100,000 Scale Territorial Plan. Source: Translated from ÇŞİDB, 2013a, 34.

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ning as "Due to the inevitable rapid urbanization created by globalization, the rural population was kept optimum and the projection populations were decided with the idea that the urban centers would keep the main population in the direction of development trends." (CSIDB, 2007a, 9). In this statement, the term "population projections", in fact, means "population forecasts". There is no concrete and technical information to justify or support this growth idea. Similarly, in PR of the Erzurum-Erzincan-Bayburt Planning Region TP, it was stated that the population projections were produced by using 1985, 1990, 1995, and 2000 general population censuses (GPCs), and 2010 and 2011 ABPRS data (see ÇŞİDB, 2016b). Methodologically, in popu-

lation projections, we would expect population data to be in the form of time series with regular intervals. However, in this TP, 2005 data are missing and the time interval between 2010 and 2011 is 1 year. Furthermore, although no census was carried out in 1995, no information is given about the source of this population data for that year. It was stated that since the projection populations in rural settlements and many urban settlements approach to zero; the AAPGR assumed by TURKSTAT in its 2023 projections were also taken into account, which are 2.2‰ for Erzurum; 8.4‰ for Erzincan; and -3.4‰ for Bayburt (ÇŞİDB, 2016b, 26) (Figure 3). It is seen that Bayburt's AAPGR is some negative value, which means that it is losing population. Its urban, rural, and total populations in the base year of 2013 were observed as 45,307, 30,313, and 75,620, respectively. However, in contrast to the observed decline, population forecasts for the year 2045 represent significant increases to 86,000, 31,500, and 117,500, respectively. Although the AAPGR value of TURKSTAT in 2023 is negative, no explanation was provided for this extraordinary increase in Bayburt's urban and rural populations.

3. Type 3 (improper use of the technique): There are seven plans of this type (see Appendix). According to the PR of the Ordu-Trabzon- Rize-Giresun-Gümüşhane-Artvin Planning Region TP (see ÇŞİDB, 2011c, 2017), population

#### 5.3. POPULATION FORECASTS

For the provinces in the Planning Region, population projections for 2045 were produced using the 1985, 1990, 1995, and 2000 population censuses and 2010-2011 Address Based Population Registration System data of TURKSTAT, and exponential method, the least squares method, compound interest method, and arithmetic method. Projections, which are detailed in the research report, were produced separately for urban settlements, i.e., district and town centers, and on the basis of districts for rural settlements. In the projection results, the approaching to zero finding for the population produced for especially rural settlements, besides many urban settlements, did not make it possible to use the projection results directly in the population forecasts in the plan period.

Therefore, for plan period population forecasts, the annual average population growth rates assumed by TURKSTAT in its 2023 projections were also taken into account. These values are 2.2‰ (2.2 per thousand) for Erzurum; 8.4‰ for Erzincan; and -3.4‰ for Bayburt.

The 2013 populations and the expected populations of the provinces in the Erzurum-Erzincan-Bayburt Planning Region 1/100,000 Scale Territorial Plan in 2045, which is accepted as the target year, are given in the tables below.

	Description	2010				
	Provinces	Urban	Rural	Total		
	Erzurum	766,729	-	766,729		
	Erzincan	169,153	50,843	219,996		
	Bayburt	45,307	30,313	75,620		
	Dianning Degion Total	001 100	91 156	1 062 245		
an amendme	n <u>t approval boundary</u>	Population form	81,150	1,002,343		
l <u>an a</u> me <u>ndme</u> Table 8. P	nt approval boundary	– Population forec	casts (2045) 2010			
l <u>an amendm</u> e Table 8. P	rianning Kegion Total n <u>t approval boundary</u> rovinces and the Planning Region <b>Provinces</b>	– Population forec	casts (2045) 2010 Rural	Total		
<u>an a</u> me <u>ndm</u> e Table 8. P	rovinces and the Planning Region Provinces Erzurum	Urban 1,270,000	easts (2045) 2010 Rural	Total 1,270,000		
l <u>an a</u> me <u>ndm</u> e Table 8. P	rovinces and the Planning Region Provinces Erzurum Erzincan	981,109           - Population forec           Urban           1,270,000           323,000	asts (2045) 2010 Rural 73,500	Total 1,270,000 396,500		
<u>an a</u> me <u>ndm</u> e Table 8. P	rt approval boundary nt approval boundary Provinces and the Planning Region Provinces Erzurum Erzincan Bayburt	- Population forec Urban 1,270,000 323,000 86,000	asts (2045) 2010 Rural 73,500 31,500	Total 1,270,000 396,500 117,500		

*Figure 3. Explanatory statement for the population forecasts in the PR of the Erzurum-Erzincan-Bayburt Planning Region 1/100,000 Scale Territorial Plan. Source: Translated from ÇŞİDB, 2016b, 26.* 

projections were produced by using extrapolations of ABPRS data for 2007, 2011, and 2015. Although these data have been generated annually since 2007, the production of population projection for year 2026, by using only three years, weakens the accuracy of the results in terms of the requirements of the regression. Since the produced results and their graphical and quantitative evaluations were not given in PR; it is not known whether the results were statistically significant. It was not explained why specifically these three techniques used were selected for the calculations. The logic behind taking the average of different regression results, which is contrary to methodological principles, was not explained either. Population forecasts, which are quite different from the calculated values, are not supported with any convincing justifications about their calculation processes and techniques. The PRs of the remaining six TPs do not contain information about the data used in population projections. Three to four extrapolation techniques were used in each one of these plans. The logic and rationale behind the selection of these specific regression models were not explained. Statistical test results, graphical and quantitative evaluations, which demonstrate the usability of the results, were not provided. Moreover, the average of different model results was taken again without a logical base. Population forecasts were made but no information was provided about their calculations, processes, and techniques.

4. Type 4 (technique without content): Two TPs were observed under this

type (see Appendix). Explanations regarding population projections and forecasts in the sections titled "Population Projections" in the PR of both TPs contain the same sentences. It is stated that the coefficient values to be used as multiplier for each sector were obtained by proportioning the employment statistics of 1990 and 2000 to the population. These coefficients were not presented in PRs, while the economic sectors of each district were listed. Despite not being related to the base year situation, they were directly taken as the basis for 'Economic Sector Forecasts' for the future. In the next stage, it was stated that the population projections were produced by three extrapolation techniques, but these resultant figures and the averages (despite being an improper use of methodology) that were said to be used, were not presented in the reports. It is stated that the final forecasts for 2040 were obtained by proportioning the coefficient value obtained from sectoral data with the 'average population projection, which has no rationale supporting it (Figure 4). Since these values were not given in PRs, it is not understood by the present authors how population forecasts were carried out.

In sum, the population values of the twenty TPs examined were questioned in two stages. Population projection calculations/techniques were examined in the first stage, and the rationale of the population forecasts were examined in the second stage. Regarding the calculations/techniques, it was determined that all the plans were inadequate in terms of statistical evaluations. As for the elements of the second stage of the examination of

In addition to these conditions taken into account, the coefficient values to be used as multiplier for each sector were obtained by proportioning the employment statistics of 1990 and 2000 to the population. In the next stage, population projections were produced using the least squares method, compound interest method, and arithmetic method and the population projections were obtained by taking the average of [the results of] these three methods. By proportioning the multiplier values obtained from sectoral data and the average population projection, the final population projections for 2040 were obtained.

**Figure 4.** The only and identical explanatory statements for the population forecasts in the PRs of the Mardin-Batman-Siirt-Şirnak-Hakkari and Malatya-Elazığ-Bingöl-Tunceli Planning Regions 1/100,000 Scale Territorial Plans. Source: Translated from ÇŞİDB, 2019a, p. 32 and ÇŞİDB, 2015c, 34.

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the forecasts, it was observed that they were determined independently of the projections produced.

## 4.2. Examinations regarding the annual average population growth rate calculations

In this section, some basic data are compiled, primarily for discussing the population forecasts of TPs, which



**Figure 5.** Comparison of the population forecasts for the provinces in 1/100,000 scale TPs with various annual average population growth rate computations by keeping the order of provinces composing each of the same TP. Source: Prepared from the data obtained from 1/100,000 Scale TP Planning Reports, TURKSTAT 2007 and 2019 ABPRS data.

were found inaccurate or incomplete in terms of methodology. All these data are at the provincial level and include ABPRS data for 2007-2019 and population projection data for 2025 from TURKSTAT, the approval (base) year and the target year of the plans and their population forecasts.



**Figure 6.** Comparison of the population forecasts for the provinces in 1/100,000 scale TPs with various annual average population growth rate computations by sorting the provinces in the order of increasing AAPGR between year 2019 and the target year of the plan. Source: Prepared from the data obtained from 1/100,000 Scale TP Planning Reports, TURKSTAT 2007 and 2019 ABPRS data.

In making comparisons, the annual average population growth rates (AAP-GR) were calculated in thousands (‰) using the TURKSTAT formulation, in order to see:

- 1. the existing trends of each province between 2007 and 2019 populations,
- 2. the population growth trend proposed by the plan on the provincial basis between the approval (base) year population and the target year forecast of the plan, and
- 3. the necessary trends that must occur after 2019, in order for each plan to reach its forecast value within remaining time (Figure 5 and Figure 6).

Averages across all provinces were found to be 16.0‰ for the first; 31.4‰ for the second, and 49.4‰ for the third calculation. Accordingly, it was observed that the plans expected an annual average population growth twice the actual trend during the plan horizon. Moreover, in order for population forecasts to be realized, in the remaining years the provinces require more than three times the existing trend's



**Figure 7.** Comparison of the provinces having negative AAPGR between 2007 and 2019 in terms of their existing populations in this period, plan approval (base) years, TURKSTAT 2025 population projections, plan target years, and population forecasts of the plans with respect to years (the table is sorted in the increasing order of the 4th column). Source: Prepared from the data obtained from 1/100,000 Scale TP Planning Reports, TURKSTAT 2007-2019 ABPRS data and 2025 province-based population projections.

AAPGR.

Regarding the existing trends, there is a total of seven provinces (covered by four plans) with negative AAPGR. In other words, seven provinces have been losing population between 2007 and 2019. The graph of existing population trends of these provinces, their plan approval (base) years, TURK-STAT 2025 population projections, plan target years and population forecasts with respect to years are shown in Figure 7. For all provinces losing population, TURKSTAT projections display similar trends accordingly. In contrast, the plans propose an increase of 18‰ or more per year. This is an indication of how the population forecasts in the plans were exaggerated, in a totally contrasting pattern to the existing trend (Figure 7).

The seven provinces at the bottom of Figure 6 require AAPGR over 100‰ to access their forecasted populations after 2019. The populations of these provinces increase with a rate of ‰30.1 per year on average (8.8‰ for Ordu with the lowest rate; 61.8‰ for Tekirdağ with the highest rate). These provinces cannot reach their forecast populations unless they somehow show extraordinary performances of AAPGR ranging from 106.5‰ (Ordu) to 189.4‰ (Çankırı) (Figure 8).

## 4.3. Examinations regarding population sizes

In this section, a comparison of population forecasts of 33 provinces, having the same or approximate (by 1-2 years) target year comparable to the TURKSTAT 2025 provincial projections, is presented (Table 1). The results show that no province except for Karabük could reach TURKSTAT's projections. However, up to 1.5 times more population than that of TURKSTAT projections are allocated to a total of 16 provinces, which are 1.08 for Giresun, between 1.5 and 2 times for 13 of the remaining provinces, more than double for Ordu and Mersin, and around 3.5 times for Çankırı (Table 1).

In fact, the sizes of these exaggerated population forecasts indicate a critical situation compared to the observed population data of 2019. In total, for the 33 provinces, the population in 2019 was 26,757,616, while TURKSTAT's 2025 projection was 28,255,425, and the population forecasts of TPs for the same year (or very close by 1-2) was 44,534,313. It was determined that TURKSTAT's projections progressed with a reasonable margin of error. However, populations allocated by TPs appear to be approximately 1.6 times of the projection results. This contradictory situation is also valid at the provincial level calculations. For example, having a population of 754,198 in 2019 according to ABPRS data, 1,590,000 was assigned to Ordu province for 2026 by the TP. As for TURKSTAT's projection for 2025, this is 763,581 which shows a stable population. Mersin and Çankırı's AB-PRS figures for 2019 were 1,840,425 and 195,789, respectively, while the population forecasts in the related TPs targeting for 2025 were 4,471,290 and 610,000. However, TURKSTAT's projections for 2025 were 1,950,784 and 176,039, respectively (Table 1).

#### 5. Conclusions

Türkiye's urbanization history has witnessed population movements that made it highly difficult to accurately determine future population figures. Events affecting the natural growth trend and geographical distribution of the population in Türkiye include: (1)Mass movements such multinational population exchange in the early periods of the Republic; (2) rapid urban population growth due to the intensive migration that began in the 1940s, which was conceptualized as the urbanization of labor (Şengül, 2001); (3) labor migration to Europe in the 1960s; (4) forced migration of Bulgarian Turks in the late 1980s; (5) migration as a result of displacement of local population due to the terror in the Southeastern Anatolia Region in the 1990s, and (6) intensive refugee immigrations over the last decade. In addition, the recognition of year 2000 GPC data of the State Statistical Institute (currently TURKSTAT) as useless and incorrect (see Akpinar, 2005), means that the institutional (conversion of SSI to TURKSTAT) and technical changes (transition from

GPC to ABPRS) broke the continuity of the time series data required to make population projections in Türkiye. For these reasons, the high margin of error in projection calculations with time series data can be considered normal, to a certain extent. However, by virtue of the development of statistical techniques and the reliable database provided by ABPRS, demographic data and general censuses have produced more reliable results since 2007.

In terms of urban planning, population data and the population forecasts for the target year are among the main inputs that determine the planning decisions. The problem with population data and their processing affects not only policies at the country level, but also land-use decisions at the local level. In this context, it is equally important to process these data using the correct techniques and accurate population data.

In this paper, the population decisions of a total of 62 provinces covered by a total of twenty 1/100,000-scale TPs published on the website of MEUCC, which is the only responsible authority for those plans, were examined in three steps: (1) population projections and forecasts, (2) annual average population growth rate calculations, and (3)



**Figure 8.** Comparison of the provinces having AAPGR over 100‰ between 2019 population and the target year forecast of the plan, in terms of their existing populations in 2007-2019 period, plan approval (base) years, TURKSTAT 2025 population projections, plan target years, and population forecasts of the plans with respect to years (the table is sorted in the increasing order of the 4th column). Source: Prepared from the data obtained from 1/100,000 Scale TP Research Reports, TURKSTAT 2007-2019.

	A	Diam	Population forecast of		TUDKOTAT	Proportion of	
Dravinaa	Approval	Plan		2010	TURNSTAT	population forecast of	
Province	(base)	target		2019	projection	the plan to TURKSTAT	
	year	year	the plan		TOF 2025	projection for 2025	
Karabük	2019	2025	253,000	248,458	275,389	0.92	
Giresun	2017	2026	494,000	448,400	458,072	1.08	
Kırşehir	2007	2025	295,000	242,938	263,109	1.12	
Kırklareli	2010	2023	445,941	361,836	381,213	1.17	
Edirne	2010	2023	485,600	413,903	412,595	1.18	
İzmir	2015	2025	5,545,000	4,367,251	4,672,976	1.19	
Manisa	2015	2025	1,879,000	1,440,611	1,505,399	1.25	
Zonguldak	2019	2025	736,000	596,053	580,284	1.27	
Samsun	2008	2026	1,800,000	1,348,542	1,413,427	1.27	
Tekirdağ	2010	2023	1,683,200	1,055,412	1,296,443	1.30	
Amasya	2015	2026	455,000	337,800	338,699	1.34	
Bartın	2019	2025	268,500	198,249	199,328	1.35	
Nevşehir	2007	2025	421,000	303,010	305,367	1.38	
Niğde	2007	2025	524,500	362,861	369,654	1.42	
Rize	2017	2026	476,500	343,212	333,037	1.43	
Aksaray	2007	2025	650,500	416,367	450,853	1.44	
Gümüşhane	2017	2026	281,500	164,521	190,270	1.48	
Çorum	2008	2026	800,000	530,864	521,647	1.53	
Muğla	2011	2025	1,643,034	983,142	1,070,849	1.53	
Artvin	2017	2026	245,000	170,875	159,048	1.54	
Aydın	2011	2025	1,966,131	1,110,972	1,196,815	1.64	
Burdur	2016	2025	440,000	270,796	266,085	1.65	
Trabzon	2017	2026	1,411,000	808,974	840,993	1.68	
Sinop	2008	2025	367,000	218,243	212,151	1.73	
Kastamonu	2008	2025	686,500	379,405	388,206	1.77	
Isparta	2016	2025	797,500	444,914	448,387	1.78	
Denizli	2011	2025	2,025,117	1,037,208	1,120,115	1.81	
Tokat	2008	2026	1,100,000	612,747	605,082	1.82	
Antalya	2016	2025	5,200,000	2,511,700	2,773,397	1.87	
Adana	2013	2025	4,487,500	2,237,940	2,316,131	1.94	
Ordu	2017	2026	1,590,000	754,198	763,581	2.08	
Mersin	2013	2025	4,471,290	1,840,425	1,950,784	2.29	
Çankırı	2008	2025	610,000	195,789	176,039	3.47	

**Table 1.** The state of the 33 provinces having the same or approximate plan target year, comparable in terms of their population size with TURKSTAT 2025 province-based population projections (sorted in the increasing order of the last column).

\* Prepared from the data obtained from the selected 1/100,000 Scale TP Planning Reports, TURKSTAT 2019 ABPRS data and 2025 province-based population projections

population sizes.

In the first step of the examination, projection techniques and population forecasts used in TPs were questioned in two stages. As a result of typological examinations carried out in the first stage, four types were identified: (1) non-technical, (2) incorrect/incomplete use of the technique, (3) improper use of the technique, and (4) technique without content. In terms of projection calculations/techniques, it was observed that all the plans were methodologically incompetent. The population forecasts in the second stage were determined, independent of the projections produced. Although population forecasting is required to take a value between the lower and upper limits of different projection results that are statistically significant, population forecasts in many TPs exceeded the upper limit of projection results. The explanations about population forecasts in these PRs where forecasts exceed above-limits were based on subjective interpretations, but not on technical and objective reasons.

Based on these findings, it is suggested that revisiting the population decisions of TPs, using a comprehensive approach adopting appropriate techniques is essential. It was determined that many different datasets, calculation methods, and plan horizons (in terms of population calculations) were used in TPs. Such a differentiation might have been acceptable in the case where these plans were prepared by different actors under different conditions. However, TPs in Türkiye are prepared and approved by the single

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authority of MEUCC and projections and forecasts are often incorrect. The findings suggest that population calculations should be revised in accordance with methodological principles. If different results appear due to this revision as compared to existing population forecasts, then it means comprehensive revision of TPs should be considered. At this point, the current absence of spatial strategic plans (SSPs) can be considered an opportunity. As such, the plans examined in this paper are the TPs, which are the top-level spatial plans among those currently in effect. In fact, the highest-level plan in the spatial planning system of Türkiye is the SSP, yet although it was first enacted in 2014, there is no SSP that has come into force, to date. Since these plans are expected to be prepared by the ministry in the near future, SSPs may be an opportunity to revise population decisions, among other decisions in the TPs. In this revision, a critical intervention is to standardize or at least harmonize projection techniques, in addition to rearranging the target vears in this manner.

An important factor determining the accuracy of population projections is the regular and continuous population database. The data used for these calculations in Türkiye are the time series data held by TURKSTAT. However, since the population data collection system was changed after 2007, and was switched to ABPRS, the question of how to use the population data collected every five years (excluding 1995) before 2007 and annually since 2007 should be addressed. In some of the TPs examined, both population datasets were used together, despite their representation of different time intervals, and in some, 'uncollected' population data were added in some way. The authors of the present paper believe that the ABPRS has proven to be a statistically regular dataset approaching 15 years in the time series since 2007. This series would be sufficient to use in long-term population projections, where pre-2007 population data are no longer necessary. In addition to single-variable extrapolation techniques, it is also possible and necessary to produce projections with further direct

techniques, by associating this dataset with other demographic data collected with ABPRS. Following these calculations, close attention should be paid so that the population forecasts of the plans remain between the lower and upper limits of the produced projections, based on technical evaluations to be made by the planning teams.

The main problem identified as a result of the examination is the considerably high differences between population trends and population forecasts. For many provinces whose populations are stable or decreasing, it was observed that the population forecasts are extremely higher than the calculated projections. Population forecast is among the fundamental inputs that directly affect planning decisions. High population forecast results call for excessive urban development area and/ or density much more than the optimum level. Over-population forecasts in TPs also bind the lower-scale plans in accordance with the principle of hierarchical integrity of plans. Decisions of the upper-scale plan hierarchically bound lower-level plans. In the case where the problem with this current state of over-populated plans is not resolved, lower-level plans will be faced with the speculative land market, development on the fringe, construction pressure on natural resources, and thus inefficient use of land as a scarce resource, and a waste of public resources. Notwithstanding the question of whether these settlements will be able to provide adequate social and technical infrastructure to carry such large populations is another question to be asked, along with besides others.

#### Endnotes

<sup>1</sup> 'Çevre Düzeni Planı' is translated as 'territorial plan' with reference to Ministry of Environment, Urbanization and Climate Change's own usage. Scholars may also prefer 'Environmental Plan', 'Environmental Physical Plan', or 'Master Plan'.

<sup>2</sup> Although the spatial strategy plan, which entered into legislation with the Regulation on Spatial Planning in 2014, is the top-level spatial plan, currently there is no sample in effect, to date. Appendix. Descriptive information, examinations, and projection typology of TPs (sorted in increasing order of approval (base) years in general and within each sub group).

Plans* (all are 1/100,000 scale TPs)	Approval (base) year of the plan	Target year of the plan	year The results of examinations over the PRs	
Sinop-Kastamonu-Çankırı Planning Region	2008	2025		
Ardahan-Kars-Iğdır-Ağrı Planning Region	2013	2040		
Adıyaman-Şanlıurfa-Diyarbakır Planning Region	2013	2040	No projections were produced, yet urban, rural, and total population forecasts were made	
Balıkesir-Çanakkale Planning Region	2014	2040	at the province and district levels.	
Yozgat-Sivas-Kayseri Planning Region	2015	2040		
Trakya Sub-Region Ergene Basin	2010	2023	No projections were produced, yet population forecasts were made on the provincial and	Type 1
Izmir-Manisa Planning Region	2015	2025	district totals.	technical)
Amasva İli	2015	2026	No projections were produced, yet population forecasts were made for the provincial total. <sup>1</sup>	
Samsun-Çorum-Tokat Planning Region	2008	2026	(1)No projections were produced, yet upper- and lower-limit population forecasts were made at the provincial level for province, district centers, town, and village totals. (2)Population forecasts were made for each district total and maximum urban populations. (3)For each town upper- and lower-limit urban population forecasts were made.	-
Kırşehir-Nevşehir-Niğde-Aksaray Planning Region	2007	2025	<ol> <li>Population projections for districts and for the provincial total were produced by exponential method for years 2005, 2010, 2015, 2020, and 2025.</li> <li>Population forecasts were made for each province and district total and no forecasts made for urban and rural populations.</li> </ol>	
Erzurum-Erzincan-Bayburt Planning Region	2016	2045	<ol> <li>Population projections for 2045 were produced using exponential, least squares, compound interest, and arithmetic methods and using the 1985, 1990, 1995, 2000 GPCs, 2010, and 2011 ABPRS data.</li> <li>Projections produced for each urban settlement (district and town centers), yet at the district level for rural settlements.</li> <li>For especially rural populations and for many urban settlements since the projections produced were found to approach to zero, these projections were not used.</li> <li>Therefore, the AAPGRs assumed by TURKSTAT in its 2023 projections were also taken into account for population forecasts of the plan period.</li> </ol>	Type 2 (incorrect/ incomplete use of the technique)
Aydın-Muğla-Denizli Planning Region	2011	2025	(1)Population projections were produced for all settlements using linear, compound interest, and exponential methods. (2)Urban, rural, and total population forecasts were made at the provincial and district levels by a collective evaluation of the average of population projections and the	
Zonguldak-Bartın-Karabük Planning Region	2019	2025	carrying capacities of the approved land-use plans. (3) The adequacy of the existing planned areas was examined by comparing population forecasts with the approved land-use plans.	
Muş-Bitlis-Van Planning Region	2011	2035	<ol> <li>Population projections were produced for all settlements using exponential, compound interest, arithmetic, and linear regression methods.</li> <li>The average of population projections at the provincial level were tested using cohort- component method.</li> <li>Population forecasts were made for each settlement by a collective evaluation of the average of population projections and the carrying capacities of the approved land-use plans.</li> <li>Areast in a evaluation was made as 'areas to be planned' or 'areas that are excessively planned' by comparing population forecasts with the approved land-use plans.</li> </ol>	
Mersin-Adana Planning Region	2013	2025	<ol> <li>Population projections were produced for all settlements using least squares, compound interest, and exponential methods.</li> <li>Population forecasts were made by a collective evaluation of the average of population projections, the carrying capacities of the approved land-use plans, and the determined ranks and functions for the settlements in the TP.</li> <li>Population forecasts were determined as intervals with lower and upper limits.</li> <li>The adequacy of the existing planned areas was examined by comparing population forecasts with the anonyce planet, use plans.</li> </ol>	Type 3 (improper
Antalya-Burdur-Isparta Planning Region	2016	2025	<ul> <li>(1)Population projections were produced for all settlements using exponential, least squares, compound interest, and arithmetic methods.</li> <li>(2) The average of the population projections was calculated and urban, rural, and total population forecasts were made at the provincial and district levels.<sup>2</sup></li> <li>(3) Population forecasts were determined as intervals with lower- and upper limits.</li> <li>(4) The adequacy of the existing planned areas was examined by comparing population forecasts with the aporved land-use plans.</li> </ul>	technique)
Ordu-Trabzon-Rize-Giresun-Gümüşhane-Artvin Planning Region	2017	2026	<ol> <li>Population projections were produced using arithmetic, exponential, and compound interest methods and using the 2007, 2011, and 2015 ABPRS data.</li> <li>The averages of these projections were compared with the population forecasts given in the PR of the TP approved on 24 June 2011.</li> <li>The urban population forecasts were made for the towns (municipalities) in the provinces of Artvin, Gümüşhane, Rize, and Giresun and for the districts in the provinces of Trabzon and Ordu<sup>3</sup></li> </ol>	
Konya-Karaman Planning Region	2018	2043	<ol> <li>Population projections were produced for all settlements using least squares, compound interest, and exponential methods.</li> <li>Population forecasts were made by a collective evaluation of the average of population projections, the carrying capacities of the approved land-use plans, and the determined ranks and functions for the settlements in the TP.</li> <li>The adequacy of the existing planned areas was examined by comparing population forecasts with the approved land-use planse.</li> </ol>	
Malatya-Elazığ-Bingöl-Tunceli Planning Region	2018	2040	(1) The coefficient values to be used as multiplier for each sector were obtained by proportioning the employment statistics of 1990 and 2000 to the population. (2) Population projections were produced using least squares, compound interest, and arithmetic methods.	Type 4 (technique
Mardin-Batman-Siirt-Şırnak-Hakkari Planning Region	2019	2040	<ul> <li>(a) Ine average of the population projections was calculated.</li> <li>(4) By proportioning the multiplier values obtained from sectoral data and the average population projection, the final population projections for 2040 were obtained.</li> <li>(5) The adequacy of the existing planned areas was examined by comparing population forecasts with the approved land-use plans.</li> </ul>	without content)

The examinations were made on the TPs published on the MEUCC website as of 2020.
The examinations were made on the TPs published on the MEUCC website as of 2020.
The footnote on page 46 of the related PR it is stated that: "Detailed study for population estimates is included in the appendices of the plan report", although no attachments were found in the report.
On page 12 of that PR it is stated that: "Based on the public investments and tourism potentials (since the other institutions have the authority and they have no future investment programs), the results of the exponential one among all projection methods have been adopted as it is thought that the population will increase more than the estimations made using the current population growth rate for the districts of Alanya, Gazipaga, Kemer, Manavgat, Serik in Antalya Metropolitan Municipality."
The related PR, while a brief explanation of population projections and forecasts was made, only the existing municipal populations for 2007, 2011, and 2015 were given in the form of tables. In Appendix-1 of the plan notes, total urban population forecasts of the district and town settlements were determined, yet the total population forecasts of the rural settlements and provincial were not determined.
\* Prepared from the PRs of the related TPs (see ÇŞIDB, 2007/2008; 2007a; 2007b; 2009/2010; 2011a; 2011b; 2013a; 2013b; 2013c; 2014; 2014/2015; 2015a; 2015b; 2015c; 2016a; 2016b; 2017; 2018; 2019a; 2019b).

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## Dynamics in post-pandemic architecture: Integrative literature review in response to postpandemic built environment

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#### Abstract

"Dynamics in post-pandemic architecture" refers to dynamics in architecture as implication of disease spread in a building for averting a future pandemic. The highly contagious and rapid spread of COVID-19 has caused changes in the architecture and way of life. The built environment needs proper strategies to act as a facilitator for averting the spread of disease in the future. The implications of disease spread and strategies for dynamics in post-pandemic architecture will be reviewed and discussed in this study. Integrative literature review used in this article is a systematic method to define previous research, relate concepts and relevant studies by reanalyses the data for future research. The first step is systematically clear selection; the second step is coding; the third step is synthesis. The integrative review considered 102 papers (of which 40 were reviewed). It was discovered that there were no articles that incorporated previous study findings comprehensively. Six strategies for future dynamics in architecture post-pandemic are revealed: control of architectural density, control of peripheries and spread, control of interaction, control of mobility, control of access, and new protocols and standards for spatial. Each strategy demonstrated the interaction between dynamics in post-pandemic architecture and security-pandemic variables in built environment. The findings: identification of the dynamics in architecture postpandemic strategies that affect the built environment in preventing disease spread in the future. This will support future research in defining appropriate future research designs and understanding the need for holistic analysis of the integrated effects of diverse dynamics in post-pandemic architecture.

#### Keywords

Dynamics, Pandemic, Public space, Future, Interior.

COVID-19 (SARS-CoV-2) The altered the everyday pandemic routines of millions of people and thus led them to re-evaluate many routine behaviors, including changes in our built environment. During the recent COVID-19 pandemic, time spent at home has increased noticeably, while daily mobility has decreased (Yağcı Ergün & Nebioğlu, 2022). Such circumstances call into question certain fundamental needs of the security concept of architecture, the dynamics of architecture and the use of spatial contexts. New requirements are needed for new security systems, protocols, and standards for spatial use.

Considering past events, epidemics, pandemics, and infectious diseases led to important advancements in urban planning, sanitary systems, and architectural designs (Megahed & Ghoneim, 2020). Several epidemics (including the recent three of tuberculosis, cholera, and ebola) highlight the importance of architects and designers in preventing disease spread when we consider their primary modes of transmission: surfaces, water, and air (Murphy, 2020). The COVID-19 pandemic will undoubtedly have an impact on architectural designs and the rapid changes in users' needs, behaviors, and daily lives in the future (Alhusban et al., 2022).

Safety and security needs are ranked second after physiological needs in Maslow's hierarchy of needs (Augustin et al., 2009). Therefore, safety and security (including security for users' health) become a fundamental need for concept and design features within the built environment. Security issues for the built environment are related to the prevention and detection of threats carried out and motivated by humans (The American Institute of Architects, 2004). When humans are present in space, security is expected to detect threats, mitigate danger, and protect. Security in the built environment is also needed in the context of a pandemic to help detect, reduce the risk, and prevent viruses.

To meet the complex challenges associated with the dynamics in post-pandemic architecture, a concept and strategy based on various disciplines related to movement, change and adaptability within architecture and the built environment design must be developed. Salama (2020) reveals a contextual, transdisciplinary framework that explains pandemics in urban settings (Salama, 2020). One of the aspects discussed in this framework is architecture with urban dynamics related to: (1) environmental density and the spread of disease; (2) traveling and transportation; and (3) global-local tensions (including urban science and human geography, urban planning, and transportation engineering). Although there are two more aspects (distancing and living-working patterns), this paper focuses on the dynamics in post-pandemic architecture.

In order to prevent pandemic spread, changing socio-spatial needs require implicit development and implementation not only at the urban planning level of design, but also in architectural design in the context of a smaller built environment (interior-structure). Structures are organized collections of defined spaces that are made of products, have an interior space, and an exterior form. While interior spaces are enclosed within a structure and defined by an organized arrangement of products (McClure & Bartuska, 2007). Therefore interior-structure in built environment is grouping of spaces and products to enhance human activities and have both exterior form and interior spaces. The interior-structure built environment is becoming one of the ways to prevent its spread, as it is more optimal, more liveable, and more pervasive, and it forms healthy behavior in humans.

The goal of this paper is to identify the dynamics in post-pandemic architecture strategies that affect the built environment in future disease prevention. The spatial problems and user need that arise with the change in post-pandemic architecture constitute the main starting point of this paper. To answer the objectives of the research in this paper, an integrative system literature review method will be used to classify, identify characteristics, justifying the post-pandemic security variables for built environment, including indicators, factors, and criteria for measuring the variables, to develop



Figure 1. Research design.

a preliminary strategy for dynamics in architecture post-pandemic.

There is a research gap for dynamics in architecture context between the pre-pandemic and post-pandemic eras. Since the dynamics in post-pandemic architecture context is based on abstract ideas, security variables in the built environment are needed. Security variables in the built environment can help improve public space safeguarding (including pandemic protection and user control within the environment). The novelty in this paper is a strategy for "dynamics in post-pandemic architecture" in terms of security variables. The dynamics in post-pandemic architecture variables will be actualized based on existing variables of security in the built environment (such as access and movement, surveillance, ownership, and so on) and the new variables for security architecture post-pandemic.

#### 2. Methodology

This integrative systematic review focuses on published research articles indexed in online databases. The process of an integrative review used to relate concepts and relevant theories using systematic review. This includes studying the concept of dynamics in post-pandemic architecture, exploring the potential for built environment security variables to develop synthesis of strategy for reducing the risk by developing dynamics in postpandemic architecture through built environment (Haigh & Amaratunga, 2010; Marion E. Broome, 2000; Torraco, 2005; Y. Zhang et al., 2019).

Two existing research (in preliminary study) on the dynamics of post-pandemic architecture exist prior to the steps for an integrative systematic review. The first study is regarding how the post-pandemic has affected urban dynamics. The second study is about how existing safety and security strategies become fundamental concepts and design features in the built environment for prevention and detection of threats. These two studies examined how urban planning and safety-security measures were altered in the built environment during the pandemic. These studies are crucial for

Dynamics in post-pandemic architecture: Integrative literature review in response to postpandemic built environment comprehending the scope and basic information of the dynamics concept and security strategies before the pandemic. The integrative review presented in this paper intends to propose a strategy for dynamics in post-pandemic architecture in terms of security variables.

The connection between preliminary study and three steps for this integrative systematic review: the selection, the coding and classification, and the synthesis, as shown in Figure 1. The first step is a clear selection and identification of the problem that the review using literature search. Literature search should clearly address issues such as search terms, the databases used, additional search strategies, and the inclusion and exclusion criteria for determining relevant primary sources. The second step is the coding and classification using data analysis process, data from primary sources are ordered, coded, categorized. The third step is the synthesis by summarized and creating strategy of dynamics in post-pandemic architecture. Finally, conclusion of reviews can be reported in a table or diagram.

#### 2.1. Step 1: The selection

The selection process was carried out by searching for sources of literature or writing data from books, proceedings, journals, and articles through the website lens.org. The search criteria included research articles written peer-reviewed, English, and in published between January 2000 and August 2022. The keywords used are "pandemic" and "dynamics". Based on these keywords, we found n = 22,185in lens.org. The next step is filtering the field of study using: "architecture" (architecture)" "ventilation "architectural design" "building design" "sustainable design," "spatial design," "Atmosphere (Architecture and spatial Design)" n=102 and accessible "open access colour Gold and Green" n=61. Exclusion criteria included articles not written in English or Bahasa Indonesia and articles that were written as editorials (n=56). In light of the inclusion and exclusion criteria, A total of 40 articles were eligible for review using the integrative method. Each of the 40 articles was reviewed

independently by the authors, focusing on the dynamics aspects of the urban built environment and interior structures that have been laid out by Salama (2022). Forty of these articles were not researched and thus were eliminated. Forty articles were recommended for inclusion in this review, as shown in Table 1.

## 2.2. Step 2: The coding and classification

The next step is the coding and classification process. There were 7 subaspects of urban dynamics (Maturana et al., 2021; Salama, 2020). From the seven sub-aspects in the previous research in urban design, only six were discussed and identified as the dynamics in postpandemic architecture. Therefore, only six sub-aspects are discussed, which are: density; peripheries and sprawl; interaction; mobility; access, space standards and protocols; and the placement of technology and materials. The coding process included screening and reviewing 40 papers to determine which articles fit into which sub-aspects using the Microsoft Excel program. The coding and classification of the contents of the discussion from literature sources are explored according to the dynamics aspect framework and sub-aspects for interior-structure.

#### 2.3. Step 3: The synthesis

The process of synthesis started by breaking down in more detail what sub-aspects of the dynamics in postpandemic architecture were associated with the security variables in the built environment. There are seven existing security variables (Briggs, 2005) and the possibility of new additional sub-aspects. 40 sources of literature were identified from the perspective of dynamics' aspects, then sorted and grouped into similar topics to create "dynamics in postpandemic architecture" framework. The framework was defined in terms of variables, indicators, and factors. The existence of indicators, factors, and measurement objectives aim to clarify the discussion of the variables that appear and create strategies for dynamics in post-pandemic architecture. The results are presented in Table 3.

#### 3. Preliminary study

Urban Dynamics in a Pandemic World addresses both the larger global perspective and the ramifications of virus transmission at the city scale (Maturana et al., 2021). Dynamics in post-pandemic architecture deal with the architectural (interior-structure) ramifications of virus transmission. There are several sub-aspects of dynamic aspects at the urban level as they relate to virus spread and urban health (Maturana et al., 2021; Salama, 2020), including: (1) user density and the effectiveness of density management; (2) peripheries and spread; (3) interaction and connectivity; (4) mobility concerning to pollution, carbon emissions, and mortality rate; (5) access, standard space, and protocol for the use of public facilities; (6) environmental density; and (7) pathways in areas with the high distribution. The difference between the urban level and the interior-structure level is in the spatialobject scale and the processing time (McClure & Bartuska, 2007). Then, from these topics, there are six subaspects related to dynamics in postpandemic architecture in interiorstructure scale, which are as follows:

- 1. Density
- 2. Peripheries and spread
- 3. Interaction
- 4. Mobility control
- 5. Access control and prevention through standards and protocols
- 6. Prevention through technology and materials

Combining proactive safety and security viewpoints with the design professional's dedication to safeguarding the public's health (like preventing a pandemic), safety, and welfare can open solutions for the built environment (O'Shea, 2009). The extent to which users can change, alter, or control their environment, on the other hand, has an impact on their sense of security and control within the built environment. Dynamics in terms of post-pandemic architecture needs to be synchronized with the aspect of security to create a more secure and safer built environment.

Controlling in security architecture is a feature, structure, or method of designing a physical product, software, building, town planning, or system for interaction with users that aims to impose or limit user behavior (Atlas, n.d.; Hopper, 2009; O'Shea, 2009; The American Institute of Architects, 2004; Zamani, 2019). Before the pandemic of COVID-19, the theory of security architecture is always concerned with crime and CPTED. The theory of security has discussed the prevention of pandemics and health problems at spatial border needs such as airports and harbours. Now the prevention of pandemics and health problems needs to be applied in most places (from the residential, workplace, and public places) in the built environment.

Briggs in O'Shea (2009) describes how the design of a built environment as expected to be able to provide user needs, provide protection and a sense of security for users without sacrificing innovation and intervention, and can keep crime away. This should be a priority in design strategies' development (Lockton & Stanton, 2010). There are 7 variables that are the basis for consideration in applying the concept of security in a built environment (Briggs, 2005; O'Shea, 2009; The American Institute of Architects, 2004). There are seven security variables: (1) access and movement (well-defined routes, spaces, and entrances for easy movement); (2) structure (structured place to prevent conflict between); (3) surveillance (all publicly accessible places can be overlooked); (4) physical protection (well-designed security features); (5) activity (appropriate human activity for the location); (6) management and maintenance (security management and maintenance). (7) Ownership (places with a sense of ownership, respect, and territoriality) (Briggs, 2005).

The next step is to categorize the research articles published in the online database using an integrative systematic review method. Based on the explanation above, there are six keywords regarding the dynamics of post-pandemic architecture based on existing research written by Salama (2020). Using the six keywords above, the next

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step is to review the findings and implications of the 40 articles with keywords in bold and code the articles based on the six keywords from the dynamics' aspects. From the results of this coding, an in-depth analysis and synthesis process is carried out by deepening the coding into various variables of the post-pandemic dynamics architecture, indicators, factors, and measurement criteria, which will then summarize the findings of this research strategy in the "Discussion" section.

#### 4. Results and discussion

This section describes: the selection of the literature process for dynamics in post-pandemic architecture; the coding and classification process of variables, and the synthesis of strategies in dynamics in post-pandemic architecture.

## 4.1. The selection of literature for dynamics in post-pandemic architecture

To consolidate the state of the art, researchers have explored the theory regarding dynamics in post-pandemic; security for health outcomes in the built environment to describe building design features that influence the dynamics in post-pandemic architecture. The use of various disciplinary theories is justified because there is no theory evaluates dynamics in post-pandemic architecture aspects holistically. Outlining this can be developed into strategies for dynamics in post-pandemic architecture in the form of risk assessments as well as strategies for managing and designing the built environment.

Salama et al. (2020)discuss post-pandemic architectural considerations as well as the nature of the new normal living and working patterns in urban design as a result of the COVID-19 pandemic. According to Salama (2020), future design and planning studies should focus on several key issues, including urban dynamics from the perspectives of human geography, transportation, and urban design; socio-spatial effects and urban life from the perspective of environmental psychology; and new environ-

#### *Table 1. Review findings and implications for research.*

No	Reference	Citing Works	Review findings and implications for research with keywords in bold (selected)
P1	(Mittal et al., 2020)	306	The movement of the COVID-19 virus plays an important key role, starting from the movement of liquid droplets to the evaporation of the COVID-19 virus in the air. This virus can settle, touch almost any area and the air.
P2	(W. Yang & Marr, 2011)	185	Precipitation is important for removing virus present in droplets, while ventilation and inactivation are relatively more important for removing <b>virus with droplets</b> <5 m or <b>in</b> aithorps activates.
P3	(Kummitha, 2020)	102	Five practical observations to control virus transmission during a pandemic, including: government needs to ensure the protection of information and privacy of its citizens; needs to actively share the information; coordinate with each other to minimize the impact; need to control pandemic info shared with the public; sharing technology and information
P4	(Azuma et al., 2020)	63	Environmental factors influence in reducing virus transmission. In Japan, the focus on the 3Cs is (1) enclosed places with poor ventilation, crowded places with lots of people and close coertications.
P5	(Knibbs et al., 2011)	59	Room ventilation is a major determinant of <b>airborne disease</b> transmission. Through this simple model, the risk of contracting influenza is <b>reduced by a significant</b> increase in air surveyses extended on the instead of the second
P6	(Dbouk & Drikakis, 2021)	52	The position of the air inlet and outlet significantly affects the flow circulation and droplet dispersion. Air purifiers do not eliminate the possibility of airborne transmission.
P7	(Jarvis, 2020)	44	Corona virus can be transmitted and survive in the <b>air in the form of aerosol particles and</b> droplets / deposits on surfaces. The way to control the transmission is through good ventilation: sunlicht / UX rays. masks are able to inactivate this virus in the air
P8	(Nasir et al., 2016)	44	Factors affected by the transmission of airborne communicable diseases in the transportation environment (such as trains, planes, boats): (1) In <b>Design and Construction</b> (2) <b>Operation and Management</b>
P9	(Kumar & Morawska, 2019)	40	Three-way approach to help reduce the spread of coronavirus: (1) government (2) built space (ventilation system) (3) community
P10	(Foster & Kinzel, 2021)	40	The use of masks, a good HVAC system and duration of exposure and number of occupants were found to be more effective than physical distancing.
P11	(Pinter- Wollman et al., 2018)	40	The built environment affects health directly and indirectly. In the building scale there are 4 themes that play an important role for physical activity: (1) building access and circulation systems (2) building elements (3) organization of the building (4) activities in space
P12	(Gao et al., 2016)	29	Increasing <b>natural ventilation</b> into buildings is a relatively effective strategy for airborne diseases
P13	(Sadrizade h & Holmberg,	29	Air movement in horizontal laminar ventilation systems works better than vertical in reducing the transmission of viruses and bacteria in the operating room.
P14	2014) (Smieszek	23	Ventilation effectively reduces outbreaks as effectively as vaccinating half the population.
P15	(He et al., 2021)	19	The air purifier fan box is considered to be more effective than simply UV-C increasing the horizontal flow rate of the <b>ventilator unit (HUV)</b>
P16	(Cheshmeh zangi,	16	The key to the city stage for environmental aspects is the <b>density and level of accessible</b> green areas, the nearest transit location
P17	(Gbadamo si et al., 2020)	9	Airborne disease transmission: (1) <b>short-distance transmission</b> - through small droplets (2) <b>long-distance transmission</b> - through small particles in airborne transmission.
P18	(Brittain et al., 2020)	9	Building design strategies to improve <b>indoor air quality and</b> reduce dispersion through good air quality with <b>adequate ventilation</b> , good air circulation, specifications of <b>materials</b> <b>used</b> and reducing additional pollution from heating and air conditioning
P19	(Srivastava et al., 2021)	8	The strategy to reduce infection in buildings is to use a combination of 100% outdoor air and UV-C in circulation, ventilation and air conditioning ducts with disinfection by UV-C RM3 unit.
P20	(Anghel et al., 2020)	8	The control strategy is to optimize ventilation by increasing outdoor air use and air change rates, reducing <b>air recirculation and using air filters such as HEPA filters</b> .
P21	(Laddu et al., 2021)	7	(1) interior - associated air quality (2) housing - house density (3) public spaces - key to social interaction (4) green areas - enduring goals (5) work - downsizing and deployment (6) shopping - approaching and scaling down (7) transportation - pedestrians, cycling, small shared mobility and robot taxis (8) city scale - mixed use environment
P22	(Singh & Tripathi, 2020)	6	Ventilation systems (temperature distribution, airflow and aerosol and droplet distribution).
P23	(Frumkin, 2021)	6	Risk factors for transmitting COVID-19 in the built environment can include <b>crowds</b> , poverty, racism in residential areas, poor circulation in spaces, and air pollution.
P24	(Sopeyin et al., 2020)	5	The Covid-19 virus is transmitted through <b>droplets and can be aerosolized</b> .
P25	(Huang et al., 2021)	4	Natural ventilation with the help of fans in residential buildings can increase the risk of infection.
P26	(Shenton et al., 2019)	4	6 Steps to understanding and preventing mosquito-borne disease transmissionn, one of them is <b>changes to the built environment</b> can provide health benefits
P27	(Grydaki et al., 2020)	3	This study demonstrates general susceptibility to <b>airborne disease transmission</b> .
P28	(Mueller et al., 2021) (Crawford	2	The output of talking droplets and coughing is more than that of aerosols in the vent. Bed orientation of the placement of additional air treatment units can increase 40% the
P20	et al., 2021)	2	number of particles extracted and reduce 25% the number of particles deposited on the surface 45 seconds after and.
F30	et al., 2020)	2	The sacing of the COVID-19 wire depends on third finite the covid
P31	(Duill et al., 2021)	2	Parameters that influence and take into account the spread of disease: duration of stay, particle concentration in the air, respiratory rate, viral life span, ventilation flow interval efficiency, volumetric flow and room size
P32	(Ronchi et al., 2020)	1	Basic relationship of human movement due to the COVID-19 Pandemic: (1) human movement (2) interaction between road users
P33	(Zhang & Ryu, 2021)	1	The factors that affect the pattern of <b>air flow</b> in the room are the effect of v <b>entilation</b> on the dew rate.
P34	(Abbas & Gursel	1	A higher indoor air temperature can help reduce infection. Multiple window openings have a higher impact on reducing the risk of infection than changing the opposite
P35	Dino, 2021) (Tang et al.,	1	configuration. Human movement in the area around the home environment has an impact on the high
P36	2021) (Y. Yang et	1	daily transmission. Factors that make the environment resilient to pandemics: decentralized urban activities,
027	al., 2021)	0	decent housing, resilient building typologies, proximity between work and home, limited travel time, diverse travel options and city allocations and facilities according to population density
P37	Tsou, 2020)	0	and psychological dynamics in urban spaces, especially shopping centers and green spaces
P38	(Sharghi & Asadi, 2020)	0	We found a relationship between behavioral orientation and physical-environmental aspects that influence disease prevention and promote health-related behaviors. In the interior design scale, elements that affect control, reduce anxiety and improve health: surface area, furniture, color, openings and exits, density, access and common spaces, windows and ventilation for natural light and ventilation, open space for movement, activities physical and contact with nature. Different age groups need different places to
P39	(Papadaki et al. 2020)	0	There are three criteria to be considered: (1) parameters related to walking design (connectivity safety, etc.) (2) anthronometric user characteristics (3) andication principle
P40	(Fezi, 2020)	0	of user movement and intervention in cities with high use of public transportation. Architecture and cities are needed to prevent and mitigate future pandemics through air control, housing approaches, public spaces, green area design, work areas, transportation and a mix of neighbourhood.

ments to accommodate contemporary living and working styles from an ethnographic angle (Salama, 2020)

Maturana et al. (2021) focus on the implications of urban dynamics and COVID-19. The authors discussed the contagious coronavirus public health crisis and how health is a key factor in the creation of architecture and urban design. The effect of virus propagation on the urban environment (urban dynamics), the method used to reduce social and physical distance are put into practice, and how rapid adoption of digital technology affects a new normal life are just a few implications highlighted by the authors. To establish a new norm that incorporates flexibility and adaptability, the writers also mentioned the necessity of adoption and redesign (Maturana et al., 2021)

Following the conceptual approaches of Salama et al. (2020) and Maturana et al. (2021), we propose six aspects of dynamics in post-pandemic architecture. Originally there were seven aspects of dynamics in urban space (Maturana et al., 2021), but after a thorough analysis and literature review of 40 articles (see Table 1), only six aspects are related to the interior-structure.

From the literature review, 20% of articles discussed "Density", 20% of articles discussed "Peripheries and Spread", 5% of articles discussed "Interaction", 32% of articles discussed "Mobility", 20% of articles discussed "Access, spatial standard and protocols" and 3% of articles discussed "Antivirus Building Materials". The summary and explanation of the six aspects are:

1. Density - Density control that exists within the interior-structure scale. There are two things related to density, namely the density of air in the room to prevent disease spread and occupancy density. Air density control is necessary because of the potential for post-pandemic diseases to spread via aerosols in the air. The way to control it is by improving the air quality in the room (for example, by providing a HEPA filter on artificial air and providing openings to allow natural air movement in the room). Control of occupancy density is necessary because of the potential for the spread of infectious diseases through humans via droplets. The way to control the rate of spread is by settling the amount of occupancy density in one room.

2. Peripheries and spread – controlled through testing and reducing the possible spread within the interior-structure scope. There are two things related to boundaries and distribution, namely: limits and distribution of air in space and boundaries in user activities and occupancy. Airborne control and distribution limits are necessary because of the potential for post-pandemic diseases to spread via aerosols in the air. The way to control it is by peripheries the dirty air using several tools and improving the indoor air quality by creating peripheries' element for improving natural air movement in the room. The potential for infectious disease transmission through humans via droplets, therefore user activity must be limited and distributed. The way to control the rate of spread is through creating interior-structure's elements to limit user's activity and capacity in area before entering the interior-structure.

3. Interaction - is the closeness of the interaction between users within the interior-structure scope. There are two things related to interaction, namely, close interaction and not-close interaction. What is meant by "close interaction" is interaction that occurs between two or more people who know each other and have a special relationship (such as husband and wife, parents and children, close friends, etc.). The control this close interaction is provided by providing a separate area for this user. What is meant by "not close interaction" is an interaction that occurs between two or more people who do not know each other. Control in these close interactions through the completion of user activities and behavior. This is necessary because of the tendency of human psychology to imitate and follow the behavior of fellow human beings.

4. Mobility control - is control of user mobility, mobility of diseases in the air, mobility of dew rate and humidity in the room, mobility of natural sunlight entering, mobility of UV-C rays in the room, and mobility of disease mobility on the elements. elements that are within the scope of the structure-interior. Control of human mobility/movement within the interior-structure is necessary to limit the possibility of spreading disease among users through a mutual contact. Control of the mobility of airborne diseases is needed to help reduce the spread of these diseases. This is done by increasing the rate of air movement in the room and increasing the entry of fresh air into the room. Controlling dew rate and indoor humidity is necessary to help reduce disease spread caused by humidity and mold indoors. This is done by improving air quality by controlling air humidity and dew levels in the room. Controlling the movement of natural sunlight indoors is necessary to help reduce disease by killing disease by using natural UV rays and increasing the body's immunity (through natural UV-C rays and vitamin D). Prevention through the mobility of UV-C rays, which are obtained naturally through sunlight and unnaturally through UV-C rays. Control of disease movement through droplets on the surface of objects is carried out by using antiviral building materials.

5. Access control and prevention through standards and protocols - is user access control and prevention through new built-environment standards, humidity-temperature indoors, and health protocols for self-protection in interior structures. Control over user access is carried out by limiting user access within the interior structure.

6. Prevention through technology and materials – is prevention via technology derived from antivirus materials used indoors. This is necessary because of the possibility of disease spreading through droplets present on the surface of the material within the interior structure.

The relevant studies from the reviewed paper, shown in Table 1, have shown that there are six aspects of dynamics in post-pandemic architecture. The findings in these steps are required to support the early identification of dynamics in Post-Pandemics Architecture's variables.

### 4.2. The coding and classification aspects of dynamics in postpandemic architecture

After the literature review of the aspects of dynamics in post-pandemic architecture identified and carried out in the literature, as shown in Table 1, the next step is the coding and classification of 40 articles. Based on the initiative's findings in the previous chapter, there are six aspects of dynamics in postpandemic architecture at the abstract concept level. These aspects (abstract ideas) need to be developed as variables so they can be used in builtenvironment design (Barrett et al., 2015; Y. Zhang et al., 2019). Variables mean identifying characteristics of abstract aspects, while indicators are ways of measuring or quantifying variables. Therefore, the coding and classification of these papers were carefully carried out up to variables and indicators in order to develop framework strategies for dynamics in post-pandemic architecture.

The coding and classifications were evaluated on the basis of aspects of dynamics in post-pandemic architecture by using 40 articles. These articles were coded and classified into variables of dynamics in post-pandemic architecture using Microsoft Excel. Through a process of coding the potential variables and classifying the characters in more detail regarding variables of the dynamics aspect associated with the security's variables in the built environment.

As mentioned in preliminary study, the concept of security has not yet discussed the form of prevention from pandemics and health issues, hence, it is important that the dynamics in post-pandemic architecture characteristics are considered in relation to each other and security variables. The identification and coding of dynamics in post-pandemic architecture characteristics described in the extant literature were used to develop strategies further, discussed below. The security variables (Briggs, 2005; O'Shea, 2009; The American Institute of Architects, 2004) namely: physical elements: (1) access movement; (2) structure; (3) supervision; (4) physical protection; pat**Table 2.** Dynamics in post-pandemic architecture charactheristics identified in previous studies and its relationship to variables in built environment.

Urbanism Post-	Structure- Interior Post- Pandemic Aspect	Detail Discussion Structure-Interior Post Pandemic	Category of Security	Variables for Dynamics in Architecture Post-Pandemic (connect to security design aspects)		
(Previous)				Previous Security Aspects	New	
		Density on diseases on air P1, P2, P4, P5, P6, P8, P10, P12, P13, P14, P15, P17, P18, P19, P20, P21, P22, P23, P24, P25, P27, P28, P29, P30, P31, P32, P33, P34, P38, P40,	Control		Indoor environmental climate	
Urban <b>Density</b>	Density			Access and movement	-	
		Density on users and human activity P3, P4, P8, P10, P11, P16, P23, P31,	Control	Surveillance		
		P32, P35, P36, P37, P38, P39,		Management		
		Perinheries & Spread on diseases on		Maintenance		
Urban	Peripheries	air P1, P2, P4, P5, P6, P7, P8, P10, P12, P13, P14, P15, P17, P18, P19, P20, P21, P22, P23, P24, P25, P27, P28, P29, P30, P31, P32, P33, P34, P38, P40,	Containment	-	Indoor environmental climate	
peripheries and <b>sprawl</b>	& Spread	Deviahavias & Causad an human		Access and movement		
		activity	Containment	Surveillance		
		P3, P4, P8, P9, P10, P11, P23, P31, P32, P35, P36, P37, P38, P39,		Activity		
				Maintenance	-	
Connectivity	Interaction	Close: Interaction between users P4, P9, P10, P11, P21, P30, P32, P35, P37, P38, P39, Not Close: User's behavior that imitating other users P4, P0, P14, P20, P32, P37, P37, P37, P37,	Control	Access and movement	-	
		P38, P39,		Ownership		
				Access and		
		<b>Mobility on users</b> P3, P4, P8, P11, P21, P30, P31, P32, P35, P37, P38, P39,		movement	-	
				Structure		
			Control	Activity		
				Management		
Laborate				maintenance	hygienist	
Jrban <b>Mobility</b>	Mobility			-	behavior	
		Mobility on indoor air system P1, P2, P4, P5, P6, P7, P8, P12, P13, P14, P15, P17, P18, P19, P20, P21, P22, P23, P24, P25, P27, P28, P29, P30, P31, P32, P33, P34, P38, P40,	Control		Indoor environmental climate	
		Mobility on humidity system P1 P8, P15, P17, P18, P19, P23, P24, P30, P33, P38,		-	Humidity	
		Mobility on natural light system P8, P18, P23, P24, P30, P34, P38,			Natural Light	
		Mobility on UV-C system	Containment		Physical	
		P7, P19, P34, P38,	Control		UV-C System	
		Mobility on droplets on building material surface	Prevent		Hygienist building	
		Access , spatial standard and		Ownership	materiais -	
		P3, P4, P8, P9, P11, P21, P30,	Prevent	Activity		
		P32, P35, P36, P37, P38, P39, Access , spatial standard and protocols: self-protection	Prevent	-	hygienist	
		P1 P9, P10, P30, P38,			benavior	
Access, space	Access, Protocol	Access , spatial standard and		Access and movement		
protocols	and Standard	protocols: new standards for built environment	Prevent	Structure		
	,u	P1, P2, P3, P8, P9, P11, P23, P26, P30,		Management		
		r31, r34, r38, r39, P40,		Maintenance		
		Access, spatial standard and protocol new standard for humidity and temperature P8, P9, P15, P19, P24, P26, P30, P31, P32, P33, P34, P38,	Control		Humidity & temperature	
Place sypologies as potential areas for virus spread	Technology - Materials	Antvitirus Building materials & Droplets on surface of building materials P1, P7, P17, P18, P28, P38,	Prevent		Hygienist building materials	
Informal settlements and urban						
poverty Reduce in						
global infrastructure						

tern context: (5) activity; (6) management and maintenance; psychological context: (7) existing ownership and the possibility of new additional variables. The results of the coding and classification based on sub-aspects of the dynamics in post-pandemic architecture are presented in the following table (see Table 2).

The characteristics of sub-aspects dynamics identified in Table 2. sum-

marize the variables identified in the literature. The integrated review papers presented in Table 1 were coded and classified according to the impact of particular variables. Below are the details finding of sub-aspects dynamics in post pandemic architecture (see Table 3).

1. "Density regarding the disease on air" discussed in 29 papers, impacted in a variable "indoor environmental climate," which controlling air movement, lowering pollutant levels, and improving indoor air quality become critical to preventing virus density in the air. This can be done by taking CO2 measurements, counting the occupancy levels, crowd density, observed mitigations, opening windows, and room volume.

2. "Density on users and human activity" discussed in 16 papers, impacted the variable 'Access and Movement' which controls user density; the variable of 'surveillance' where controlling visibility in layout and in user's density; variable of 'activity' where controlling the user's activity and variables 'management maintenance' in space become important. These four variables are impacted by the wide and visibility of the room, the pathway, the wall and furniture pattern, and the quality of checkpoints (for fever checkpoints, forced closure, quarantines) in reducing density.

3. 'Peripheries & Spread of the disease on air' discussed in 30 papers were impacted by a variable "indoor environmental climate." The indicators are similar to the aspect of disease density on air, where containment and control of air movement, reduction of pollutant levels, and improvement of indoor air quality become important to the periphery and prevent virus spread on air. This can be done by taking CO2 measurements, counting the occupancy levels, crowd density, observed mitigations, opening windows, and room volume.

4. 'Peripheries & Spread based on Human Activity' discussed in 14 papers. The variables "access and movement," which concern containment of the user's activity and movement; "surveillance," which controls visibility in layout and the user's activity

Dynamics in post-pandemic architecture: Integrative literature review in response to postpandemic built environment and movement; "ownership," which concern allowing the user's hierarchy, territory, and sense of ownership; "activity," which concern appropriate boundaries for the user's activity; and "management and maintenance," which concern providing peripheries in space, which be These six variables are impacted by the width and visibility of the room, the pathway, the wall, and furniture pattern, and the quality of checkpoints (for fever checkpoints, forced closures, and quarantines) in improving perimeters and containing the spread.

5. 'Close Interaction Between Users' discussed in 13 papers, and 'not close interaction: user's behavior that imitates other users' discussed in 11 papers. These two sub-aspects were influenced by the variables "access and movement," where containment of the user's close interaction between families and friends, and non-close interaction between strangers in the pathway and corridor become important; variable "ownership," where allowing the user's hierarchy, territory, and sense of ownership changes the interaction between families and friends; and variable "activity," where concern appropriate interaction as user's activity between families, friends, and strangers.

6. "Mobility on Users" discussed in 12 papers. The variables "access and movement," which is concerned with containing the user's movement; "structure," which is controlling the user's mobility through the structure in the built environment (walls, furniture, signage); "surveillance," which is controlling the user's mobility through natural visibility in space; "activity," which is concerned with creating appropriate user's mobility and activity; "management and maintenance," which is concerned in providing peripherals in space and 'hygienist behavior' which is concerned with the user personal protection (using mask or face mask, hand sanitizer, etc). These six variables are impacted by the width and visibility of the room, the pathway, the wall and furniture pattern, the quality of checkpoints (for fever checkpoints, forced closures, and quarantines), and individual protection.

7. 'Mobility of air in indoor air sys-

tem' discussed in 30 papers were impacted in variable 'Indoor Environmental Climate' where controlling the mobility of disease, decreasing the pollutant levels and improving the condition indoor air quality become important to prevent the virus spread on air. This variable is connected to the variable density and periphery-spread of density on air.

8. 'Mobility of natural system' is divided into 3 parts. 'Mobility on humidity' discussed in 11 papers; Mobility on natural light' discussed in 7 papers and 'mobility on UV-C System' discussed in 4 papers. This mobility on the natural system was impacted by variable 'Indoor Environmental Climate', variable 'humidity' and variable 'natural light'. The need of controlling natural systems can be done by controlling humidity in the indoor air quality, improving the natural light, and improving of the natural UV-C in the built environment can help reduce the mobility of disease in the built environment.

9. 'Mobility of droplets on building material surface' discussed in 8 papers were impacted in variable 'hygienist building materials' by controlling the choice of building materials and coatings of indoor surface on walls, floor and furniture can prevent the virus spread on air.

10. 'Access, spatial standard, and protocols: Users' access discussed in 12 papers. The variable "ownership," where allowing the user's hierarchy, territory, and sense of "activity" changes the access and protocols of users.

11. 'Access, spatial standard and protocols: self-protection' discussed in 5 papers were impacted in variable 'hygienist behavior' where the degree with varied protection to improve hygienist behavior using diversity and a number of tools.

12. 'Access, spatial standard, and protocols: new standards for built environment' discussed in 14 papers. The variables "access and movement," which is concerned with containing the user's access and following protocols; "structure," which is controlling the user's access through the structure in the built environment (walls, furniture, signage); "surveillance," which is controlling the user's access through **Table 3.** Findings of sub-aspects dynamics in post-pandemic architecture charactheristics and its relationship to variables in built environment.



natural visibility and protocols in space; "management and maintenance," which is concerned in providing access, spatial standard and protocols in space.

13. 'Access, spatial standard and protocols new standards for humidity and temperature' discussed in 12 papers, were impacted in variable 'humidity and temperature' where the need of controlling of natural systems can be done by controlling humidity and temperature in the indoor air quality (warm and wet climates seem to reduce the spread of virus).

14. 'Antivirus Building Materials & Droplets on Surface of Building Materials' discussed in 6 papers were impacted in variable 'hygienist behavior' where the degree with varied protection to improve hygienist behavior using diversity and number of tools.

According to these findings, there are 7% of articles discuss the variable 'Access and Movement', 2% of articles discuss the variable 'structure', 5% of articles discuss the variable 'surveillance, 6% of articles discuss the variable 'ownership', 8% of articles discuss the variable 'activity', 5% of articles discuss the variable 'management maintenance', 41% of articles discuss the variable 'indoor environmental climate, 3% of articles discuss the variable 'hygienist behavior, 10% of articles discuss the variable 'humidity and temperature', 3% of articles discuss the variable 'natural light', 2% of articles discuss the variable 'UV-C System' and 6% of articles discuss the variable 'hygienist building materials' (see Figure 2)

#### 4.3 The synthesis: Strategies for dynamics in post-pandemic architecture

The process of synthesis started by breaking down in more detail the perspective of dynamics in post-pandemic architecture, coding, and classifying and grouping similar topics to create a "dynamics in post-pandemic architecture" framework. The framework was defined in terms of "variables," "indicators," and "factors." The "variables" have been explained in a previous sub-chapter. In this sub-chapter, we will explain in more detail the existence of indicators, factors, and measurement objectives to clarify the discussion of the variables that appear and create strategies for a dynamics in post-pandemic architecture. The results are presented in Table 4.

Based on these findings, below is a synthesis of variables, indicators, and factors:

• "Access and Movement": The indicator is the presence of access to pathways and orienting objects. The factor and measurement criteria are

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based on well-defined routes, spaces, entrances, and pathways that provide movement, access, and peripheries to humans and disease.

- "Structure": The indicator is the degree to which places are structured and do not cause conflict. The factor and measurement criteria are the zoning, orientation, and structure of the room (wall, floor, furniture) that structure human mobility without causing conflict.
- "Surveillance"—The indicator is the degree to which surveillance provides appropriate natural visual visibility through the layout. The width of the room and the spaces overlooked for visibility are the factors and measurement criteria.
- "Ownership"—The degree to which the built environment provides a hierarchy, a sense of ownership, boundaries, and personalization is the indicator. The layout, floor area, and furniture layout are the factors and measurement criteria to promote a sense of ownership, personalization, and territoriality.
- "Activity"—The indicator is the degree to which users have an appropriate activity, mobility, access, and spatial configuration of space. The factor and measurement criteria are appropriate elements of the built environment that facilitate user activity and are appropriate to the location.
- "Management maintenance"—The indicator measures the extent to which management has provided appropriate space maintenance. The factors and measurement criteria are control and quality, and they are designed with management and maintenance in mind.
- "Indoor environmental climate" the indicator is related to the pollutant level and air conditions. The factors and measurement criteria are CO2 measurements, occupancy levels, crowd density, room volume, and opening window size and position to reduce or prevent the spread of infectious disease.
- "Hygienist behavior"—The indicator is related to varied protection to improve hygienist behavior. The



*Figure 2.* Relationship between aspects dynamics in postpandemic architecture.

factors and measurement criteria are the amount of diversity and the tools to help improve hygienist behavior.

- "Humidity and temperature"—The indicator is related to the degree of central humidity and cooling system in the room. The thermostat and air conditioner central control are the factor and measurement criteria.
- "Natural light"—The indicator is related to the control, quantity, and quality of natural lighting in the room. The natural light orientation and glazing area with no direct sunlight but a larger window are the factor and measurement criteria.
- "UV-C System"—The indicator is related to the degree of control of the UV-C system in the room. The better qualities of UV-C lighting power are the factor and measurement criteria.
- "Hygienic building materials"—The indicator is related to the choice of building materials and the coatings of indoor surfaces on walls, floors, and furniture. The factor and measurement criteria are the quality and quantity of building materials used to help improve room hygiene.

Based on the result, there are some adjustments, changed and new security variables for dynamics in post-pandemic architecture. The conclusion of the changed and strategies of Dynamics in post-pandemic architecture as mentioned below:

• Density aspects related to security context (variables: access and movement, surveillance, activities, maintenance management) and

Measu Criteria

all publicly spaces are

More a More and better quality

UV-C system

Number of UV-C

UV-C L

Table 4. Dynamics in post-pandemic architecture variables, indicator, factors and measurement criteria.

Table 4. (continued).

Natural Light (NEW) Light

hygier bebay

Physical

UV-C Syster

Hygien buildin

hygienist behavior

							(Structure	lnterior)	Security Pandem
Dynamics in Architecture (Structure-	Post-Pandemi Aspect Interior)	© Sub-Aspect Security- Pandemic	Variables of Security- Pandemic Theory	Indicators of Security- Pandemic Theory	Factors of Security- Pandemic Theory	Measurement Criteria			
	CONTROL Density on diseases on air	Indoor environmental climate (NEW)	Indoor air quality (air pollution, odours, fresh air supply, ventilation)	The Indoor Air Quality related to pollutant levels (e.g. dust, Volatile Organic Compounds (VOCs) etc.) and air conditions (e.g. CO2 and humidity)	CO2 measurements, occupancy levels, crowd density estimates and observed adherence to mitigations (e.g. wearing face coverings) Room Volume Opening window	to reduce or prevent the spread of infectious diseases through different modes of disease transmission by using of plants or other organism to absorb the pollutants, introduce new air and purify the air			Physical Element
		Physical	Access and movement	The presense of access of pathway and orienting objects with identifiable destinations	The Wide of pathway and orienting pathway	Well-defined routes, space and entrance that provide convenient movement without compromising security:	Mobility	CONTROL Mobility on users	
DENSITY		Elements (OLD)	Surveillance	The degree to which the surveillance provides appropriate visual layout supporting density of users	The Wide of room and visibility	all publicly accessible spaces are overlooked			Pattern context
	CONTROL Density on users and human activity	Pattern Context (OLD)	Activity	The degree to which the users have an appropriate density and activity on space	Appropriate structure-interior elements (eg. Walls, floor pattern and furniture pattern) to ease users density (eg. reducing capacity, fever checkpoints, forced closure, voluntary	level of human activity is appropriate to the location			
			Management maintenance	The degree to which the management have an appropriate maintenance of space to prevent density	Control and the quality of checkpoint and users' density	Designed with management and maintenance in mind			
Peripheries & Spread	CONTAINMENT Peripheries & Spread of disease on air	Indoor environmental climate (NEW)	Indoor air quality (air pollution, odours, fresh air supply, ventilation)	The Indoor Air Quality related to pollutant levels (e.g. dust, Volatile Organic Compounds (VOCs) etc.) and air conditions (e.g. CO2 and humidity)	CO2 measurements, occupancy levels Room Volume Opening window size and position	to reduce or prevent the spread of infectious diseases through different modes of disease transmission (indirect contact with pathogens and contaminated object, direct person to person contact,		CONTROL Mobility on indoor air system CONTROL Mobility on humidity	
		Phontoni	Access and movement	The presense of access of pathway and orienting objects with identifiable destinations	The Wide of pathway and orienting pathway	droplet spread) Well-defined routes, space and entrance that provide convenient movement without compromising security;		CONTROL Mobility on natural light sustem	Natural I (NEW)
	CONTAINMENT	Element	Surveillance	The degree to which the surveillance provides appropriate visual layout supporting density of users	The Wide of room and visibility	all publicly accessible spaces are overlooked		CONTROL Mobility on UV-C system	Physical Element UV-C Sys
		Psychological Context	Ownership	The degree to which the structure-interior allows to provide hierarchy, sense of ownership	layout, floor area, furniture layouting	promote a sense of ownership, respect, territorial, responsibility and community		PREVENT Mobility on droplets on building	(NEW) Hygienis building
	& Spread based on human activity	Pattern context	Activity	The degree to which the users have an appropriate boundaries and activity on space	appropriate structure-interior elements (eg. Walls, floor pattern and furniture pattern) to ease users density (eg. reducing capacity, fever checkpoints, forced closure, voluntary guarantines)	level of human activity is appropriate to the location	Access, Protocol and Standard	material surface PREVENT Access, spatial standard and protocols: user's access	(NEW) Psycholo Context
			Management maintenance	The degree to which the management have an appropriate maintenance of space to provide peripheries and roroad	Control and the quality of checkpoint and users' density	Designed with management and maintenance in mind			Pattern context
Interaction	CONTROL Close: Interaction between users	Physical Element	Access and movement	spread The presense of access of pathway and orienting objects with identifiable destinations	The Wide of pathway and orienting pathway	Well-defined routes, space and entrance that provide convenient movement without compromising security;		PREVENT Access, spatial standard and protocols: self.	Hygieni behavior (NEW)
	Not Close: User's behavior that imitating other users	Psychological Context	Ownership	The degree to which the structure-interior allows to provide hierarchy, sense of ownership, boundary, personalization	layout, floor area, furniture layouting	promote a sense of ownership, respect, territorial, responsibility and community	Dynamics in	_protection	Sub-Asn
		Pattern context	Activity	The degree to which the users have an appropriate boundaries; activity on space and the pattern of close and social contact	appropriate structure-interior elements (eg. Walls, floor pattern and furniture pattern) to ease users mobility (eg. forced closure, voluntary	level of human activity is appropriate to the location	Architecture (Structure	■Aspect Haterior)	Security Pandem

new variable: Climate and Nature (Indoor Air Quality)

- Aspects of peripheries and spread related to security context (variables: surveillance, activity, access - movement, maintenance, and ownership management) and new variable: Climate and Natural (Indoor Air Quality)
- Aspect of interaction related to the • previous security context (variables: activity, access-movement,

		Variables of				
Bynamics in Post-Pandemic Architecture Aspect (Structure-Interior)	Sub-Aspect Security- Pandemic	Variables of Security- Pandemic Theory	Indicators of Security- Pandemic Theory	Factors of Security- Pandemic Theory	Measurement Criteria	
		Access and movement	The presense of access of pathway and orienting objects with identifiable destinations	The Wide of pathway and orienting pathway	Well-defined routes, space and entrance that provide convenient movement without compromising security:	
PREVENT Access, spatial standard and protocols: new standards for built environment	Physical Element	Structure	The degree to which the user have access places that are structured - different users do not cause conflict	The zoning in the room and orienting of the room	level of human accessed structured without causing conflict and appropriate to the location	
		Surveillance	The degree to which the surveillance provides appropriate visual layout	The Wide of room and visibility	all publicly accessible spaces are overlooked	
	Pattern Context	Management maintenance	The degree to which the management have an appropriate maintenance of space to control mobility	Control and the quality of checkpoint and users' mobility	Designed with management and maintenance in mind	
CONTROL Access, spatial standard and protocol new standard for humidity and temperature	Humidity & temperature (NEW)	Indoor Humidity and the temperature of the room	The degree to which the central humidity and cooling system can be controlled	Air Conditioner central control	Termostat in the room give better control	
Technology Materials & Droplets on surface of building materials	Hygienist building materials (NEW)	Hygienist building materials on surface	The choice of building materials and coatings of indoor surface on walls, floor and furniture.	number of building materials to help improve hygienist materials	More and better quality	

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and ownership)

- Aspect of mobility is related to the security context (variables such as structure, supervision, activities, maintenance management, physical protection, and ownership) and new variables (behavioral, hygienic behavior, climate, and nature) (indoor air quality, humidity, room temperature, natural lighting, UVC-System, hygienic surfaces of building materials, and so on).
- Aspects of access, spatial standards, and protocols related to the security context (variables: structure, supervision, activities, access and movement, management of care, and ownership) and new variables (Hygienic behavior, humidity and room temperature, hygienic building material surfaces)
- Behavior of Antivirus Building Materials in the new variables (Hygienic Building Materials)

#### 5. Conclusion

The literature review on the dynamics in post-pandemic architecture is growing rapidly. The relationship between the dynamics' aspects and the need for security in the built environment has been elevated and is growing rapidly. Before the pandemic, security as a built environment helped improve the public space by safeguarding it from crime. But during and after the pandemic, the concept of security changed and needed adjustment. The aspect dynamics in post-pandemic architecture also need to be adjusted based on this need.

After some study and a literature review, this paper has identified the changed dynamics in post-pandemic architecture and strategies that affect the built environment in future disease prevention. Some of the security variables in previous studies need to be adjusted, and there are new security variables for dynamics in post-pandemic architecture. The previous security variables are having adjustment and still used in dynamics in post pandemic architecture. For example: "access and movement" variable is orientating to limit people accessing the building and controlling the movement of people (using physical and social distance). The new variables in dynamic(s) post-pandemic architecture are in natural environment context (indoor environmental climate, humidity and temperature, natural light, UV-C System) and behavior context (hygienist behavior form the users and usage of hygienic building materials). In conclusion, there are adjustment in previous security variables and additional strategies for Dynamics in post-pandemic architecture.

Some limitations of this study are as follows: some papers not written in English or Bahasa were excluded; some interesting aspects such as distancing and the pattern of living and working in the new normal are not discussed; the articles included in this review are up to August 2022 (and there is the possibility of new articles). This paper provides a current state-of-the-art review of current research in the field, as well as a strategy for future research in the field to improve understanding of the dynamics aspect in design-related fields.

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# Tracing an ancient monument within a multi-layered historicalurban context: The octagonal structure in Pergamon/Bergama

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# Abstract

A large part of Bergama has been inscribed as a World Heritage Site due to its rich history that transformed the city into a 'multi-layered cultural landscape'. As these cultural and urban layers often overlap, the remains of older layers are hidden beneath the younger ones. This paper examines this phenomenon by focusing on the octagonal structure.

In the last decade, scattered remains of ancient walls and enclosed spaces have been discovered, incorporated into the houses in the former neighborhood of Greeks and Armenians. The long-lost monument, the octagonal structure, is situated at the southern skirt of the fortified city hill of Pergamon, facing towards the Kaikos (Bakırçay) plain. As the (Hellenistic) Attalid Kingdom's capital city, the city hill of Pergamon once incorporated not only the palaces of the royal family but also a great variety of monuments.

The aim of this paper is to provide an overview of the rediscovery of the octagonal structure by giving references from its research history, describing current access routes to the structure, and interpreting the concept of 'multi-layered city' based on its state of preservation. The study of a monument which is buried under private properties is highlighted as another challenge, not only in terms of potential accessibility issues but also in terms of conditions affecting observation and documentation. The octagonal structure at Pergamon is presented here as a case study to emphasize the potential of discoveries in multi-layered cities.

# Keywords

Bergama, Multi-layered cultural landscape, Octagonal structure, Pergamon, Settlement pattern.

# 1. Introduction

Throughout its history, the town of Bergama (İzmir Province, Turkey) has been home to numerous civilizations that have left their traces on the cultural, urban, and architectural fabric. Although this is a common phenomenon to be observed in cities in Asia Minor, in Bergama, the composition of material evidence of past cultures forms the unique image of the city today. As a consequence, 'Pergamon-Bergama and its multilayered cultural landscape' has been inscribed on the World Heritage List of UNESCO in 2014 (Bilgin Altınöz et al., 2016).

The site of the octagonal structure (hereafter referred to as the Octagon<sup>1</sup>) is at the heart of a residential quarter today, where this multi-layered character can be well observed (Figure 1). This historical settlement is situated on the lower slopes of the city hill of ancient Pergamon, and after antiquity it was inhabited for the first time by Ottoman Greeks from the 16th century onwards<sup>2</sup> (Conze et al., 1913a, p. 352, Pirson 2017, p. 122). The fact that this settlement was partly built on ancient ruins explains the origin of the local name of this neighborhood: Kale Mahallesi<sup>3</sup>. Accordingly, the choice of this area for the developing Greek neighborhood also raises the question whether the Greek community of Bergama considered themselves the descendants of the ancient Pergamenians (Augustinos, 2011, p. 270; Bachmann, 2012, p. 491; Bammer, 2001, p. 71). Following political affairs resulting in dramatic events, especially the population exchange between Turkey and Greece in 1922-23, there was no Greek community left in Bergama and the neighborhood was partially inhabited by migrants from Greece and the Balkans (Anagnostopoulou, 2013, p. 531; Smith, 2022; Ulusoy Binan, 2018, p. 16).

According to the publications of the Pergamon excavation until a decade ago, the Octagon was not a known monument (Pirson & Scholl, 2014; Radt, 2002). For the first time in 2013, scattered remains of ancient masonry and enclosed spaces were found incorporated into the houses, thanks to the testimonies of inhabitants of the Kale Mahallesi (Pirson, 2017, p. 105; Tezer Altay, 2021). The next stages were the documentation of ancient remains and extensive research in the excavation archives. However, some challenges arose during the documentation process as it was carried out on private properties, making this research project also a case study of fieldwork in multi-layered urban contexts. In addition, physical conditions were determinants in the extent and duration of documentation. Nevertheless, the documentation has led to the conclusion that these scat-



*Figure 1.* The historical residential quarter on the lower slopes of the ancient city hill of Pergamon, 2010 (Pergamon Excavation Archive, Istanbul).

tered remains are parts of an octagonal monument with a diameter of about 40 meters. Furthermore, the archives provided surprising information about the ancient structure, proving that the Octagon had, in fact, been discovered much earlier but was forgotten for certain reasons. Therefore, focusing on the research history sheds light on the factors that led to the loss of knowledge over a long period of time.

#### 2. Research history

According to archival records, the Octagon was initially discovered by the first generation of researchers at Pergamon in 1880s, and was only traceable through visual materials such as maps, that were produced at that time. The structure was thoroughly documented during the second excavation period at the beginning of 20th century. However, these records remained unpublished and were partially lost, eventually and were becoming completely forgotten until the definitive rediscovery of the ancient structure in 2013. The summary of the research history of the Octagon during excavation periods is presented below, divided according to changing leadership and excavation stages.

#### 2.1. First excavation period (1878-1886)

The first excavation period in Pergamon was directed by the Royal Museums of Berlin and conducted under Carl Humann between 1878-1886. Until then, Pergamon had only been known from ancient literary sources and reports of travellers but was never systematically investigated. The first systematic excavations focused on the upper plateau of the city hill, so the Octagon must have been far out of sight since it is located a rather long distance away. However, the maps produced by the end of this period suggest otherwise.

The first accurate city plan of Pergamon, prepared by Humann in 1886, preserved in the archives of the Berlin State Museums, shows that the Octagon must have already been discovered by then. On this map, the structure can be seen together with other discovered monuments of the city (Tezer Altay, 2021, p. 225). Subsequently, the first guide book of Pergamon, *Führer durch die Ruinen zu Pergamon*, was published in 1887. Here, the Octagon is again depicted on the city map, but there is no information given about the structure in the book's text (Generalverwaltung der Königlichen Museen zu Berlin, 1887). During this period in general, the Octagon is mentioned neither in the excavation diaries nor in the published reports.

There are key figures, who probably knew about the Octagon, during this time. One of them is building researcher Richard Bohn, who conducted studies on ancient walls on the city hill between 1880-1886, mainly focusing on the fortification systems (Conze & Schuchhardt, 1899, pp. 110-111). As the southern extent of the fortification was already overbuilt by new houses, the remains of the ancient walls could be identified only in small parts. Bohn was, therefore, not able to distinguish whether they were part of the fortification or not. During this study, a small part of the Octagon was also recorded, which most probably belongs to the superstructure. However, before Bohn could finalise and prepare his work for print, he passed away in 1898. After his unexpected death, his documents were brought to Pergamon the same year to be re-studied. At that time, the excavation director Alexander Conze, states that he walked along all walls that Bohn had recorded in his work, and became acquainted with every wall "stone by stone" (Conze et al., 1912, p. 30). This suggests that the remains of the Octagon must have been re-visited during that ime.

Another key figure is cartographer Otto Berlet, who was invited to Pergamon in 1898 by Conze, particularly for the preparation of the map of Pergamon and its surroundings ('*Pergamon und Umgebung*'). Berlet states that he based his work on Humann's works and Bohn's maps (Conze et al., 1912, p. 37). The map that Berlet finished in 1904 was published for the first time in the first volume of the *Altertümer von Pergamon* (Conze et al., 1913b) and its draft version from 1898 is preserved in the archives of the Berlin State Museums. These two versions from 1898

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and 1904, however, differ in a crucial detail: The Octagon can be seen on the draft version, whereas it was removed for the published map. The riddle of why the Octagon disappeared from the map could be solved thanks to a worksheet of Bohn's with notes on it. Evidently, it was Berlet who deliberately omitted the Octagon from the map (Tezer Altay, 2021). The reason for this may be that archaeological evidence of the Octagon might not have been visible on site any more, possibly because ongoing construction activities had eventually covered the remains. Furthermore, the unexpected deaths of Humann and Bohn might have caused the loss of related knowledge, as they were probably the only ones who had seen the remains of the Octagon.

# 2.2. Second excavation period (1900-1911)

The second excavation period was carried out through the Athens Department of the German Archaeological Institute (hereafter referred to as DAI) and under the field supervision of architect Wilhelm Dörpfeld. He had previously gained experience at archaeological sites like Olympia, Troy and the Acropolis in Athens, and eventually become the director of the Athens Department of DAI in 1887.

The main focus of this excavation period remained on the prominent hill and included also the lower plain, where many other ancient remains were known to be hidden within the younger urban layers. The key figure of this period is building researcher Paul Schazmann, who investigated especially the Roman buildings in the lower plain between 1906-1909 (Dörpfeld, 1908, pp. 370-371; 1910, pp. 385-388). This area encompasses the city expansion area of the Roman Imperial Period, outside the Eumenian city walls towards the Kaikos plain (Pirson, 2017, p. 97). The first written record acknowledging the Octagon was discovered in Dörpfeld's unpublished excavation diary:

"This week Mr. Schazmann has investigated and documented the large octagonal Roman building located below the church of Zoodochos Pigi."4 (Dörpfeld, 1909, p. II-002)

Written correspondances between Schazmann and Conze in the archives of the Berlin State Museums further support this observation. In one of them, Schazmann states that he

"was very absorbed by the octagonal building under Makropoulos' house, the entire lower part of which is admirably well preserved and will provide an interesting plan and section." (Archive of Berlin State Museums, P152)



*Figure 2.* Cross section drawings of the Octagon, drawn by Paul Schazmann in 1909 (Pergamon Excavation Archive, Berlin).

Drawings of Schazmann are stored in the Pergamon Archive of the Head Office of DAI in Berlin. However, only one plate including two cross sections of the Octagon is preserved, while the plan drawing is missing (Figure 2). In the following excerpt from Dörpfeld's annual report on Pergamon, Schazmann mentions the Octagon:

"The other round building, which is preserved almost intact on the first floor, is located in the northeastern quarter of the city, slightly below the Greek Agora we have excavated; its massive forms are instructive for the use of [an?] octagonal construction, so popular later in Byzantine [Empire]. The purpose of the superstructure, of which some granite columns have been preserved, has not yet been determined."<sup>5</sup> (Dörpfeld, 1910, p. 387)

In addition, Dörpfeld indicated that the upcoming volume of the Altertümer von Pergamon would be a compilation of Schazmann's works focused on the Gymnasion and the Roman buildings in the lower city (Dörpfeld, 1908, p. 370; Deutsches Archäologisches Institut, 1910, p. l). However, the volume was never completed, probably due to the outbreak of the First World War. The sixth volume of the Altertümer von Pergamon, which solely focused on the Gymnasion, was published in 1923. Schazmann's work on the Roman buildings in the lower plain was preserved in archives and examined for the first time by architect Ulrike Wulf (Wulf, 1994).

# 2.3. Third excavation period (ongoing since 1929)

The foundation of the Istanbul Department of DAI in 1929 marked a change in directorship of the Pergamon Excavation. Following the upheavals of the First World War and the Independence War of Turkey, excavations in Pergamon were resumed under the supervision of archaeologist Theodor Wiegand. During this period, the members of the excavation team included two key figures: Paul Schazmann, who also participated in the previous excavation period, and archaeologist-numismatist Erich Boehringer, who would later become the director of the excavation. Wiegand's supervision ended in 1938 due to the outbreak of the Second World War and there is no evidence of fieldwork on the Octagon until this period.

In 1957, excavations were resumed under the leadership of Boehringer. Schazmann's obituary written by Boehringer proves that the latter undoubtedly knew about the Octagon:

"But not only the Gymnasium in Pergamon was his [Schazmann's] task. Besides this, he researched and measured the Roman buildings of the lower city, [...] an octagonal building below the Lower Agora, [...]. Schazmann was able to present plans and drawings of these buildings [...]. They were considered lost, but five years ago there were still some at the son Paul Emile Schazmann's in Bern, and there is hope that more will be found. They are to be published elsewhere." (Boehringer, 1972, p. 11) According to this excerpt, Schazmann's drawings of the Octagon

were considered lost in the 1970s, and the location of the monument remained unknown as it was not indicated on the maps at that time (Boehringer, 1959). One of the foundational publications focusing on the urban development history of Pergamon, also examined Schazmann's unpublished work on the Roman buildings in the lower plain for the first time (Wulf, 1994). However, among many drawings of Schazmann, only those of the Octagon remained unpublished, likely because the drawings were not labelled, hence the structure was not identified. As a result, the ancient building remained forgotten until its re-discovery in 2013. Since then, a more systematic research has been conducted, revealing the current state of the ancient structure, which is described below.

# 3. Access and the state of preservation

In Bergama, a significant part of the lower southern slope of the ancient city hill is occupied by a residential neighborhood today, called 'Kale Mahallesi' by the locals. Situated on a sloping terrain towards the south, this historical neighborhood comprises around 1000 houses, with the oldest dating back to the first half of the 19th century (Alanyalı, 1994). Despite the high density of ancient remains

throughout the quarter, at first glance, it is difficult to determine to what extent they have been preserved. However, several ancient structures within the Kale Mahallesi have been identified and studied at different scales including the main city gate (Eumenian Gate) and fragments of the Eumenian City Wall, marking the southern edge of the fortified Hellenistic city. Furthermore, the so-called Gurnelia (modern 'Domuz Alanı') and the socalled lower southwest Gymnasion should be mentioned, both of which were built within the expansion area of the Roman Imperial Period (Figure 3).

In the heart of this neighborhood another ancient monument was identi-

fied in 2013, following the oral reports of local residents in its immediate vicinity. In 2014, the Bergama Museum conducted a rescue excavation at the house. Following the information from the local residents, further research revealed other houses containing walls or spaces that might belong to one single structure. This hypothesis was proven right after the fieldwork in 2015 and 2017 proved that all individual fragments, each accessed from different houses, constitute one monumental octagonal structure. The preserved structure remains almost entirely underground, giving the impression of foundations of a free standing, central-planned monument.



*Figure 3.* Ancient structures located at the south skirt of the city hill of ancient Pergamon (Digital Map of Pergamon, 2020). Green: The area of the Kale Mahallesi as of today. Blue dashed lines: presumed line of the city walls, after Wulf, 1994.

Today, the site of the ancient structure is occupied by ten houses. On-site observations showed that the ancient structure can be accessed only from six of them (Figure 4, 5). Each access route follows a specific path, leading to a separate part of the structure under different conditions. At the house in which the Museum conducted rescue excavations, a spatial segment of the Octagon was uncovered by removing a vast quantity of debris<sup>6</sup>. Further remains within the house were documented through brief measurements of their outlines. In the following sections, access routes, documented spaces and the state of preservation of the segments are briefly described, according to the respective cadastral code of the houses7.

#### 3.1. Block 456 Parcel 19

Within the local community, the house on Block 456 Parcel 19 is known as the 'Priest's house'. It is located next to the former Greek Orthodox church of Zoodochos Pigi, today the primary school (14 Eylül İlkokulu). The location and the remarkable appearance of this house with its distinctive architectural characteristics confirm this information. In the basement floor, a gate leads to the ancient structure below (Figure 6). Evidence of an illicit excavation resulted in the Bergama Museum's rescue excavation in 2014, during which artifacts from various historic periods were recovered. In 2015, the house was sold and restored, and is now used as a private guesthouse.

The finds from the excavation could not narrow down the dating of the building. However, the uncovered space has enabled further research on aspects such as building technique and spatial composition of the structure.

The excavation revealed a corridor and a passage connecting to it in the center. In the corridor, two corners (at 135° angles) were identified forming the building's octagonal shape. The walls on both sides of the corridor display different masonry techniques. Both the corridor and the passage feature segmental vaults, where the latter has an 8-meter span (Figure 7). The original floor level could be determined in a single trench. Interestingly, the small ashlar blocks comprising the facing of the walls are almost entirely missing above the level of this trench. This means that these blocks were sys-



*Figure 4.* Superimposition of the cadastral map and plans of the houses and the remains of the Octagon (red: substructure, blue: superstructure).

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tematically removed, probably during the construction of houses in the Greek neighborhood. As a result, the internal structure of the wall (mortared rubble) was exposed, and iron clamps joining the ashlar blocks in the masonry were stolen. Except for the sewer connections from the houses above, the vault of the ancient building is generally in good condition.



Figure 5. Plans of the houses, shown with the incorporated segments of the Octagon.

0 5

20 m



*Figure 6.* Entrance to the space from the gate on the floor, 2019 (Author, 2019).



*Figure 7.* View of the corridor, with the segmental arch of the passage on the right (Author, 2018).

# 3.2. Block 458 Parcel 1 (access via Parcel 2)

The house on Block 458 Parcel 2 dates back to 1859, as indicated by the inscription on the entrance door. The central hall of the house leads to the courtyard at the back of the building. A door in the courtyard serves as the entrance to the ancient structure, which leads under the building on the neighboring parcel (Parcel 1). The framing of the entrance door with original stone jambs indicates that this access is likely contemporary with the house.

Upon entering the ancient structure through the courtyard, one descends two steps into another vaulted corridor with a different character, compared to the previous one. Due to the position within the building plan, this corridor is called the inner corridor and the previous one (in Block 456 Parcel 19) the outer corridor.

In the inner corridor three corners are identified (at 135° angles). The barrel vault of the inner corridor is in a very good condition and shows an opening in each vault segment between the corners (Figure 8). At the end of the accessible part of the corridor, there are younger walls, probably used to set borders between different users. Current function of the ancient corridor is the accommodation of a small toilet, located at the entrance from the courtyard.

The owner of the house stated that a ventilation window in the central hall of the building, close to the floor level, "was built to ventilate the tunnels below." The location of this vent on the plan corresponds to a line through which the outer corridor of the ancient structure would possibly pass.

# 3.3. Block 458 Parcel 3

The house on Block 458 Parcel 3 has no historical character. Except for the front facade, there is no material evidence that may be associated with the Octagon. The facade seems to contain an older wall so it can be assumed that it belongs to the ancient structure due to its positioning. The remains of this older wall can be better distinguished in an old photograph taken in the 1970s (Figure 8). This ancient wall may be the only remain of the Octagon's superstructure that has survived until today.

## 3.4. Block 458 Parcel 22(a)<sup>8</sup>

The building has no historic character. Remains of the Octagon were identified in the storage room at the courtyard. A small part of an ancient wall was found incorporated in the younger walls of the storage room. The space behind this wall was accessible only through a gap that had been filled with rubble by the inhabitants of 2015.

The accessed segment consisted of another passage in the south, displaying similar characteristics to the one on Block 456 Parcel 19. Here too, a younger wall of mortared rubble at the opposite end of the passage was constructed, probably in order to establish a border.

The space was mostly filled with rubble and garbage at different levels, resulting in challenging conditions regarding accessibility and conducting fieldwork inside. As the present building is interconnected with the ancient building, it is currently not possible to determine how much of the ancient building is fully preserved.

## 3.5. Block 458 Parcel 23

The house on Parcel 23 seemed to have been abandoned long ago (fieldwork 2015). Though it exhibits historical features, it must have undergone numerous repairs and, therefore, lost much of its original substance. In a room on the ground floor, large ashlar blocks were discovered immediately behind wall plaster. These blocks, similar to those found in Parcel 22a, belong to the segmental arch of the passage. Under these blocks, loose stones were removed in order to create an access point to the passage. Within this area, the working conditions

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were as demanding as on Parcel 22a, restricting fieldwork to taking measurements only. This space could not be entered for a second time.

## 3.6. Block 458 Parcel 25

The house is a typical Greek house of the 19th century. According to Tsolisos's book on the Greek community of Pergamon (Tsolisos, 1984, p. 272), Georgios Tseftsis lived in this house between the years 1914-1922. Between 2009 and 2016, Dr. Martin Bachmann, architect of the Pergamon the excavation, lived in the building with his family<sup>9</sup>. Since 2019, the building has been used by an association.

The basement floor of the house is integrated into the southern part of the outer corridor, which is a decision that must coincide with the construction



Figure 8. The inner corridor of the Octagon. Walking level is at the feet of the vault (Author, 2015).



Figure 9. View of the remains of the superstructure of the Octagon (left: 1973, Pergamon Excavation Archive, Istanbul; right: 2015, Author).

of the house (Figure 9). Here, one of the corners of the outer corridor was demolished to provide a spatial connection between the ancient corridor and the basement of the house. The segmental vault of the corridor is well preserved.

#### 4. Documentation in dark chambers

Physical conditions and logistics of the site played a major role in defining the methods and extent of the work. The fieldwork at the Octagon was limited by various factors, significantly impacting the outcome.

The most decisive factor was the accessibility. Most of the accessed spaces described above could be visited only once or twice, as the fieldwork caused an inconvenience to and feelings of insecurity of the inhabitants. However, there is a widespread local awareness of cultural heritage, generally perceiving older cultural heritage as more valuable than the younger. In this case study it became apparent that the ancient remains were regarded as more important than the 19th century houses. This misperception consequently lead the inhabitants to fear losing the rights over their property, which was the main reason for reluctance and rejection of this academic fieldwork.

Another determinant of the fieldwork was the physical conditions. Some of the spaces were very humid and lacked fresh air, mostly due to the extensive use of these spaces as the respective houses' sewer outlets. The exposure to these straining external



*Figure 10. Connection between the ancient corridor and the basement of the house (Author, 2014).* 

factors could only be mitigated by dividing the working time into short periods and taking regular breaks.

In some of the spaces, standing straight and walking upright was not possible. These spaces were then studied crawling and documented by oral descriptions, saved as audio recordings.

Almost all of the accessed spaces lacked daylight. The lighting of the studied spaces was only possible by using flashlights or headlamps, resulting in a poor visibility.

Only in the house on Block 456 Parcel 19, brighter lamps could be set up using the building's electricity network. The establishment of a safe work environment allowed for longer working periods at this property, eventually enabling a thorough study using different techniques, including drawing on paper.

The first step towards a systematical documentation was photogrammetry, in this case Structure from Motion (SfM)<sup>10</sup>. Unfortunately, due to inconsistent lighting of the study area amongst other technical reasons, this method proved to be insatisfactory. The second - and more traditional - approach was measuring with a Total Station. The coordinates of the measured points and the subsequent pointcloud proved to be quite valuable for further research, as it creates a precise and coherent image of the object of study. However, the model of the measured object also has to be located in its accurate position in the city plan, which requires the correct merging of these points within the overall measurement network. The merging could be carried out, but in the case of the Octagon it was very time-consuming due to its subsurface location. The measuring process with a Total Station was followed by on-site hand drawings.

## 5. Afterlife of the Octagon

Although the octagonal plan layout became significantly widespread after Late Antiquity, its origins date back as early as the end of 2nd century BC. A wellknown example which marks this date is the Tower of the Winds at Athens, a monument that served as a clock pavilion with the function of a weather station, depicting the mythologically based wind system of the Greeks (Kienast, 2014). From Asia Minor, another example from late 1st century BC is the Octagon at Ephesos, which is the alleged mausoleum of Arsinoe IV (Thür, 1990). However both examples from late Hellenistic Period are considerably smaller than the Octagon at Pergamon (diameters: ToW: 7,5 m; OaE: 4,4 m; OaP: 39 m), and differ from it in their construction techniques.

Based on its detailed architectural study and comparisons particularly on the building technique with other monuments at Pergamon, the Octagon is most probably dated to the 2nd century AD. Its shape and size are evocative of functions of a mausoleum or a temple (Figure 11). No contemporary examples with similar characteristics (i.e. size, shape, building technique) have been found in Asia Minor. Yet, octagonal temples in Gaul (Fauduet, 2010) seem to be distant relatives of the Octagon at Pergamon, but their relevance remains to be examined.

It is unclear how long the Octagon at Pergamon remained in use and whether its construction was ever completed. The city of Pergamon fell on hard times, especially in the second half of the 3rd century (a major earthquake in 262 and invasions between 255-276) and must have suffered its first major decline under the Roman rule.

Based on archaeological evidence, the city was never completely abandoned, and remained in use also during the Byzantine era (Otten, 2010; Rheidt, 1991). The city was later taken over by the Karasi Dynasty in the early 14th century and, soon after, by the Ottoman Empire. However, written records and visual materials do not indicate the presence of the Octagon until the early 20th century.

The Octagon has not been visible for at least the last two centuries, probably since the area was redeveloped by the Greek community in the early 19th century. On the site of the ancient structure, prominent religious and educational buildings of the Greek community were constructed: in the northwest, the Greek Orthodox church of Zoodochos Pigi was built (in 1836, in the place of a former church) (Tsolisos, 1984, p. 22). East of the church, the Priest's house (see above, Block 456 Parcel 19), and south of it, the Greek primary school for girls were located, both of which have survived until today. The second half of 19th century marks the time when non-muslim communities in the Ottoman Empire gained more social rights and privileges following the Ottoman Reform Edict (Islahat Fermanı) of 1856. Especially after this period, the area around the church was intensely developed and inhabited until the population exchange between Greece and Turkey in 1923.

Most of the evidence concerning later uses of the Octagon and its impact on the urban fabric can be associated with the time of the Greek community. Although the ancient structure would entirely be covered with new residential buildings during this time, the builders were well aware to benefit from it in various ways. For instance, spaces of the Octagon were divided into segments according to parcels and were integrated into the houses, as can be seen in the cases of Block 456 Parcel 19, Block 458, Parcels 2 and 22(a) (Figure 5). According to statements of elderly residents, these spaces were used, for example, as storage rooms and wine cellars.

The motivation to incorporate ancient spaces into newly built houses has resulted in these houses' alignment with the outline of the ancient structure, which is clearly reflected in the urban texture<sup>11</sup> (Figure 4). Also on a larger scale, the relation between ancient remains and anomalies on the terrain is another aspect to be considered. The Octagon is located southeast of 14 Eylül İlkokulu, the only school in the neighborhood as of today. In fact the site of the school has previously attracted attention, as it is one of the few places in the neighborhood on flat terrain, a distinctive feature that might be associated with the presence of ancient structures below<sup>12</sup>. However, the Octagon is located at the edge of the flat area, where the slope to the south begins. Therefore, this potential association, particularly in the area of the school, needs to be taken into consideration in case of further research.

At least until 1909, when Schazmann first documented the structure, the internal spaces of the Octagon were not yet used for dumping waste (Figure 2). One can draw this conclusion, as the level of deposit was depicted significantly lower in his drawings, compared to the situation observed in 2013. Sometime after 1909, the structure must have fallen completely out of use, as in 2013 the space (in Block 456 Parcel 19) was found almost completely filled with waste and soil. According to the assumption that, since the 2nd century AD, the backfilling of the rooms took place for the first time in the last century, the rate at which the deposition occurred is quite high. Moreover, during this last period, the Octagon was systematically exploited as a quarry of cut stone, probably for the needs of the houses being built at the time. As a result, the Octagon was forgotten and neglected, leaving it vulnerable to damage. In 2015, during the restoration of the Priest's House (Block 456 Parcel 19), a small part of the vault of the Octagon was damaged, probably due to a lack of information or interest in the existing structure. Following the application of the author to the Conservation Board of Izmir in 2021, the Octagon has been registered as a historical asset to be protected by law<sup>13</sup>.

#### 6. Conclusion

Studying of archaeological remains at a multi-layered urban site is a challenging task, especially when the upper layer is still a living one. In the case of the Octagon, the documentation process had to be handled with particular care, as this activity took place exclusively on private properties. Involvement and support of local official authorities (such as the Museum) and continuous communication with inhabitants about this study played key roles in the success of the documentation. However, it should be pointed out that conducting a field study on private properties can pose a variety of constraints, as the reaction of the inhabitants to the study cannot be anticipated. Yet, as stated above, inspecting neighboring parcels of the Octagon may yield results, that provide further insights about the ancient urban context.

This case study also highlights the importance of archive studies, especially if the excavation itself has a long history. The Pergamon excavation project, which has been carried out for over 140 years under different management authorities and teams, has a significant amount of archival material stored in separate locations. Therefore, sufficient time should be reserved to complete research in the archives. Data obtained from the archival research revealed that the Octagon has actually been known since the earliest stages of the Pergamon excavation, but remained in focus only for very short periods of time. In addition, the fact that the notes and drawings on the Octagon were never published, has caused the monument to be forgotten to this day.

The fieldwork revealed not only the preserved remains of the Octagon, but also its use and impact on the city over time. The structure has been utilized in various ways and as a result, it has directly influenced the spatial orientation of the residential sections developed on it. This correlation accommodates great potential for the study of multi-layered cities. The results obtained from the architectural documentation of the Octagon and a detailed architectural comparative approach to discuss its potential functions will be the subject of another article.

Whatever its function might have been, the Octagon did not have a long lifespan and probably fell out of use as an inevitable consequence of events that occurred shortly after its construction. Since then, its fragments must have been reused multiple times, a common phenomenon of long-lived cities. The longevity of the city of Bergama might also explain why its foundation level is entirely preserved, i.e. for the sake of "reuse". From the early 19th century onwards, a new residential settlement was built on the subsurface remains of the Octagon, benefiting not only from its solid walls and foundations but also from its spaces. However, these spaces must also have fallen into disuse in the last century, as indicated by the enormous amount of deposit found inside.

As a remarkable monument of its time, the Octagon had long deserved extensive research. Although today it is

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no longer visible from the public space, since its reveal by this research, it has been under protection by law and has finally taken its place on the latest digital map of Pergamon<sup>14</sup>.

# Endnotes

<sup>1</sup> The Octagon is investigated within the framework of the author's doctoral research titled "Pergamon – Bergama'nın Kent Gelişimi Bağlamında Sekizgen Yapı" (The Octagonal Structure in the Context of the Urban Development of Pergamon – Bergama) under the co-supervision of Prof. Dr. Turgut Saner (Istanbul Technical University) and Prof. Dr. Felix Pirson (German Archaeological Institute Istanbul).

<sup>2</sup> In addition to the Greek inhabitants, the existence of an Armenian community in this area could only be attested by a small number of sources with limited information. Today, the majority of the houses in the neighborhood date between the second half of the 19th century and the early 20th century.

<sup>3</sup> The word 'kale' means 'castle', commonly used for places, and refers to older settlements or ancient remains in the same area.

<sup>4</sup> The Zoodochos Pigi Church used to be the main church of the Greek Orthodox community of Bergama, see also Berlet's map of 1907; plate III in Conze et al., 1913b.

<sup>5</sup> All excerpts are translated by the author. Although it is not mentioned explicitly, granite columns must have been part of the Zoodochos Pigi Church. Today, there is a primary school in the original location of the church (constructed in the 1970s) and only two remaining granite columns lay in its courtyard.

<sup>6</sup> After the museum excavation, access to the ancient space in this house was only granted with permissions of both the Bergama Museum and the owner of the house and, hence, became semi-official. For accessibility issues, see also section 4.

<sup>7</sup> All houses are registered in Talatpaşa Mahallesi, Bergama, İzmir.

<sup>8</sup> Parcel 22 is used by two different parties, which only became apparent during the fieldwork in 2015 and not through the official records. For a clear distinction of the area accommodating the ancient remains, the parcel was divided and the relevant area numbered 22a.

<sup>9</sup> Thanks to late Martin Bachmann, the significance of the ancient remains in the basement of the building was recognised, and through his supportive guidance, eventually became the subject of this dissertation.

<sup>10</sup> The technique Structure from Motion (SfM) aligns and rectifies photographs in order to create the 3D model of the object. Orthophotos (the views of the object) can be extracted from the 3D model. The most satisfying result is obtained by drawing on paper over printouts of the orthophotos on-site. This method enhances on-site observations, where further details can be identified.

<sup>11</sup> This intriguing aspect has already attracted the attention of urban archaeology scholars studying multi-layered cities (Capoferro Cencetti, 1979; Migliorati, 2017). I sincerely thank A. G. Bilgin Altınöz for making me aware of this concept.

<sup>12</sup> The so-called Gurnelia is a good example of the association of surface characteristics with the presence of ancient remains. The outline of this large monument has been preserved by the residential urban fabric, where houses were built along this outline, leaving a large square in the center ('Domuz Alanı'). However, the motivation behind the preservation is based more on pragmatic reasons of statics rather than common concerns of preservation of cultural heritage.

<sup>13</sup> The registration is issued by the Board (İzmir II Numaralı Kültür Varlıklarını Koruma Bölge Kurulu) on 27.09.2022, document number 16775.

<sup>14</sup> The Digital Map of Pergamon is open access and can be experienced online under https://www.dainst.blog/ transpergmikro/pergamon/pergamon-map/

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# A preliminary list of lean and sustainability based supplier selection criteria in the construction industry

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# Abstract

Construction companies' supply chains, their efficiency and effectiveness, and leanness and sustainability performance can influence competitiveness, cost and time effectiveness and sustainability performance of the construction companies. This paper aims to provide a preliminary list of lean and sustainability based supplier selection criteria to be considered in the supplier selection phase to support establishment of lean and sustainable construction supply chain. With this aim, following the literature review covering 16 standards, indices and certificates, the Delphi Method and Best-Worst Method (BWM) were applied. The literature review revealed 649 criteria which have been refined to eliminate the overlapped criteria. In total 222 criteria were remained and grouped under 4 main categories. Based on these 4 main categories of criteria, four main groups of four round Delphi Surveys were performed. Delphi survey outputs provided input to the BWM to further assess and organize the criteria for supplier selection. In BWM, all main groups' optimal weights and their related criteria optimal and global weights were calculated. The identified criteria list can be considered as an input to the decision-making about supplier selection so that lean and sustainable construction supply chain establishment can be supported. This research is expected to be useful for construction industry professionals and academics in the relevant field.

# Keywords

Best-Worst method, Construction supply chain management, Delphi method, Project management, Supplier selection.

# 1. Introduction

As construction industry (CI) has significant environmental footprint compared to other industries, complying with the Pareto principle, CI's enhanced sustainability performance can be effective in the fight against climate change, and in supporting sustainable development. Competitive business world has inspired the suppliers to outperform their competitors by adopting novel and effective approaches for higher productivity and revenue (Shukla et al., 2021). Significance of the supply chain (SC) development in this competitive environment is evident from studies in the literature (Narasimhan & Das, 2000) as the SC has become a factor that distinguishes performance and competitiveness of a firm (Vickery et al., 1999; Morgan & Monczka, 1996). Egan (1998) asserted that the vital part is played by the SC in bringing about innovation and maintaining incremental and sustained performance improvements. Latham (1994) and Egan (1998) suggested that supply chain management (SCM) techniques should be implemented by the CI. Firms can improve their performance by evaluating the SC performance and eliminating the ineffective processes in pre-construction and construction phases. Involvement of numerous entities in the SC in the CI leads to complexity of the SC structure.

CI is significant from the development and ecological point-of-views (Tatlici & Sertyesilisik, 2019). Researchers have emphasized that SCM must include the sustainability dimensions of social, economic and environmental performance since 2000s (Rajeev et al., 2017). Researchers and scholars consider SCM as helpful for enhancing global environmental sustainability and increasing business productivity at the same time (Acquaye et al., 2017). SC provides remarkable contribution to the formation of circular economy that ensures sustainable economic development. SCM calls for comprehensive information about relevant processes, entities and individuals, logistics, products and services, as well as breakdown of resources and traceability of resources at all phases

of production from acquisition of raw materials to completion of fully-functional building or project (Tatlici & Sertyesilisik, 2019). CI requires a strategy that organizes SC processes to support the project planning and to improve SCM (Tatlici & Sertyesilisik, 2019). As sustainable SCs necessitate efficient suppliers, suppliers must be selected carefully as they serve as the basis of SC systems (Rezaei et al., 2016; Suhi et al., 2019).

Latham (1994) and Egan (1998) emphasized that there is a quality problem in the CI and low level of client satisfaction. Furthermore, CI is wellknown due to its environmental footprint. These problems are related with SC. Latham (1994) and Egan (1998) emphasized importance of SCM in CI. Construction organizations show interest in working alongside qualified suppliers to ensure the projects' success, attaining organizational objectives and rapidly recovering from interruptions in SC (Mahmoudi et al., 2022). Integration of lean and sustainable approaches to SC process can support solution of CI's problems. The main research problem of this research is related with how to establish lean and sustainable construction supply chain (LSCSC). The main research question of this paper is: "What are the supplier selection criteria for the establishment of LSCSCM?"

Sustainable and lean approaches' integration into the construction process plays important role in minimization of the environmental footprint of the CI and SC. Lean construction (LC) refers to the construction processes that deliver maximum value with lowest possible waste and minimum possible harm to environment and society (Le & Nguyen, 2021). Construction companies have been using the LC approach effectively for 20 years to render better performance (Le and Nguyen, 2021). Intensified competition can motivate companies to comply with sustainable and lean construction management principles.

CI is seeking of the practice needs of implementation of lean and sustainable management knowledge for competitiveness. LSCSCM orientation is a literature and industry gap (Bon-

Gang Hwang & Wei Jian Ng, 2013; Martínez-Jurado & Moyano-Fuentes, 2014; Wai Peng Wong & Kuan Yew Wong, 2014) to get competitive advantage in industry. Most construction companies have made it a practice to consider SC during the formulation of differentiation strategy due to significance of SC in achieving competitiveness (Waters & Waters, 2007). Effectiveness of SC can be established by implementing lean management approach and sustainable practices simultaneously. For example, the choice of a contractor is a complementary part of construction projects as the suitable contractor needs to be chosen that the construction projects and structures meet the quality standards (Erdogan et al., 2017). Efficiency in and competence of the contractor employed determines the quality of the constructed structure or building (Zavadskas et al., 2015). Establishment of an efficient SC can support customer value and competitiveness of the firm (Rahman et al., 2015).

Previous studies (e.g., Sevkli et al., 2008; Patil & Adavi, 2012; Eshtehardian et al., 2013; Cengiz et al., 2017; Polat et al., 2017; Karabayir et al., 2020; Sabri et al., 2022) have mainly focused on and examined the supplier selection criteria. This current paper differs from the previous studies and contributes to the literature as it analyses sustainability and lean approaches' integration to the supplier selection process. Furthermore, this paper contributes to the literature as it employs the Delphi survey and BWM together in determination of the supplier selection criteria.

This paper aims to provide a preliminary list of lean and sustainability-based supplier selection criteria to be considered in the supplier selection phase to support establishment of LSCSC.

# 2. Literature review

Enhancing sustainability performance of its supply chains (SCs) can contribute to the sustainable production in CI and to reduce its environmental footprint. Organizations can enhance their performance through improved management of their SCs and establishment of long-standing

associations with SC entities (Egan, 1998). Hence, organizations must keep their SC under control and manage the processes (Maestrini et al., 2017: 299). It is essential to ensure the timely involvement of the supplier (Vrijhoef, 2011). The supplier selection decision at the project start plays significant role in minimization of cost, wastes and time losses. Furthermore, lean and sustainable SC is possible through effective supplier selection as supplier selected for the project based on the working standards, efficiency and material/method choices can affect the construction process. For this reason, achievement of the construction supply chain management (CSCM) is directly related to the success of the decisions made. Effective management of the project and its success depends on LSCSCM criteria.

Researchers and experts held the view that sustainable SCs allow organizations and firms to be more productive and to have greater reputation among clients (Chin et al., 2015). SCM entails practices that cover all phases of production and hence, it has become an integral part of manufacturing (Ferreira et al., 2016). Furthermore, sustainable SCs can reduce adverse impacts of processes on the society and environment (Chin et al., 2015). Main activities of sustainable supply chain management (SSCM) include management and planning of SC processes, review of customer demands and employee requirements (Badri Ahmadi et al., 2017). SSCM efforts to ensure maximum profit and to control ecological and social impact of the SC processes (Badri Ahmadi et al., 2017). Specifically, organizations need to resort to SSCM including employees, suppliers and customers (Suhi et al., 2019).

LC practices and approaches gradually made their way to the SC and distribution in the decade of 1990 (Tortorella et al., 2018). Implementing lean practices in SCs leads to lower amounts of waste and consequently yields better performance (Takeda-Berger et al., 2018, Saudi et al., 2019; Tortorella et al., 2019). CI has benefitted from the implementation of lean practices (Enshassi et al., 2019). LC approach has facilitated CI in better management

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of SC by improving the integration and efficiency of the SC (Meng, 2019; Koskela et al., 2020). The workflow or plan of processes in the CSC is streamlined with the integration of lean practices into the SCM (Le & Nguyen, 2021). There is still a need for more research on the emerging trend of integrating LC practices into CSCM (Lee & Nguyen, 2021). The concept of lean SCM emerged when lean principles and practices were incorporated into the SC (Khorasani et al., 2020). This concept further improved SCs performance. Lean SCM enables construction companies to overcome many challenges by enhancing the awareness of relevant concepts, motivating the senior management to accept change and focus on social factors essential for effective SCM (Abu et al., 2019). Garcia-Buendia et al. (2021) indicated the possibility of better performance in case of implementing the lean approaches in SCM.

The basis of competition in many industries is related with SC development (Narasimhan & Das, 2000). Problems in the SC need to be solved as fast and as effective as possible mainly due to the pressure on manufacturers and contractors to accomplish the work on time complying with quality requirements. Financial performance is exhibited by those organizations that have acquired coordination and responsiveness skills, which are elements of SCM abilities performance (Yu et al., 2018; Liao & Kuo, 2014). Competitive edge is generated in SC performance due to SCM abilities that generate tangible and intangible assets (Asamoah et al., 2021). Furthermore, they bring about SCM skills' development (Asamoah et al., 2021). Failure in SCM can damage company's reputation and risk company's survival. It is important for companies to look for innovative ways to manage the rising competition in the global market. At such point, adopting a performance improving system to SC at relatively early stages of projects could minimize the breakdown between suppliers while supporting smooth continuity of work. This could lead to LSCSCM collaboration between designers and contractors to the advantage of all parties to take a competitive

advantage. As a result, the supplier selection decision at the beginning of the project plays significant role in minimization of loss and preventing potential problems. Moreover, LSCSC can be supported by cooperation with the most suitable supplier. Thus, suppliers can contribute to the improvement in communication by contractors.

The collaboration of the project and company features, human resources, and organizations have an impact on the SC and its process. SC's effectiveness depends on work motivation, adaptability, employee engagement, leadership, empowerment and shared norms (Othman & Ghani, 2008; Shub & Stonebraker, 2009). Effective SCs are typically found in organizations that offer employees continuous training (Smith-Doerflein et al., 2011). The human resource practices of an organization should be consistent with its SCM to support the SC members' involvement, encourage SC integration and ultimately, ensure that improved business outcomes are attained (Gómez-Cedeño et al., 2015). A vital part is played by human resource management (HRM) as it functions as a means of assigning relationships and responsibilities within the SC (Lengnick-Hall, 2013). There is a significant relationship between certain HRM practices (Menon, 2012). Gómez-Cedeño et al. (2015) were of the view that there were substantial direct effects of HRM on SCM outcomes and SCM implementation, and indirect effects on improving organizational performance and customer satisfaction. Alshurideh et al. (2022) emphasized the affirmative outcomes of integrating HRM and SCM in organizational sustainable SCs for managers, practitioners and academics

Trio of environmental factors, material, and design is in interrelated interaction. This trio can facilitate SC, if these are brought together in a project. Based on the project, the decision of the material planned to be used in the design phase and its environmental impact, affect in a closed loop. Making a clear decision on the material to be used in the design phase can reduce the disruptions that may occur in the SC and construction process. In fact,

the design team's contact with potential suppliers during the design phase can facilitate the SC flow in the future. An increasingly significant perception in SCM is collaboration as it has been identified by enterprises that working together offers benefits that are significantly greater than the risks (Kuo et al., 2021). When there is a smart SC, collaborative relationships between the stakeholders within the SC is enhanced (Kuo et al., 2021). SC network of the construction materials had and still has an environmental impact due to the requirements of industrialization and urbanization, particularly within the developing countries (Xu et al., 2020). Hence, it is vital to accurately evaluate construction materials SC network environmental protection efficiency so that targeted and correct optimization measures can be formulated and an economically and environment-friendly construction materials SC network can be ensured (Xu et al., 2020). Through these resource-efficient contributions, low-energy consumption direction can be created and ecological damage and environmental pollution can be decreased.

Performance and reporting can contribute to continuous monitoring of the SC and supplier performance. Strategy that can be used by companies as part of SSCM to cater to report on and enhance the degree of sustainable practices among suppliers as well as in their own operations is developing a sustainability report (Doorey, 2011). Researchers need to give increasing attention to the field of integrating SSCM with sustainability reporting (Wan et al., 2016). Strategy-making

and long-term planning on the basis of sustainable development can be improved by sustainability accountability and reporting (Niehaus et al., 2018). Furthermore, there is effect of sustainability reporting on SSCM practices in leading companies as it causes the risks and operational efficiencies to be recognized and decreased, and supports the integration of sustainability issues within management procedures (Bunclark & Barcellos-Paula, 2021). The focus of earlier studies on construction SCs was on the way their construction projects performed, and not on their SCs, by measuring components like developer satisfaction and waste levels (Thunberg, 2016). Thunberg (2016) responded to this by proposing that CSC performance measurement should be carried out with respect to SC responsiveness, SC reliability and costs. A positive effect of SC agility, information technology and SC resilience is determined by Cherian and Arun (2022) on SC performance. It is necessary to improve the scientific rationality and operability of green construction SC performance evaluation (Liu et al., 2018).

#### 3. Methods

This paper aims to identify the criteria to be considered in the supplier selection phase to support establishment of LSCSC. With this aim, three step research process has been performed (Figure 1).

Step 1: It is important to understand the role of environmental performance indicators (EPIs) in allowing experts to study environmental issues (e.g., pollution, climate, energy, biodiversity,



Figure 1. Three main steps of the research.

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Table 1.	Brief	defini	tion o	f standa	rds, ind	lices an	d certific	ates.	
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Name	Definition
Global Report Initiative (GRI)	GRI stands for Global Reporting Initiative. It provides organizations with the opportunity of sustainability reporting
	(GRI, n.d.). The GRI entails 70 indicators for the sustainability measurement in terms of economy, society and
	environment (Joung et al., 2013). The GRI report allows comparing the sustainability performance delivered by an organization with the GRI standards. It also allows management of organization's sustainability performance. The
	GRI reporting intends to determine the decision-making at different organizational levels besides allowing the
	organization to manage decision-making (Courtnell, 2019).
Walmart Sustainability Product	Walmart has three key sustainability goals: to produce zero waste; 100% renewable energy will be provided; and
Index	selling products that sustain people and the environment. The index collects and analyzes information throughout a
Dow Jones Sustainability	DJSI is a benchmark used for assessment of the sustainability and financial performance of firms specifically the
Indexes (DJSI)	leading 10% firms listed in the Dow Jones Global Total Stock Market Index (SAM Sustainable Asset Management,
	2012). The indices are very helpful for investing individuals and firms. The DJSI is mostly applied for assessing the
	assess the social dimensions of organizational performance (RobecoSAM 2022)
2005 Environmental	The Yale Centre for Environmental Law and Policy formulated the ESI index with the objective to determine the
Sustainability Indicators (ESI)	ecological responsibility for different countries (SEDAC, 2022). The ESI entails 6 category of policy and 21 factors
	that are analyzed on the basis of 68 indicators of environmental sustainability (Environmental Performance Index, 2008)
Environment Performance Index	The EPfI was formulated by experts at Yale University to support the ESI. The EPfI evaluates the efficiency of the
(EPfI)	environmental policy of countries in terms of mitigating and preventing harm to environment and consequent effects
	on enhancing the ecosystem vitality, human health, and better resources management sustainability (Environmental
	environmental issues (Tamanini, 2016).
International Organization for	Organizations are required to formulate their own set of indicators for self-assessment of their environmental
Standardization (ISO 14031)	performance under the ISO 14031 standard. The standard deals with manufacturing in three categories: 1)
	environmental condition, 2) operational performance, and 3) management performance (International Organization for Standardization n d)
Environmental Pressure	EPrI entails indicators to measure the harmful practices of humans that are detrimental to environment. The number
Indicators for European Union	of indicators entailed in EPRI is 60 which covers almost 10 policy areas of climatic changes, air pollution, coastal
(EPrI)	and aquatic environments, damage to ozone layer, exhaustion of resources, issues of urban environment, waste, water
Japan National Institute of	The NICTED area of includes in directors that course a nationlan area institutes a sustitutions through training area dat
Science and Technology Policy	or imported patents and scientific publications, and technological progress based on staff skill level (NISTEP, n.d.).
(NISTEP) European Environmental	······································
Agency Core Set of Indicators	The EEA-CSI offers a number of reporting indicators. The EEA-CSI provides measurements that can be used to
(EEA-CSI)	organize positive ecological effects in EU countries (imzuwi, n.d.).
Corporate Social Responsibility	CSR is described as the self-regulating model that is equally beneficial for an organization, the stakeholders and the
(CSR)	of their processes (Farrington et al., 2017).
Lean Reporting Criteria	The theory and practice of lean accounting and management reporting are relatively new and continue to develop.
	Recent research across 244 U.S. companies found that the implementation of lean accounting improves the
	reporting: daily or hourly reporting of cell performance, weekly reporting of value stream box scores and monthly
	reporting of Value stream income statements (Pickering, 2017).
Agile Reporting Criteria	Hence, the agile approach can be deemed as an important technique that allows project managers and project teams
	increased flexibility, improved project predictability, customer satisfaction, reduced risks, more relevant metrics.
	continuous improvement, better control, improved team morale.
IFC	The main focus of the Performance Standards is the clients. These standards allow risk identification as well as
	evaluation of impacts of risks. Consequently, the identified risks can be prevented and mitigated. Moreover, Performance Standards can be used to reduce the negative effects of risk through proper risk management strategies
	(IFC, 2022). Performance Standards direct the business towards sustainability through stakeholder involvement and
	communication of responsibilities of the client associated with a project. The IFC performance standards identify
	ecological and social risks. IFC standards makes it mandatory for the entities making direct investments to ensure minimum possible risk to environment and society through the implementation of Performance Standards for better
	exploitation of prospects (IFC, 2022). The IFC standards are followed by construction organizations for management
	of environmental and social risks. IFC offers guidance to the businesses to adjust their activities in adherence to the
	Sustainability reamework, relevant strategies, principles and initiatives provided by IFC performance standards.
	2022).
Sustainable Development Goals	The United Nations General Assembly formulated the SDGs. It entails 17 global objectives or goals that serve as the
(SDG)	"sketch or model that can be followed to obtain sustainability on the whole" (United Nations, 2017). It was proposed
	(United Nations, 2015).
Sustainable and Green Building	"In the CL triggering the SC with lean and sustainability can be obtained through the integration of the principles of
Certification (Breeam, DGNB,	sustainable and green building certifications into the SC" (Kupeli Tatlici & Sertvesilisik, 2022). The certificates
Greenstar and Casbee)	related to the subject were searched in detail, a total of 45 were found. It has been determined that 4 certificate
	standards could provide maximum useful data for current study. These are: Breeam, DGNB, Greenstar and Casbee.
	construction projects including buildings and infrastructure (BRE Group, n.d.). The DGNB System is an effective
	method that evaluates the sustainability of construction project with respect to their environmental, socio-cultural and
	economic impacts such that all the impacts are given equal weightage (DGNB, n.d.). Another method named Green
	infrastructure or building is sustainable enough ("Green Star." 2022). CASBEE is also employed to estimate the
	performance of building and the surrounding area in terms of its sustainability (JSBC, 2016).
Sustainable and Green Material	The International EPD System issues report about the product in light of its life-cycle assessment to highlight the
Certification (EPD)	impact of that product on global environment. The information communicated in EPD is clear, certified and

erosion, environmental education and ecosystem services) and help them to assess efficiency of the methods that determine environmental impacts and exhaustion of natural resources (Ruez, 2019). The EPIs allow experts to determine the impact of various actions affecting the environment in either positive or negative ways with the different applications of EPIs for different situations (e.g., scales and topics) (Ruez, 2019). Considering the literature, internationally used standards, indices and certificates covering sustainability, lean and environmental factors that can contribute to this study have been researched (Table 1). The standards have been selected according to the prevalence and scope of their worldwide usage. Indices have been selected considering their contribution to the certifications for their inadequacies in accordance of lean and sustainability approaches. For instance, as Passos Neto et al. (2022) mentioned, the criteria from the Global Reporting Initiative (GRI) were selected as it is a globally known and widespread organization. Furthermore, regarding to the certifications, 4 widely used certificates (i.e., Breeam, DGNB, Greenstar and Casbee) were examined. In this context, 16 standards, indices and certificates were examined in depth to determine the criteria for supplier selection to obtain LSCSCM (Table 1).

A total of 649 criteria were determined from 16 standards, indices and certificates that contribute to the aim of the study, which include sustainability and lean approaches. The identified 649 criteria have been refined for four times as overlapped criteria were combined and repetitive criteria were removed in each refining phase until further iteration could not be possible (Figure 1). As a result, 222 criteria were remained as input to the four group Delphi surveys (Figure 1). The identified 222 criteria were grouped into the four main categories [i.e., Project & Company features, Human Resources, Organizations (PHO), Environmental Factors, Material, Design (EMD), Performance, Reporting (PR) and SC] based on their contents (Figure 1). The first group, PHO, focuses on the current capacity of the supplier, the training of its employees, and the performance of its human resources when selecting a supplier. The EMD group evaluates the construction supply chain (CSC) process by prioritizing its environmental impact. Meanwhile, the technical characteristics of the materials to be used are important, and also take attention on choosing the environmentally friendly material at the design stage. The PR group takes into account the potential supplier's past performances when constructing the SC. Furthermore, it includes regular reporting by examining the performance of selected suppliers in the SC process. The SC group focuses on the process itself, with the start of the process.

Step 2: Four groups of Delphi surveys were applied simultaneously to identify the criteria to be used in the weight analysis in Best-Worst Method (BWM). Complying with Chan et al. (2001), Yeung et al. (2007), and Sourani and Sohail (2015), the Delphi

method of this research consisted of four rounds. Delphi Rounds 1 and 3 of all four main groups of Delphi method were conducted through online research tool (veti.itu.edu.tr). Delphi Rounds 2 and 4 of all four main Delphi groups were conducted through e-mails sent to the participants of the four group. According to Chan et al. (2001), proper selection of experts for the panel is essential for effectiveness of the methods. Sample of each Delphi group was identified specially for each Delphi group based on their expertise and research areas. Identified lists of experts consist of academics and professionals in the relevant field. For PHO group 36 academics and 22 professionals, for EMD group 27 academics and 5 professionals, for PR group 32 academics and 28 professionals, and for SC group 44 academics and 23 professionals were invited to research. Some participants were included in more than one group. For all 4 main Delphi survey groups, in total 159 experts (105 academics and 54 professionals) were asked to take part in the Delphi surveys.

For the first round of the Delphi method, respondents in each group were inquired to choose minimum 5 maximum 10 criteria that are the most supporting criteria for achievement of LSCSCM from their related Group point of view. The consolidated findings from Round 1 were provided to respondents for Round 2 Delphi survey, and they were asked to evaluate their selections to determine if they wanted to change their initial choice. In the third round of the survey, participants assigned scores to the criteria using 5-point Likert scale ranging from 1 to 5 where 1 indicated 'the least important' and 5 indicated 'the most important'. Only the criteria with 50% or more of expert approval in round 2 were included in this round. The round 4 required the participants to review the scores they had assigned earlier to their group criteria considered the compiled results obtained from the previous round. E-mails were sent to remind all participants who had not yet completed their forms for each round. The data obtained from the Rounds 3 and 4 were transferred to the Statisti-

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cal Packages for Social Sciences (SPSS) program and the reliability statistics (Cronbach's Alpha Coefficient), test of normality and correlation analysis were made for each group of criteria.

Step 3: Delphi survey outputs provided the input data for and the basis for the BWM to assess and organize the criteria for supplier-selection. Rezaei (2015) put forward a multi-criteria decision making (MCDM) method namely the BWM to employ structured approach for comparisons to deal with the complexity. Unlike other MCDM methods involving pairwise comparisons, the BWM involves comparison of each criterion individually with the best and the worst criteria (Labella et al., 2021). Literature indicates better performance of BWM compared to the analytic hierarchy process (AHP) (Rezaei, 2015; Malek & Desai, 2019; Gupta et al., 2020). Numerous research has been conducted on BWM due to its greater effectiveness in comparison to AHP approach (Liu et al., 2021). Moreover, BWM renders more consistent results than other MCDM methods (Ajrina et al., 2018). BWM also outperformed AHP in terms of statistical validation (Gupta et al., 2020; Moslem et al., 2020; Mostafaeipour et al., 2021). The main feature that makes BWM better than other methods is that this approach does not require many pairwise comparisons (Wankhede & Vinodh, 2021). Additionally, limited data requirement and lesser time-consumption are some of the pros of using BWM compared to traditional MCDM methods (Salimi & Rezaei, 2018). BWM has recently been used in the CI and has relatively limited resources in the literature (e.g., Norouzi & Namin, 2019; Scherz & Vafadarnikjoo, 2019; Mahmoudi et al., 2020; Celik & Gul, 2021; Ghasemi et al., 2021). The BWM method was employed in this current study as it allows the experts to effectively apply the concept of LSSC in SCM in the CI. The BWM method entails 5 steps for assigning optimal and global weight to decision criteria (Rezaei, 2015): The initial step includes identification of decision criteria (determined via Delphi results)  $\{c_1; c_2; ..., c_n\}$  (Rezaei, 2015). The second step involves identification of the best and the worst criterion (Re-

zaei, 2015). The third step involves best criterion comparison over the other by the weightage valued between 1 and 9 (where 1: equally important, 5: strongly more important, and 9: extremely more important) (Rezaei, 2015). The assigned number indicates the significance of the best criterion over the other. This results in Best-to-Other's vector, which is:  $A_{B} = (a_{B1}; a_{B2}; ...; a_{Bn})$ , where  $a_{Bi}$  denotes the preference of best criterion over other (Rezaei, 2015). The fourth step involves comparison of the worst criterion over the other by the weightage valued between 1 and 9 (Rezaei, 2015). Similar to step 3, the experts assign weightage valued between 1 and 9 to the criteria being compared against the worst one (Rezaei, 2015). The assigned number indicates the significance of the other criterion over the worst one (Rezaei, 2015). This results in Others-to-Worst vector, which is:  $A_w = (a_{1w}, a_{2w}, ..., a_{nw})$ , where a w denotes the preference of criterion over worst criterion (Rezaei, 2015). The fifth and the last step involves determination of the optimal weights (w<sup>\*</sup>, w<sup>\*</sup><sub>2</sub>, ..., w<sup>\*</sup><sub>n</sub>) (Rezaei, 2015). To compute factors' optimal weights, the maximum absolute differences  $\left| \frac{W_B}{W_j} - a_{Bj} \right|$ 

and  $\left| \frac{W_j}{W_W} - a_{jW} \right|$  for j should be minimized (Rezaei, 2015). This can be formulated as (Rezaei, 2015): Minmaxj  $\left\|\frac{W_B}{W_W} \sim 0^j \left\|\frac{W_j}{W} - a_{jW}\right\|_{1}$ 0

$$\sum_{j=1}^{n} W_j = 1$$

 $w_j \ge 0$ , for all j (Rezaei, 2015). This equation is converted into linear programming program to obtain the required solution as: Min  $\xi$  subject to

$$\begin{aligned} \left| \frac{W_B}{W_j} - a_{Bj} \right| &\leq \xi \\ \text{, for all } j \\ \left| \frac{W_j}{W_w} - a_{jW} \right| &\leq \xi \\ \text{, for all } j \\ \sum_{j=1}^n W_j &= 1 \end{aligned}$$

 $w_j \ge 0$ , for all j (Rezaei, 2015).

These steps were monitored for analyzing the optimal weights between criteria of the four main groups (i.e., PHO, EMD, PR and SC). BWM study

*Table 2.* Summary of results of the 1<sup>st</sup> and 2<sup>nd</sup> rounds of the Delphi Surveys.

		Round	1		Round 2				
	Number of participants		Number of criteria		Number of participants		Number of criteria		
	Total	Responded	Total	Selected	Total	Responded	Total	Selected	
PHO	58	10	42	33	10	8	33	11	
EMD	32	8	87	19	8	8	19	8	
PR	60	14	49	23	14	9	23	8	
SC	67	15	44	24	15	12	24	7	

*Table 3.* List of the groups selected criteria and their abbreviations selected from the 2nd round Delphi.

Groups	Expansions of Criteria	Reference Index
PHO1	Prioritizing risks and opportunities in construction projects based on possible economic, social and environmental impacts	GRI 102
PHO2	Inspection of the social, cultural and environmental impacts of construction projects by an independent organization	GRI 102
PHO3	Working with waste management companies in construction projects	GRI 306
PHO4	Company's openness to collaborate with universities for research/ allocates funds for research / creates a qualified project team	NISTEP
PHO5	Organizing training for company employees	CSR
PHO6	Paying attention to complaints from employees	EPrI
PHO7	Having codes of conduct in the company	DJSI
PHO8	Integrating sustainability into the firm's brand strategy	DJSI
PHO9	Having resources to realize organizational structure and planning	DJSI
PHO10	Investing in human resources development	DJSI
PHO11	Monitoring the individual performance of human resources	DJSI
EMD1	Having a vision and mission focused on sustainable material selection	GRI 103
EMD2	Selection of material from recycled material	GRI 103/EPD
EMD3	Based on local and national standards in material selection	GRI 103
EMD4	Priority of supplier location and material handling system in material selection	GRI 103/204
EMDS	Priority of performance criteria in material selection	GRI 103 GRI 202
EMDO	taking into account the location of the project	GRI 203
EMD7	Using environmentally friendly and recyclable material	GRI 206/301
EMD8	Paying attention to whether it causes environmental problems in the long term in material selection	DJSI
PR1	Monitoring performance	Lean Reporting Criteria
PR2	Detailed examination of the social, economic and environmental impacts of construction materials in the report preparation process	GRI 101
PR3	Affecting performance of the organization from unclear corporate strategies, not being conveyed to managers and employees	Lean Reporting Criteria
PR4	Having sustainability reporting in construction projects	GRI 101
PR5	Covering the performance of the entire project with the sustainable reporting	GRI 101
PR6	Following and reporting the sustainable job descriptions of all stakeholders	GRI 101
PR7	Periodic preparation of sustainable reports	GRI 101
PR8	Reporting how much value the suppliers add	Agile Reporting
SC1	Priority of local suppliers in the production process	GRI 203
SC2	The importance of location in the selection of suppliers	GRI 308
SC3	Ordering the materials to be used as needed without storage	GRI 205/ Lean Reporting Criteria
SC4	Openness of suppliers to innovations that promote sustainability	Sustainable and Green Building Certification (Greenstar)
SC5	Paying attention to the shelf life of the products stored in the construction site	GRI 205
SC6	Monitoring the practices of stakeholders by applying sustainable and lean production specifications and guidelines in the sumply chain	Walmart/DJSI
SC7	Taking environmental factors as the basis when selecting the supply chain suppliers	GRI 308

was created via the SurveyMonkey form. This form was created complying with the 5 stages of BWM in compliance with Rezaei (2015): comparison of all main groups (PHO, EMD, PR, SC) with each other, comparison of PHO sub-criteria (11 criteria), comparison of EMD criteria (8 criteria), comparison of PR criteria (8 criteria), and comparison of SC criteria (7 criteria). After data were gathered, the optimal weights were analyzed and calculated for all four main groups. Criteria optimal weights were found separately for all 4 main groups. Finally, all criteria global weights were calculated and overall performance ranking was obtained. Global weights calculated by multiplication of the criteria optimal weight and criteria's related group optimal weight.

As the Delphi process (Step 2) included reduction of the criteria set. Delphi participants consisted of experts from the CI and academics for the PHO, EMD, PR and SC groups. Furthermore, in BWM, it was aimed to create a new sample who could objectively evaluate the remaining criteria in Delphi as a whole process without being bound by the 4 groups. To identify the sample for BWM, academics that have research papers on SCM, and CSCM experts have been searched. As a result, the new participants consisted of 27 SC related academics and pro-

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fessionals. Lastly, the survey link was emailed to the sample.

#### 4. Results

# 4.1. Data obtained through Delphi surveys 4.1.1. Results of the 1st and 2nd Rounds of the Delphi Surveys for the 4 main groups

In the first round, all data gathered form participants have been evaluated. The criteria which were rated at low level were eliminated. Consequently, the criteria with at least 20% of expert votes were kept for all 4 main groups (Table 2). As a result, 33 criteria out of 42 were remained for the PHO group, 19 criteria out of 87 were identified for the EMD Group, 23 criteria out of 49 were remained for the PR group, and 24 criteria out of 44 for identified for the SC group for the 2<sup>nd</sup> round of Delphi surveys. For the second round of Delphi, all remained criteria in each group listed in an Excel file including the rate of criteria. Similar to Chan et al. (2001) and Yeung et al. (2007), the criteria that ensured minimum 50% rate in the second round were chosen for the Delphi round three. Summary of the data gathered from the second round from all groups is provided in Table 2.

The list of the criteria selected from all four groups at the end of the 2nd round of Delphi surveys and criteria related references are provided in Table 3.

# 4.1.2. Results of the 3<sup>rd</sup> and 4<sup>th</sup> Rounds of the Delphi Surveys for the 4 main groups

Data obtained through the 3<sup>rd</sup> and 4<sup>th</sup> rounds of the Delphi Surveys for the 4 main groups were transferred to the SPSS computer software for computing analyzes to obtain correlation analysis. The following steps were monitored for analyzing the relationship between criteria of the four main groups (i.e., PHO, EMD, PR and SC). For the first step, the reliability test was computed for Rounds 3 and 4. At the second step, the normality test, skewness and kurtosis were performed for Rounds 3 and 4. Results of the normality test, skewness and kurtosis values have been provided in the Appendix A. At

Table 4. The Alpha Cronbach Value results of Rounds 3 and 4.

	R	eliability Statistics	
	Cronbach's Alpha	Cronbach's Alpha	N of Items
	Round 3	Round 4	
PHO	.852	.862	11
EMD	.741	.641	8
PR	.602	.819	8
SC	.698	.780	7

Table 5. Matrix of correlation between the PHO, EMD, PR and SC criteria.

PHO Gr	PHO Group Criteria										
	PHO1	PHO2	PHO3	PHO4	PHO5	PHO6	PHO7	PHO8	PHO9	PHO10	PHO11
PHO1	1	.570	.114	.853**	.342	.174	.234	.570	.522	.271	.000
PHO2		1	.429	.535	.429	.218	.683	.429	.218	.882**	.535
PHO3			1	.000	.143	218	098	.429	.218	.339	.535
PHO4				1	.267	.000	.365	.535	.408	.254	.000
PHO5					1	.218	.293	.714*	.655	.611	.802*
PHO6						1	.149	.218	.333	.311	.000
PHO7							1	098	.149	.788*	.365
PHO8								1	.655	.339	.535
PHO9									1	.311	.408
PHO10										1	.762*
PHO11											1
EMD G	oup Crit	eria									
	EMD1	EMD2	EMD3	EMD4	EMD5	EMD6	EMD7	EMD8			
EMD1	1	141	.062	.258	.091	.645	062	.868*			
EMD2		1	439	.091	.710	091	.439	.038			
EMD3			1	.240	113	240	731	.336			
EMD4				1	.354	.167	.320	.420			
EMD5					1	354	.113	.149			
EMD6						1	.240	.560			
EMD7							1	101			
EMD8								1			
PR Grou	ip Criteri	a									
	PR1	PR2	PR3	PR4	PR5	PR6	PR7				
PR1	1	.340	.273	262	.366	.339	069				
PR2		1	.595	.355	.710*	.749*	.512				
PR3			1	.308	.562	.471	.069				
PR4				1	237	.570	.693*				
PR5					1	.320	.043				
PR6						1	.822**				
PR7							1				
SC Grou	p Criteri	a									
	SC1	SC2	SC3	SC4	SC5	SC6	SC7				
SC1	1	.899**	.564	.188	.033	231	.217				
SC2		1	.624*	.184	.320	068	.106				
SC3			1	.294	.597*	.108	102				
SC4				1	.094	.108	102				
SC5					1	.058	417				
SC6						1	.376				
SC7							1				
<ol> <li>Correlation</li> </ol>	on is signif	icant at the	0.05 level	(2-tailed).							

\*\*. Correlation is significant at the 0.01 level (2-tailed).

the third step, correlation analysis was made for the Round 4 results.

For the first step, all 4 main groups' reliability statistics were computed and evaluated (Table 4). For the PHO group the Cronbach's Alpha was calculated to be .852 in the 3<sup>rd</sup> round and 0.862 in the 4<sup>th</sup> round. For the EMD group, the Cronbach's Alpha was identified to be.741 for the 3<sup>rd</sup> round and 0.641 for the 4<sup>th</sup> round as one participant failed to respond in the 4<sup>th</sup> round. For the PR group, Cronbach's Alpha was calculated to be .602 for the 3<sup>rd</sup> round and 0.819 for the 4<sup>th</sup> round. For the SC group, Cronbach's Alpha was calculated as .698 for the 3<sup>rd</sup> round and 0.780 for the 4<sup>th</sup> round.

As the second step analysis for all groups criteria (i.e., PHO, EMD, PR and SC), the skewness and kurtosis values obtained through SPSS showed normal distribution according to Tabachnick standard range  $(\pm 1.5)$  for

**Table 6.** Optimal weights of four groups forsupporting establishment of LSCSCM.

	BWO			
	РНО	EMD	РК	sc
	Weights	Weights	Weights	Weights
SCPP1	0,477273	0,204545	0,159091	0,159091
SCPP2	0,119048	0,601190	0,214286	0,065476
SCPP3	0,051282	0,128205	0,564103	0,256410
SCPP4	0,064815	0,157407	0,157407	0,620370
SCPP5	0,047377	0,602369	0,155668	0,194585
SCPP6	0,066038	0,141509	0,141509	0,650943
SCPP7	0,046632	0,590674	0,108808	0,253886
SCPP8	0,141631	0,568670	0,053648	0,236052
SCPP9	0,115979	0,162371	0,063144	0,658505
SCPP10	0,139785	0,139785	0,086022	0,634409
SCPP11	0,229358	0,137615	0,064220	0,568807
SCPP12	0,047619	0,333333	0,238095	0,380952
SCPP13	0,079365	0,507937	0,206349	0,206349
SCPP14	0,053333	0,126667	0,253333	0,566667
SCPP15	0,086957	0,521739	0,260870	0,130435
Average Weights	0,117766	0,328268	0,181770	0,372196

**Table 7.** Global weights of all four groups' criteria that have impact on lean and sustainable SC.

			PHO3	0,076483	9	0,009007	32
			PHO4	0,093743	4	0,011040	27
			PHO5	0,086062	6	0,010135	29
PHO	0,117766	4	PHO6	0,104368	3	0,012291	26
			PHO7	0,091617	5	0,010789	28
			PHO8	0,125880	1	0,014824	24
			PHO9	0,073514	11	0,008657	34
			PHO10	0,083730	8	0,009861	31
			PHO11	0,075671	10	0,008911	33
			EMD1	0,127432	5	0,041832	11
			EMD2	0,128255	3	0,042102	9
EMD			EMD3	0,105910	8	0,034767	15
	0,328268		EMD4	0,127970	4	0,042008	10
		2	EMD5	0,123907	6	0,040675	13
			EMD6	0,128283	2	0,042111	8
			EMD7	0,137098	1	0,045005	7
			EMD8	0,121144	7	0,039768	14
			PR1	0,117317	6	0,021325	21
		3	PR2	0,127107	5	0,023104	20
			PR3	0,130234	4	0,023673	19
	0,18177		PR4	0,106771	7	0,019408	22
PR			PR5	0,141497	1	0,025720	16
			PR6	0,140036	2	0,025454	17
			PR7	0,133770	3	0,024315	18
			PR8	0,103269	8	0,018771	23
			SC1	0,135770	4	0,050533	4
			SC2	0,145890	3	0,054300	3
			SC3	0,110640	7	0,041180	12
SC	0,372196	1	SC4	0,122110	6	0,045449	6
			SC5	0,125810	5	0,046826	5
			SC6	0,201153	1	0,074868	1
			SC7	0,158627	2	0,059040	2

all four main groups. In accordance with the normal distribution results of groups, the Pearson correlation test was performed as the third and the last step of the Delphi study to assess the relationship between normally distributed data.

In the Table 5, the Pearson correlation matrix of each group was analyzed in the SPSS program as a result of the 4-rounds of the 4 group Delphi surveys, and criteria directly related to each other were determined. The criteria having 1% significance level correlation for each group are indicated in black and bold character in the Table 5. The criteria having 5% significance level correlation for each group shown are indicated in red and bold character (Table 5). At the end of the Delphi Round 4 of each 4 main Delphi group, all remaining criteria were used as inputs to the BWM study to analyze their optimal and global weights and rank them according to their importance.

## 4.2. BWM results

The survey was conducted from practitioners' perspectives to identify the criteria level of importance. In total, 15 responses were obtained from 27 SC related academics and professionals. The results from SC professional participants (SCPP) were monitored for analyzing the optimal and global weights between criteria of the 4 main groups (i.e., PHO, EMD, PR and SC).

Optimal weight of the SC main group (0.372196) ranked higher followed by the EMD group (0.328268), the PR group (0.181770) and the PHO group (0.117766) (Table 6). The result depicts SC as the most effective performance group for achieving LSCSCM. It is found that the EMD group is the second important group whereas the PHO group has the least importance level.

Following the groups optimal weights calculation, analyzes were made within the criteria of each group and their optimal weights were found. From the Table 7, in the SC group, SC6 (0.201153) was found to be the most effective criteria. SC7 (0.158627) occupies second position in the group. These criteria were followed by SC2 (0.145890), SC1 (0.135770), SC5 (0.125810), SC4 (0.122110), and SC3 (0.110640).

In the EMD group, EMD7 (0.137098) was found to be the most effective criteria. EMD6 (0.128283) was ranked second in the LSCSCM adaptation performance in CI. These criteria were followed by EMD2 (0.128255), EMD4 (0.127970), EMD1 (0.127432), EMD5 (0.123907), EMD8 (0.121144), and EMD3 (0.105910).

In the PR group, PR5 (0.141497) was found to be the most effective

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criteria followed by PR6 (0.140036), PR7 (0.133770), PR3 (0.130234), PR2 (0.127107), PR1 (0.117317), PR4 (0.106771) and PR8 (0.103269).

In the PHO group, 'Integrating sustainability into the firm's brand strategy (PHO8)' (0.125880) is found to be the most significant criterion in group followed by PHO2 (0.104568), PHO6 (0.104368), PHO4 (0.093743), PHO7 (0.091617), PHO5 (0.086062), PHO1 (0.084365), PHO10 (0.083730), PHO3 (0.076483), PH11 (0.075671), and PHO9 (0.073514).

The criteria are ranked and compared with global weight values to present a clear picture of significant criteria. SC6 (0.074868) criteria from SC group ranked first as global weight and the following second and third ranked criteria are SC7 (0.059040) and SC2 (0.054300) (Table 7). Furthermore, the global last ranked three criteria are from PHO group which also ranked last in group optimal weighting. These globally last ranked criteria from highest to lowest weight are as follows; PHO3 (0.009007), PHO11 (0.008911) and PHO9 (0.008657).

# 5. Discussion

According to the Delphi results, 11 out of 42 criteria for PHO, 8 out of 87 criteria for EMD, 8 out of 49 criteria for PR, and 7 out of 44 criteria for SC have been elected. Criteria obtained through Delphi surveys were used as input to the BWM. Global weights show that the decision makers in the BWM focus on the SC group criteria as a priority. Although the group rankings from the highest to the lowest are as SC, EMD, PR and PHO, the related criteria ranking order shows variety in order. Global weights ranking can be used for the supplier selection. SCPPs' top global weighted criteria in the descending order can be briefly explained and discussed as follows (Table 8):

SC6 (0.074868) can contribute to SC performance. It is vital to actively accomplish monitoring of the specifications and guidelines throughout the project life cycle. Controlling can make it easier to determine the variance and adopt the required precautions on time (Sertyesilisik, 2016).

SC7 (0.059040) conforms to the principles of leanness as well as sustainability. Hence, it is possible to identify supply related environmental and social risks early on (Koplin et al., 2007). Precautions need to be adopted to ensure that the operations are carried out smoothly (Sertyesilisik, 2016). The steps that are critical in choosing the strategy and ensuring objectives include identifying environmental factors, and assessing and prioritizing them (Alfaro-Saiz et al., 2020). These steps can help in identifying the efforts that should be made and hence, allocating resources that would be used within the SC. Each member of the SC should possess green knowledge and have the financial expertise to determine the SCM practices that are most appropriate for the organizations (Jing et al., 2019).

SC2 (0.054300) was found to be the third important criterion. Another factor that plays an essential part in the selection of supplier is geographical location because it has an impact on the lead time, logistics costs, and transportation (Wawasan Open University, 2012). There are certain organizations that need their suppliers to be situated within a given distance from their facilities. Furthermore, SC1 (0.050533) evolved to be a critical strategy for SC resilience. Prashara (2021) states that collaborating with local suppliers and service providers supports local communities with respect to generating trust, achieving market sustainability, and benefits at the societal level. Local presence is vital from the industrial point of view for fulfilling market requirements so that rapid, reliable, flexible, and more cost-efficient product and service delivery can be attained (Christopher, 2021). Suppliers can be protected from SC disruptions and external risk factors through localization as this strategic solution can decrease problems related to distance, variations in international currency, transportation costs, geopolitical risks, and worldwide market fluctuations (Andersson & Segerdahl, 2012). Furthermore, manufacture of building materials may provide important employment benefits to the local region (Rousseau, 2009). This can contribute to the social sustainabili-

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ty, and economic development of that region. Additionally, in recent times, there are a greater number of suppliers, retailers and SC members that are keen on using localization strategies in their specific areas to deal with SC risks and disruptions in the post-COVID-19 period (Sakthivel et al., 2021).

SC5 (0.046826) can help the products to keep a specified level of performance. The materials to be used in construction vary widely. As different storage conditions may be required for each material, it should be ensured that the necessary conditions are provided at site as well as in the manufacturer company so that materials do not get wasted.

SC4 can help suppliers to have more product information than their competitors. There is an inherent link between the sustainability concept and digital transformation, which increasingly becomes involved in all business domains, ranging from governance to operations (Bigliardi & Filippelli, 2022). Hermundsdottir and Aspelund (2021) asserted that consistent with the results of majority of the studies, firm competitiveness was affected positively from sustainability innovations. Furthermore, Yalabik and Fairchild (2011) stated that when there is competitive pressure from the market, environmental innovation is driven to a higher degree than regulations.

EMD7 (0.045005) can provide several advantages. For example, reducing CO2 emissions and global warming (Suhamad & Martana, 2020). From the sustainable development viewpoint, construction materials refer to the way resources are used effectively to fulfil the needs for and requirements of the current and future generations, while decreasing the damage caused to the environment (Rostami et al., 2015; Weißenberger et al., 2014).

EMD6 (0.042111) necessitates selection of appropriate suppliers. Taking precautions require improvement in the way technological and organizational solutions are developed for constructing urban environments with relatively few resources (Chebanova et al., 2019). Furthermore, the vital economic and technical indicators of buildings construction may be improved by ensuring the quality of construction objectives (Chebanova et al., 2019).

EMD2 (0.042102) can support achievement of sustainability. It is vital to use more recycled materials (Shooshtarian et al., 2020a). When recycled materials are used at any stage, the need to obtain new materials is decreased (Treloar et al., 2003). A reliable technique that is used for managing construction and demolition waste is waste recovery (Shooshtarian et al., 2020b). Using recycled materials in the CI can reduce the need for raw materials so that material depletion and other environmental issues can be reduced (Oyedele et al., 2014).

EMD4 (0.042008) can be a beneficial factor in the SC. When the supplier's location is close to the company, lower transport and delivery expenses can be incurred. Similarly, in case easily deformed product is supplied, a better option would be to source a supplier near the business so that the goods could be rapidly delivered (Factors Influencing Choice of Supplier, 2022).

## 6. Conclusion

This paper identified a preliminary list of lean and sustainability based supplier selection criteria to be considered in the supplier selection phase to support establishment of LSCSC. With this aim, following an in-depth literature review, four groups of four-stage Delphi surveys and the BWM have been applied. One of the most critical aspects of a successful construction project is the CSCM. Integration of lean and sustainable approaches to the construction SC can act as a key for the construction companies to get competitive advantage as it can support reduction in waste, elimination of waste of time, reduction in loss of money and lack of coordination and enhancement in effective use of resources and logistics. LSCSCM can support setting up an effective organization chart in the beginning of the construction project as it can support selection of suppliers.

SCPPs' top ten global weighted criteria in the descending order were determined as (Table 8): SC6; SC7; SC2; SC1; SC5; SC4; EMD7; EMD6; EMD2; and EMD4. Recommendations for application of these identified top ten global

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Rating	Top ten globa	l weighted criteria	Recommendations for application of criteria
Order	Criteria Code	Global weight	Road Map for Implementation
1	SC6	0.074868	While creating the supply chain, the lean and sustainable production capacity of the stakeholders should be considered.
			In case of poor performance in production (e.g., quality, and logistics),
2	SC7	0.059040	When selecting the supply chain suppliers, the production process of
2		0.000000	potential suppliers should be examined. Factors such as the source of
			raw materials, the waste generated in production, and the carbon
			footprint left should be evaluated.
3	SC2	0.054300	The supplier can be selected according to the optimum distance to be
			determined according to the climatic conditions in the region where the project is built Furthermore, the second tions and iting need to
			the project is built. Furthermore, the geographical conditions need to be considered for ease of transportation and the industrial production
			capacity conditions
4	SC1	0.050533	For rapid, reliable, flexible, and more cost-efficient product and
			service delivery, it is vital to consider selection of the local suppliers.
5	SC5	0.046826	To avoid the disruption risks of stored materials at the construction
			site, it can be ensured that the materials are not kept for a long time. In
			this case, from the contractor's point of view, lean production
			approaches and techniques such as Just in Time should be taken as a
			these approaches and techniques should be considered
6	SC4	0.045449	In order for the project to gain competitive advantage, suppliers should
-			be ready to adapt sustainability. This criterion can be included in the
			contract in order to monitor the practices in the SC process.
7	EMD7	0.045005	The supplier's materials must comply with the Sustainable and Green
			Material Certifications, and applied by adding related criterion to the
0	EMD6	0.042111	contract.
0	LIVIDO	0.042111	of the project in accordance with the region and its living conditions
			Likewise, it is important that the materials to be used are correctly
			determined at the design stage. (e.g., avoiding the selection of
			materials that will deform quickly in harsh weather conditions and
			difficult to logistics)
9	EMD2	0.042102	Depending on the product range of the supplier, it can be ensured that
			the products are partially or completely selected from recycled
			materials. This recycled material ratio can be determined through the
			established
10	EMD4	0.042008	Type of materials, the supplier location and the distance of logistics
			are important. The handling system details of delicate materials should
			be clarified. Qualifications of handling system requested by the
			contractor could be included in the contract.

*Table 8.* Recommendations for application of top ten weighted criteria obtained from BWM results in CI.

weighted criteria in CI are described in Table 9. All criteria are important for supplier selection to enhance LSCSCM performance (Table 8). Considering these criteria and using them in supplier selection as input to the decision process can support CI professional's decision-making process. With this roadmap, the selection process can be able to progress faster and result-oriented and support achievement of lean and sustainable chain establishment considering cost, time, performance, environment, and quality aspects. In addition to supplier selection, monitoring the performance of SC5, EMD7, EMD2 and EMD4 criteria throughout the SC process can contribute to the LSCSCM. Furthermore, criteria can be included in the contract to ensure that SC members comply with LSCSCM requirements. Similarly, SC4, EMD7, EMD2 and EMD4 can be qualified as criteria to be included in the contract.

Regarding SC6, the budget and timing of the project targets can be kept through deterrent sanctions on the stakeholders. Furthermore, in addition to budget, quality and time factors, environmental effects should be taken into account while creating the SC for SC7. Application of lean approaches in the production process can ensure that the environmental footprint is minimized. According to the SC2, the suppliers should be selected by determining the optimum distance based on the ease of transportation of the project location. For example, it can be possible to minimize disruption in the materials supply and labor due to the adverse weather conditions. Thus, time and financial losses can be avoided/reduced. SC1 mentioned that local suppliers should be given priority to take quick action in possible design changes during the construction process. It can have a positive effect in terms of communication and ease of control of the production process. Moreover, regarding SC5, construction site is a complex area where material circulation is intense. Materials delivered too early may be damaged, causing time and financial loss. Material and quality performance can be increased through JIT application. For SC4 criterion, selecting suppliers open to innovative practices (e.g., sustainability and lean) can contribute to the project. In each process where the supplier takes conscious action, the workload of the construction manager may decrease. Looking at the project profile, it can gain competitive advantage in CI. Selecting materials that comply with the Sustainable and Green Material Certification as mentioned in EMD7 can contribute to the competitive advantage. Furthermore, for EMD6, experienced suppliers who have done business in the same environment as the project location should be selected for the construction process and material procurement to progress in harmony. Thus, solution-oriented and fast material selection, application and supply can be supported. For EMD2, selecting a supplier that can make applications with partially recyclable materials in the project can support sustainability and competitive advantage. Finally, supplier location is an important EMD4 criterion for reducing logistics' carbon footprint. Materials' transport system selection can further contribute to this. Suppliers with environment-friendly packaging and planned delivery can minimize waste, unnecessary cost increases and environmental impacts.

Difficulties were encountered in this research. For example, difficulties encountered in BWM study were mainly due to participants' unfamiliarity with the method. Furthermore, the main limitation of this research is its focus on the supplier selection phase.

Project managers and construction executives may use this research results as an initial step to assess, track, and improve their SCs performance. This study has the significance of pioneering use BWM in the CI. Furthermore, it used Delphi survey and BWM successively. This study can provide a new perspective to academics and practitioners for understanding of how to further support LSCSCM. The implications of this paper can be used for future research. Furthermore, future researches are recommended to focus on the effects of adapting Industry 5.0 to the SC for lean and sustainable benefits on suppliers.

#### Acknowledgement

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## Appendices

Appendix A. Normality test, skewness and kurtosis results for Delphi Round 3 and 4.

	Tests of Normality							
	Kolmogo	rov-Smiri	nov	Shapiro-Wilk				
	Statistic	df	Sig.	Statistic	df	Sig.		
PHO1	.443	8	.000	.601	8	.000		
PHO2	.347	8	.005	.676	8	.001		
PHO3	.300	8	.033	.798	8	.027		
PHO4	.228	8	.200*	.835	8	.067		
PHO5	.391	8	.001	.641	8	.000		
PHO6	.513	8	.000	.418	8	.000		
PHO7	.391	8	.001	.641	8	.000		
PHO8	.228	8	.200*	.835	8	.067		
PHO9	.250	8	.150	.849	8	.093		
PHO10	.280	8	.065	.745	8	.007		
PHO11	.280	8	.065	.745	8	.007		

*Table A1.* Shapiro-Wilk test results for the Group PHO's Delphi Round 3.

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		Tests of Normality							
	Kolmogo	rov-Smirr	IOV	Shapiro					
	Statistic	df	Sig.	Statistic	df	Sig.			
PHO1	.301	8	.031	.782	8	.018			
PHO2	.263	8	.109	.827	8	.056			
PHO3	.263	8	.109	.827	8	.056			
PHO4	.250	8	.150	.849	8	.093			
PHO5	.263	8	.109	.827	8	.056			
PHO6	.455	8	.000	.566	8	.000			
PHO7	.391	8	.001	.641	8	.000			
PHO8	.263	8	.109	.827	8	.056			
PHO9	.455	8	.000	.566	8	.000			
PHO10	.300	8	.033	.798	8	.027			
PHO11	.250	8	.150	.849	8	.093			

 Table A2. Shapiro-Wilk test results for the Group PHO's Delphi round 4.

Table A3.	Skewness	and	kurtosis	normality	results	comparison	of the	Group	PHO's	rounds 3
and 4.				,		-		-		

		Roi	und 3	Rour	nd 4		
Criteria		Statistic	Std. Error	Statistic	Std. Error	Tabachnick (z value)	
PHO1	Mean	4.63	.263	4.25	.313		
	Std. Deviation	.744		.886			
	Skewness	-1.951	.752	615	.752		
	Kurtosis	3.205	1.481	-1.481	1.481	normai	
PHO2	Mean	4.38	.375	4.25	.250		
	Std. Deviation	1.061		.707			
	Skewness	-1.960	.752	404	.752	normal	
	Kurtosis	3.937	1.481	229	1.481	normai	
PHO3	Mean	4.38	.263	4.25	.250		
	Std. Deviation	.744		.707			
	Skewness	824	.752	404	.752	normal	
	Kurtosis	152	1.481	229	1.481	normai	
PHO4	Mean	4.13	.295	4.00	.267		
	Std. Deviation	.835		.756			
	Skewness	277	.752	.000	.752	normal	
	Kurtosis	-1.392	1.481	700	1.481	normai	
PHO5	Mean	4.63	.183	4.25	.250		
	Std. Deviation	.518		.707			
	Skewness	644	.752	404	.752	normal	
	Kurtosis	-2.240	1.481	229	1.481	normai	
PHO6	Mean	4.88	.125	4.75	.164		
	Std. Deviation	.354		.463			
	Skewness	-2.828	.752	-1.440	.752	normal	
	Kurtosis	8.000	1.481	.000	1.481	normai	
PHO7	Mean	4.63	.183	4.63	.183		
	Std. Deviation	.518		.518			
	Skewness	644	.752	644	.752	normal	
	Kurtosis	-2.240	1.481	-2.240	1.481	Z value (-1.51)	
PHO8	Mean	4.13	.295	4.25	.250		
	Std. Deviation	.835		.707			
	Skewness	277	.752	404	.752	normal	
<b>B</b> ITO 0	Kurtosis	-1.392	1.481	229	1.481		
РНО9	Mean	4.00	.267	3.75	.164		
	Std. Deviation	.756		.463			
	Skewness	.000	.752	-1.440	.752	normal	
<b>DUO10</b>	Kurtosis	700	1.481	.000	1.481		
PHOIO	Mean	4.25	.366	4.38	.263		
	Std. Deviation	1.035	750	./44	750		
	Skewness	-1.6/5	./52	824	./52	normal	
DUC11	Kurtosis	3.136	1.481	152	1.481		
PHOTI	Mean	4.25	.366	4.00	.267		
	Std. Deviation	1.035	750	./50	750		
	Skewness	-1.675	./52	.000	./52	normal	
	Kurtosis	3.130	1.481	/00	1.481		

		Tests of Normality							
	Kolmogo	rov-Smirn	IOV	Shapiro-Wilk					
	Statistic	df	Sig.	Statistic	df	Sig.			
EMD1	.371	8	.002	.724	8	.004			
EMD2	.281	8	.062	.809	8	.036			
EMD3	.281	8	.062	.809	8	.036			
EMD4	.263	8	.109	.827	8	.056			
EMD5	.301	8	.031	.782	8	.018			
EMD6	.301	8	.031	.782	8	.018			
EMD7	.347	8	.005	.676	8	.001			
EMD8	.327	8	.012	.810	8	.037			

Table A4. Shapiro-Wilk test results for the Group EMD's Delphi round 3.

Table A5. Shapiro-Wilk test results for the EMD's Delphi round 4.

	Tests of Normality					
	Kolmogo	rov-Smirn	IOV	Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
EMD1	.435	7	.000	.600	7	.000
EMD2	.296	7	.063	.840	7	.099
EMD3	.338	7	.015	.769	7	.020
EMD4	.504	7	.000	.453	7	.000
EMD5	.360	7	.007	.664	7	.001
EMD6	.504	7	.000	.453	7	.000
EMD7	.338	7	.015	.769	7	.020
EMD8	.258	7	.174	.818	7	.062

*Table A6.* Skewness and kurtosis normality results comparison of the Group EMD's Delphi rounds 3 and 4.

		Round 3		Rour	nd 4	
Criteria		Statistic	Std. Error	Statistic	Std. Error	Tabachnick (z value)
EMD1	Mean	4.50	.267	4.43	.369	
	Std. Deviation	.756		.976		
	Skewness	-1.323	.752	-1.230	.794	normal
	Kurtosis	.875	1.481	840	1.587	normai
EMD2	Mean	4.13	.398	3.86	.261	
	Std. Deviation	1.126		.690		
	Skewness	-1.113	.752	.174	.794	normal
	Kurtosis	.291	1.481	.336	1.587	normai
EMD3	Mean	4.13	.398	3.57	.297	
	Std. Deviation	1.126		.787		
	Skewness	-1.113	.752	1.115	.794	normal
	Kurtosis	.291	1.481	.273	1.587	normai
EMD4	Mean	4.25	.250	4.14	.143	
	Std. Deviation	.707		.378		
	Skewness	404	.752	2.646	.794	Mat a surveil
	Kurtosis	229	1.481	7.000	1.587	Not normal
EMD5	Mean	4.25	.313	4.57	.202	
	Std. Deviation	.886		.535		
	Skewness	615	.752	374	.794	normal Z value (-1.76)
	Kurtosis	-1.481	1.481	-2.800	1.587	
EMD6	Mean	4.25	.313	4.71	.286	
	Std. Deviation	.886		.756		
	Skewness	615	.752	-2.646	.794	Not normal
	Kurtosis	-1.481	1.481	7.000	1.587	
EMD7	Mean	4.38	.375	4.43	.297	
	Std. Deviation	1.061		.787		
	Skewness	-1.960	.752	-1.115	.794	normal Z value (-1.51)
	Kurtosis	3.937	1.481	.273	1.587	
EMD8	Mean	4.13	.227	4.14	.340	
	Std. Deviation	.641		.900		
	Skewness	068	.752	353	.794	normal Z value (-1.14)
	Kurtosis	.741	1.481	-1.817	1.587	

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	Tests of Normality					
	Kolmogo	rov-Smiri	nov	Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PR1	.245	9	.127	.825	9	.039
PR2	.259	9	.083	.844	9	.065
PR3	.298	9	.020	.752	9	.006
PR4	.414	9	.000	.617	9	.000
PR5	.223	9	$.200^{*}$	.838	9	.055
PR6	.272	9	.054	.805	9	.024
PR7	.278	9	.044	.833	9	.049
PR8	.389	9	.000	.728	9	.003

Table A7. Shapiro-Wilk test results for the Group PR's Delphi Round 3.

Table A8. Shapiro-Wilk test results for the Group PR's Delphi Round 4.

	Kolmogo	rov-Smirr	ıov	Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PR1	.298	9	.020	.752	9	.006
PR2	.271	9	.056	.816	9	.031
PR3	.351	9	.002	.781	9	.012
PR4	.351	9	.002	.781	9	.012
PR5	.223	9	$.200^{*}$	.838	9	.055
PR6	.245	9	.127	.825	9	.039
PR7	.269	9	.059	.808	9	.025
PR8	.351	9	.002	.781	9	.012

 Table A9.
 Skewness and kurtosis normality results comparison of the Group PR's Delphi

 Rounds 3 and 4.

<u> </u>		Round 3		Rou	ind 4	Tabachnick
Criteria		Statistic	Std. Error	Statistic	Std. Error	(z value)
PR1	Mean Std. Deviation	4.11 1.054	.351	4.22 .972	.324	
	Skewness	-1.094	.717	.000	.752	normal
	Kurtosis	.611	1.400	-2.800	1.481	Z value (-1.89)
PR2	Mean	4.00	.373	3.78	.434	
	Std. Deviation	1.118		1.302		
	Skewness	690	.717	354	.717	normal
	Kurtosis	800	1.400	-1.806	1.400	Z value (-1.29)
PR3	Mean	4.22	.324	2.22	.401	
	Std. Deviation	.972		1.202		
	Skewness	-1.600	.717	68	.752	1
	Kurtosis	3.194	1.400	.741	1.481	normal
PR4	Mean	4.33	.167	4.11	.200	
	Std. Deviation	.500		.601		
	Skewness	.857	.717	.018	.717	
	Kurtosis	-1.714	1.400	1.126	1.400	normal
PR5	Mean	4.11	.261	3.89	.261	
	Std. Deviation	.782		.782		
	Skewness	216	.717	.216	.717	normal
	Kurtosis	-1.041	1.400	-1.041	1.400	
PR6	Mean	4.33	.236	4.11	.351	
	Std. Deviation	.707		1.054		
	Skewness	606	.717	-1.094	.717	
	Kurtosis	286	1.400	.611	1.400	normai
PR7	Mean	4.00	.236	4.22	.278	
	Std. Deviation	.707		.833		
	Skewness	.000	.717	501	.717	normal
	Kurtosis	286	1.400	-1.275	1.400	
PR8	Mean	4.00	.289	4.11	.200	
	Std. Deviation	.866		.601		
	Skewness	-1.485	.717	.018	.717	normal
	Kurtosis	4.000	1.400	1.126	1.400	normai

	Tests of Normality						
	Kolmogo	rov-Smirr	lov	Shapir			
	Statistic	df.	Sig.	Statistic	df	Sig.	
SC1	.261	12	.023	.845	12	.032	
SC2	.237	12	.061	.891	12	.123	
SC3	.316	12	.002	.802	12	.010	
SC4	.296	12	.005	.818	12	.015	
SC5	.302	12	.003	.835	12	.024	
SC6	.309	12	.002	.768	12	.004	
SC7	.300	12	.004	.809	12	.012	

Table A10. Shapiro-Wilk test results for the Group SC's Delphi round 3.

Table A11. Shapiro-Wilk test results for the Group SC's Delphi Round 4.

	Tests of Normality						
	Kolmogo	orov-Smirr	nov	Shapiro-Wilk			
	Statistic	df	Sig.	Statistic	df	Sig.	
SC1	.166	12	$.200^{*}$	.876	12	.078	
SC2	.245	12	.044	.895	12	.137	
SC3	.323	12	.001	.780	12	.006	
SC4	.323	12	.001	.780	12	.006	
SC5	.358	12	.000	.813	12	.013	
SC6	.354	12	.000	.732	12	.002	
SC7	.258	12	.026	.818	12	.015	

*Table A12.* Skewness and kurtosis normality results comparison of the Group SC's Delphi Rounds 3 and 4.

0.1		Rou	ind 3	Roi	ind 4	Tabachnick
Criteria		Statistic	Std. Error	Statistic	Std. Error	(z value)
SC1	Mean	3.75	.305	3.50	.337	
	Std. Deviation	1.055		1.168		
	Skewness	.035	.637	.000	.637	normal
	Kurtosis	-1.399	1.232	-1.428	1.232	
SC2	Mean	3.83	.271	3.58	.288	
	Std. Deviation	.937		.996		
	Skewness	412	.637	274	.637	normal
	Kurtosis	298	1.232	654	1.232	
SC3	Mean	3.33	.310	3.25	.179	
	Std. Deviation	1.073		.622		
	Skewness	275	.637	170	.637	
	Kurtosis	-1.472	1.232	091	1.232	normal
SC4	Mean	4.08	.260	4.25	.179	
	Std. Deviation	.900		.622		
	Skewness	-1.082	.637	170	.637	
	Kurtosis	1.492	1.232	091	1.232	normal
SC5	Mean	3.50	.417	3.42	.336	
	Std. Deviation	1.446		1.165		
	Skewness	866	.637	-1.003	.637	normal
	Kurtosis	474	1.232	.190	1.232	
SC6	Mean	4.42	.193	4.50	.195	
	Std. Deviation	.669		.674		
	Skewness	735	.637	-1.068	.637	
	Kurtosis	190	1.232	.352	1.232	normal
SC7	Mean	4.08	.193	4.17	.207	
	Std. Deviation	.669		.718		
	Skewness	086	.637	262	.637	
	Kurtosis	190	1.232	685	1.232	normal

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## Residential mobility of suburban households under the unforeseen impacts of large-scale projects in Istanbul

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#### Abstract

The purpose of this study is to investigate the determinants of residential mobility in the event of unforeseen effects of new developments referring to household vulnerability. Each household has experienced mobility according to its own assessment of housing and residential environment. This sort of mobility is the result of a mismatch between a household's current residence and their expected living environment. Fluctuations in land value changes and neighbourhood rezoning among many consequences of new residential developments lead to forced mobility in the neighbourhood. Göktürk, one of the most important peripheral residential districts in Istanbul, is surrounded by ongoing developments as well as the presence of informal settlements with expanding gated communities. Therefore, the socio-demographic characteristics of households, as well as their housing status and environment, are applied to determine the probability of household vulnerability. This study is based on primary data, which was collected directly from a designed survey of 210 households in this neighborhood. Furthermore, Binary Logit Regression is used to identify the vulnerability of households exposed to forced mobility. According to the findings of the study, the location, households' dimensions, middle and low income groups, and insurance ration are significant predictor variables in residential mobility. Another finding of this study is that the probability of vulnerability is assigned to each household in the event of unforeseen effects of large-scale projects. This study contributes to addressing the issue of prospective mobility of households in a peripheral district of Istanbul City by taking into account the probability of their vulnerability.

#### Keywords

Binary logit regression, Household, Land value, Residential mobility, Vulnerability.

#### 1. Introduction

Large-scale urban transformation projects have been underway in Istanbul for almost 40 years, but there have been ongoing difficulties with the financing system, technical construction principles, urban planning laws, and the eviction of the urban poor. Among other issues in these projects' planning and implementation processes, the routes and locations of these projects are incompatible with urban plans and environmental regulations. The abovementioned projects, also recognized as UTPs (urban transformation projects), actually imposed a mechanism on the urban land market in Istanbul that the first victims were households in informal settlements, whether or not they had title deeds (Kuyucu & Ünsal, 2010; Doğan & Stupar, 2017). Since the 1980s, the relocation of the urban poor from city centers to remote areas such as the countryside to reconstruct the image of Istanbul city, following prescribed globalization rules and guidelines while disregarding local living conditions, has resulted in a chain of tragedies in Istanbul's urban planning system (Yıldız, 2004; Kuyucu & Ünsal, 2010).

According to globalization theory, the so-called global countryside is created when differentiating geographies with changing degrees are connected to the global network through place reconstitution. Differential outcomes resulting from local interactions define the extent and patterns of reconstitutions. In the event of poor urban governance, global countryside areas are exposed to unforeseen and uncertain opportunities that can turn into threats and weaknesses. For urban developers, such areas are the main targets for developing residential and commercial projects to engage in the globalized economy and commercial exploitation (Matusitz, 2010; Welsh & Heley, 2021; Woods, 2007). Relying on documented experiences, such reconstitutions violate environmental resources and urban poor rights (Kuyucu, 2014, 2017; Eren, 2019).

The conflict between large-scale project developers and the vulnerable group is more severe in some cases and

more peaceful in others since the result is the same (Yıldız, 2004; Kuyucu & Ünsal, 2010). Because, under the banner of neoliberalism, the beneficiaries of UTPs are urban developers, speculators, and households that are economically stronger (due to the duplication of their property values). Since these projects were early-return investments, the location selection was more noticeable for central government and developers than providing advocacy plans for the urban poor living in the target sites. Therefore, the urban poor is considered as a vulnerable group in this reinterpretation of socioeconomic separation (Eren, 2019; Dogan & Stupar, 2017).

There is some confusion in the debate about the definition of vulnerable in this article, which mainly refers to one type of vulnerability. The vulnerable variable in this discussion comprises households that encounter difficulties once they are forced to leave their current housing and are also at risk of eviction due to their socioeconomic and locational circumstances.

The experience of the Ayazma and Tepeustu regions, and the forced relocation of its poor residents with low-income levels, large average households size, and relocation away from their workplaces (factories and industrial centers) are among the first examples that detected the characteristics of vulnerable households (Kusucuoglu, 2010; Uzunçarşi, 2016).

Another concept used by this study is the vulnerable residential environment, which refers to areas in informal settlements, worn-out dwellings enclosed between newly built luxury residential projects (apartments) and gated communities, and also areas with high housing and land market dynamics. Forced evictions occur in such an environment that possesses the aforementioned features.

The Göktürk district in Istanbul, one of Turkey's most significant metropolitan areas, is chosen as an example location because it is thought to be particularly vulnerable to such changes in the greater Istanbul area. This means that the city's urban areas frequently present considerable uncertainties for residential construction. The neighborhood is surrounded by two largescale projects and is located in a protected forestry area. Having informal settlements attached to it, as well as a suitable housing and land market due to the presence of new groups of demanders (employees in international airport companies, employees, pilots, and so on), Göktürk was chosen as a proper case for the current study. Ignoring the monitoring of the development process of the specified projects in this area can result in serious threats such as the presence of land speculators seeking profit and the emergence of new informal settlements in forestry areas (Figure 1).

The spatial-physical changes in the areas adjacent to Sabiha Gokcen Airport demonstrate the importance of addressing the Göktürk neighborhood concerning the construction of largescale projects such as the airport. One of the effects of the construction of Sabiha Gokcen and Ataturk airports on urban development is that workers at these two airports choose the nearest neighborhood for their residences. Before the construction and opening of Sabiha Gokcen Airport (2001), the neighborhood's building and population density was low, and the price of urban land and accessibilities in this neighborhood were reasonable. Following the launch of this project, the construction of communication roads, urban density, job opportunities, and demand for residential unit construc-



*Figure 1.* Location of case study and large-scale projects (Göktürk).

tion accelerated (Karaca, 2015; Özcan & Gündoğar, 2015). Scholars in socio-politics and urban planning have always attempted to address the issue of pressure on low-income households and their eviction from their dwellings in a supportive manner (Kuyucu & Ünsal, 2010; Kuyucu, 2014, 2017). However, this study aims to take a practical step toward overcoming this issue.

The current study attempts to investigate the determinants of residential mobility in the event of unforeseen effects of new projects (Third Highway Ring -Kuzey Marmara Otoyolu, the new airport, and Canal Istanbul, which will connect the Black Sea with the Marmara) emphasizing vulnerable households.

In the following debates, the neighborhood of Göktürk is analyzed using variables derived from residential mobility literature and the binary logit regression. BLR has been utilized in light of the current study's strategy, which bases residential mobility on a dual status (move or stay). Furthermore, the vulnerable degree of location is defined by fluctuations in land values and features of residential quarters.

## 2. Literature review: Residential mobility and households' vulnerability

Individuals and households have a wide range of options and degrees of mobility depending on the prevailing circumstances, including life events and cycles and the economic, political, social, and environmental impacts. Mobility is defined as "whether or not a move occurred," and it is an action taken by people who can and are motivated to change their circumstances (Teater, 2009).

Newton and Bell (1996) provide an in-depth analysis of mobility due to spatial characteristics of physical locations from the perspective of social justice. According to their research, insufficient government policies regarding the land housing market process result in inequalities in access to services and benefits obtained from urban reconstitutions in terms of the income distribution. Because the positive and negative features of urban areas influence household income, vulnerability is felt

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strongly in low-income households as a result of the interaction between social justice, location, and population movement in the countryside. (Newton & Bell, 1996; Wulff & Newton, 1996).

It should be noted that there are winners and losers during the mobility process since opportunities to move to suitable housing are not equally distributed to dwellers (low and middle-income families). Moreover, in most cases, movement worsens their situations due to external conditions (Wulff & Newton, 1996; Barnhardt & Barnhardt, 2016). According to Wulff and Newton (1996), The decision-making process behind mobility is best comprehended as a continuum ranging from voluntary to forced moves (Wulff & Newton, 1996).

Due to McAuley and Nutty (1982), the requirements for individuals and families depend on the present life-cycle stage, dwelling size, neighborhood amenities, school quality, proximity to businesses or services, employment opportunities, and climate (McAuley et al., 1982).

Residential mobility is influenced by changes in the family life cycle (Mc-Carthy, 1976), as well as the housing needs and consumption opportunities of households in response to changes in their circumstances. Affecting residential mobility, life courses, and life cycle concepts emerged as supportive tools that distinguish mobility patterns and interpret probable household reactions to external changes (Clark & Onaka, 1983; Catte et al., 2004). According to this approach, when there is a mismatch between the housing characteristics and the family's requirements and preferences, the household is prompted to move to adjust its housing and needs. Rossi's (1955) research of "household mobility between Philadelphia neighborhoods" up until the mid-1980s is where the life-cycle notion in the residential mobility approach first developed (Jones & Wenning, 2005). (Morris, 2017; Rabe & Taylor, 2009; Anderson et al., 2014; Sánchez & Andrews, 2011; Morrow-Jones & Wenning, 2005; Warner & Sharp, 2016).

The other perspective, life-course, which has become the dominant model in mobility studies since 1980, is traced back to Rossi's pioneering work in sociology and developmental psychology (Withers, 1997). The theory's core premise emphasizes how a nuclear family, as one of the several socially constructed institutions, influences individual life. In the early studies for life course, a family is not the only major life institution in which people participate, but other events such as life course components (such as housing career, main events, occurrences from education, family formation, and career decisions) are also interrelated (Jones & Wenning, 2005).

The relationship between mobility and life courses and cycles has significant implications because when external shocks are experienced by households at different stages of their life cycle, whether they are nearing the end or just starting, they will react differently. (Coulombel, 2010). Their reactions to shocks such as abrupt development projects may be welcoming, resistive, or interactive (Kuyucu & Ünsal, 2010; Ronquillo, 2014; Coulombe, 2010),

The next subject concerning residential mobility is the cost of living, associated with household income, which drives this study to migration pattern followed by the discussion of the life course as the movement of people between regions and within cities is examined via migration (Cadwallader, 1985). According to Da Vanzo, 1978, who investigated micro-level data, the unemployed are more inclined to move than the employed (Fischer & Nijkamp, 2014).

It can be argued that remote working, which has gained widespread attention during the global pandemic of COVID-19, could not significantly affect avoiding the potential threats to evictions of urban poor people because of structural socioeconomic gaps between those who can and cannot work remotely. Households with low socioeconomic status are employed in jobs that are categorized as elementary and service jobs and require armed forces. According to the International Standard Classification of Occupations (ISCO), the abovementioned jobs are at skill level 1 and are considered simple and manual tasks. This skill level requires merely a basic level of education and physical strength. House and office cleaning, kitchen assistance, skilled agricultural, gardening, forestry, sales, and specialized workers are among the occupations that frequently provide services to residents of other areas (International Labour Office, 2012; Cetrulo, 2021; Tronco Hernandez, 2020).

Migration is also classified into two types, short and long-distance moves. Life cycle, accessibility, and housing choice reasons prevail in short-distance moves, whereas employment reconsiderations dominate in long-distance moves (Hedman, 2011). The mobility that occurs within an area is termed short-distance moves. Local movers do not pass any administrative boundaries. Such mobility depends on the satisfaction of the housing environment (such as local housing markets and accessibility) and family circumstances (e.g., life-cycle). Due to interstate-scale mobility and dependence on employment opportunities, long-distance moves occur less frequently than short-distance moves. While comparing the difficulty of long and short-distance moves, the former is regarded as a lifetime decision (Clark & Onaka, 1983; Kang et al., 2012; Morrison et al., 2003). The dynamics of local and short-distance migration have emphasized the dissatisfaction or relocation behavior induced by both family circumstances and the housing environment or the stress created by the provision of government services and developers' privileges (Hedman, 2011). In other words, mobility is imposed on households as a result of abrupt changes which are beyond their control and are rooted merely in metropolitan economic policies (Steinbrink, 2013; Kusucuoglu, 2010; Uzunçarşi, 2016).

In conclusion, a household's monetary and non-monetary resources, such as income, life stage, tenure situation, neighborhood status, and others, which change over time, determine a household's intention to move either directly or indirectly. In addition, individual characteristics such as employment, education, socioeconomic position, cultural and social preferences, migration intentions, destination, and origin households are all significant in moving up the neighborhood ladder (McAuley et al., 1982; Hedman, 2011). On the other hand, the housing market's dynamics and the stages of a household's life cycle could potentially modify the housing characteristics (Clark & Onaka, 1983; Henley, 1998). Space of housing units and Household size are significant reasons for moving, as larger families require more space, while smaller families are compelled to migrate due to the lack of available space (Rossi, 1955; Speare et al., 1975; Clark & Onaka, 1983). In the context of the combined discussion of income and life cycle measures, the income variable has less influence on migration forecasting for the retired population (Cadwallader, 1985). Family ties and work security are likely to be more significant for older people, thus reducing their motivation to move (Cadwallader, 1985; Clark & Lierop, 1987; Eluru et al. 2009; Hedman, 2011).

The abovementioned variables will be covered in more detail in the following discussion, along with their correlations with each other to determine how vulnerable households can be.

## 2.1. Determinants of households' vulnerability in residential mobility

Residential mobility theories link household behavior (family stability, neighborhood quality) to (re)produce spatio-temporal structures. In contrast, socio-economic and the microgeographies of the neighborhood, which act as a structuring engine, influence household mobility (Bruch & Mare, 2012). The analyses under this theory are designed to predict household mobility based on their characteristics and neighborhood quality. Binary Logistic Regression has been applied in this study since the outcome is modeled based on whether they move or not.

Logistic regression is efficient to investigate the relationship between household vulnerability, socio-demographic characteristics, and neighborhood features. When a researcher needs to model the relationship between one or more predictor variables and a dichotomous dependent variable, binary logistic regression (BLR) is preferable. The issue can be addressed by estimat-

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ing the probability that a case will fall into one of two categories based on the dependent variables provided by the model's predictors. BLR estimates regression parameters by taking into account the fact that probabilities are limited to 0 and 1. Additionally, it does not assume that residuals have a normal distribution and constant variance (Tabachnick & Fidell 2007).

Before defining the dependent variable and employing a binary model, the paper assesses a household's vulnerability to unforeseen changes in development based on socioeconomic circumstances. This evaluation is necessary because it identifies vulnerable households who are more likely to encounter eviction from their dwellings.

According to related research, being single or cohabiting influences residential mobility because singles seek new opportunities and couples expect no changes (Dane et al. 2014). Single-person households, whether elderly or young, and single parents with schoolaged children affect residential mobility badly (Parkes et al. 2002).

Marriage and having children necessarily entail more space, while a divorce or any other type of family dissolution necessitates moving into a smaller home with adult children (Eluru et al. 2009; Rabe & Taylor 2009v; Heppenstall et al. 2011). Families with children might require a smaller home after their children marry or, depending on their culture, seek a large house. Due to their dependence on the schedules and locations of their children's activities, families with school-aged children are less likely to move. Another significant variable that influences the intention to move is higher education, which generates more job opportunities and higher earning potential (Dane et al. 2014). Households can consider more options for mobility if they have the chance to work in higher economic positions (Böheim & Taylor, 1999). Households have varying propensities to move depending on their income level. High-income households are hesitant to relocate because they frequently live in homes that they have chosen from a variety of options based on criteria other

than price. Depending on their other economic characteristics, people in the middle class are hesitant to move. Since living to them merely means shelter of the lowest standards, low-income people frequently move (Dane et al. 2014). Therefore, the determinant factor affecting land values is the location of dwellings, as residents of higher-valued areas are less likely to move to new homes (Fernandez-Duran et al. 2011). So, families with elementary or illiterate levels of education in Göktürk are vulnerable to abrupt development changes due to fewer opportunities to find new jobs.

The other factor that must be taken into account when estimating a family's intention to move is the disproportion between household size and dwelling space (Sánchez & Andrews, 2011; (Kelley, 1980).

Regarding the preceding statements, single-person households and households with home mates would be classified as vulnerable people. Other variables that influence household relocation encompass work type and insurance status. Households who work informally and without insurance may encounter difficulties with the unforeseen effects of physical adjustments. Households with low incomes and those earning less than the minimum wage (according to Turkish labor law) are considered vulnerable (Agarwal et al., 2022). Additionally, in the event of a significant urban transformation, people with Yeşil Cards, no insurance at all, or who are covered by a family member's insurance are all at risk of being evicted.

Tenant households and families with numerous children are also vulnerable (Theodos & Mctarnaghan, 2018). According to the EU standard for housing space per person (Appolloni & D'alessandro, 2021), households' intention to move may increase if there is an insufficient proportion between the dwelling space and the size of their households.

The living environment quality is determined by the location of the dwelling, as households living in informal settlements (Gecekondu) or besieged by such areas are considered vulnerable in terms of the land val-

*Table 1. Definition of household's vulnerability variables.* 

Variable	Description			
Elderly ration	Home mate			
(Life-cycle stage)	One-Single households (Elderly or Young)			
	Elderly couples no child			
	Elderly couples with little child			
	Elderly couples with adult & little child			
Having schooling child	Age <15			
Informal Job	Farmer			
	Seasonal worker			
	Irregular unskilled jobs			
	Unpaid family work			
Income	Low income group			
	Salary <minimum in="" td="" turkey<="" wage=""></minimum>			
Insurance type	Yeşil card, No insurance, Benefited from one			
	of the family members			
Education Level	Illiterate, elementary level			
Dwelling Tenure	Rent, Family			
Housing space per person	<42.56 m2 (EU standard)			
Location	Squatter settlements (gece kondu), apartments,			
	residential projects. Gated communities			

ue and the quality of their residential environment. Built on the lands, with or without official titles, without building permits, considered an extraneous economic market, belong to the state, their dwellers are developers and hold use value, so-called informal settlement (Gecekondu). It must be noticed that informal settlement in Istanbul dates back to the early 1950s and is recognized because of industrialization and subsequent rapid urbanization. Formed close to the factories and workplaces, informal settlements are the aftermaths of poor urban governance of Istanbul's massive rural immigration wave (Şentürk, 2013; Sezer, 2017; Turgut Yildiz, 2004).

The abovementioned properties are the outputs of the selected model due to specified independent and dependent variables. They are merely related to the socioeconomic status of the residents, such as working in the informal sector because of their education level, having large households, etc., and living in areas with land value fluctuations. Vulnerable households exposed to the unforeseen effects of large-scale projects are assumed to be classified based on their socioeconomic characteristics, as shown in Table 1.

#### 3. Methodology

This paper discusses the findings of a model for households exposed to unforeseen development effects based on 2019 survey data collected in a spatial sampling model that depicts the residential mobility pattern of all income group households in the case study. This survey covers 210 cases to investigate the characteristics of Göktürk neighborhood residents. The questionnaire is divided into two sections that assess households' socioeconomic characteristics and their satisfaction with the physical qualities of their neighborhood. The Pearson chi-square test is utilized to investigate the relationship between the socioeconomic characteristics of a household and the dependent variable, which is supposed to be applied in a binary logit model.

The validity of the extracted models is examined using tests such as Chisquare (Omnibus, Hosmer, and Lemeshow) and values of -2 Log-likelihood. Two factors are utilized for spatial sampling in the case study that contributes to defining the dependent variable (vulnerability of the residential environment). First is the geographic distribution of neighborhood fragments in Göktürk (informal settlements, Kemer country, 2B lands, apartments, and new residential projects), and second is land value fluctuation between 2004 and 2018. Gece Kondu refers to settlements inhabited by low-income households, whereas Kemer Country includes high-income households living in gated communities (Figure 2). It should be noted that the term "2B lands" was derived from the "B" clause of Article 2 of the 1987 Forest Law No. 6831. According to the Article 2B clause, lands that have lost their forest character since October 31, 1981, and have been determined to be suitable for other agricultural purposes should be excluded from the forestry lands (URL 1).

By assigning weights to the variables of both factors on a Likert scale ranging from 3 to 9 and then overlaying them, a map of subareas is produced that defines the specific level of environmental vulnerability for each household's location. This map provides a base for randomly choosing 210 samples from the categorized subareas of Göktürk. Weights are assigned to variables 3 to 9 respectively, Kemer country to informal settlements for neighborhood segments, while for land values, 3 belongs to areas with zero or at most one change in the value and 9 refers to more than three times the change in value.

In this study, since residential mobility is being analyzed in a dichotomy state (resistant =stay, vulnerable=ex-

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Table 2. Data, methods, and outcomes.

Data gathering	Data ana	alysis method	1 Minutes and			
method	Method Platform		Achievement			
land use (2006, 2013, 2018)	Spatial analysis GIS-Molusce		Homogenous residential sub-areas			
Land taxation value (e-devlet) (2004 to 2018)	Land value prediction	GIS-Kriging- Recalssify- Overlay	Assigning grades into the dummy variable of vulnerability and resistancy to move (or force to move) to another residence			
		Regression analysis	Vulnerability of built-up environment (graded map)			
Households survey	Binary logit regression		Probability of households vulnerability			
	Descriptive analysis	SPSS- Pearson, Chi-square test/ logistic regression	Definition of variables dependence into vulnerability (households profile), (socio- economic features), grades (0-9)			

posed to mobility), the most appropriate method is Binary Logit Regression.

To define the vulnerable areas to the unforeseen effect of large-scale projects, the following steps are taken (Table 2).

#### 4. Case study

Göktürk is a neighborhood in the northern periphery of Istanbul. In 1986, it was a small village where the main activities of its inhabitants and were agriculture livestock. However, with the establishment of Göktürk municipality in 1994, it gradually transitioned into an urban neighborhood (Rieniets & Esen, 2016). This neighborhood is divided into four sub-areas, which include 2B lands, gated communities, newly constructed apartments, and informal settlements (Eyup Municipality, 2014). The areas surrounding new apartments and housing developments are a mix of run-down apartments from the neighborhood's early development and newly constructed luxury apartments in the last ten years. Between 2000 and 2018, the neighborhood experienced nearly fourfold population growth (8383 to 36811). The greatest increase in population growth between 2007 and 2015. (16085 to 34976) -(Figure 3). In terms of land value fluctuations, during the years 2004 and 2018, on average, land values have grown by about 48 times across the neighborhood. In these years, there were three distinct periods of abrupt value increases: 2005-2006, 2009-2010, and 2017-2018-(TÜİK, 2000-2018; URL 2) -(Figure 4).

By examining the diagrams of population and land values, it is clear that the population in this neighborhood nearly doubled shortly after the increase in land prices. This increase in land value and population has occurred between the years of approval and implementa-



Figure 2. Layers of factors.



Figure 3. Population changes.



Figure 4. Land value changes.

tion of large-scale projects. The population of Göktürk has multiplied which has increased the demand for housing from workers at the new airport and driven up land prices in three stages.

Furthermore, this neighborhood is bordered by three large-scale urban projects: the third airport, canal Istanbul, and the Marmara motorway- (Sari, 2016). The development of Göktürk can be seen as a multifold increase in

Independe	ent variables	Crosstab coefficient indexes	Pearson Chi- Square	Cramer's V
	Having a schooling	Value	10.343	.222
	childern	Р	0.016	.016
		Value	9.197	.210
	Elderly ratio	Р	0.056	.056
	-	Value	3.475	.129
	Illiterate ration	Р	0.747	.747
		Value	10.64	.226
	Household's size	Р	0.059	.059
Socio-economic	T	Value	4.845	.152
characteristics	1 enure status	Р	0.089	.089
	•	Value	15.018	.268
	Income	Р	0.002	.002
	7.0 I'I	Value	0.147	0.027
	informal job	Р	0.702	0.702
	Insurance type	Value	22.407	0.327
		Р	0.021	0.021
	Living years in	Value	40.126	.438
	current housing	Р	0.02	.021
Dwelling	TT -	Value	54.843	.512
features	Housing per space	Р	0.002	.002
Residential	Terretion	Value	16.837	.284
environment	Location	D	0.00	000

**Table 3.** Variables included in the binarymodels.

population and, as a result, an increase in housing demand from employees working at the new airport, as well as a three-stage increase in land prices and new roads.

This discussion will be covered in sufficient depth in the following sections.

#### 5. Result and discussion – households' vulnerability model to unforeseen effects of large-scale projects in Göktürk, Istanbul

Defining a specific variable is required for this study to utilize the binary model. The dependent variable is determined by the level of vulnerability of the subareas in which the household resides (Location). This section discusses the specifics of defining this variable from the residential environment and socioeconomic factors, as well as determining their degrees in the proposed models.

## 5.1. Dependent variable for depicting the vulnerability degree

The vulnerability degree of the built-up area is utilized to define this variable, specifically through fluctuations in land values from 2004 to 2018 (Nasrollahzadeh & Koramaz, 2021) and zoning of residential neighborhoods. Within the utilization of land price changes over time and residential features of the site, subareas are significantly specified, with degrees greater than the threshold (degree=6) as vulnerable (affective status to unforeseen impacts) and degrees less than that as resistant (resistant to unforeseen effects) (stable

to any socio-physical development shocks). The value allocation logic of BLR is used to define the vulnerability threshold value. As a result, the threshold is defined as a moderate value (degree 6) between '3' (the lowest) and '9' (the highest) (degree 6). There are mutual relations between changes in land values and economic characteristics of households, as well as residential zoning and social household characteristics. So the vulnerable variable derived from the preceding discussion is employed in the binary logit model.

Cross-analysis and the chi-square test are used to examine its dependence on other independent variables referring to households' socioeconomic circumstances. Independent variables with significant and non-significant dependence on household vulnerability were investigated in order to define different models using binary logit analysis to extract significant factors indicating highly exposed families to the unforeseen effects of large-scale projects.

According to Table No. 3 Cramer's V test, some variables have greater severity of dependence than the rest, such as having a school-aged child, household size, income, income, insurance type, living years in current housing, housing per space, and location (Table 3).

#### 5.2. Probability of residential mobility based on households' vulnerability

Household vulnerability (more exposed to unstable environmental status) is declared as a categorical variable in the binary logit analysis, while the dependent variable is vulnerable or resistant; "Vulnerable" is chosen as the reference category.

Vulnerable: '1', Resistant: '0', and '1' refer to households that are more likely to be relocated based on their vulnerability degree derived from their environmental circumstances (as the overlay of vulnerability degree to largescale project effects and the types of the neighborhood in Göktürk - (Figure 5).

In the first model, the factors obtained from the regression model (Table 3) are assumed to distinguish the vulnerability of households exposed

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*Table 4. Significant variables in the equation.* 

Predictor	в	S.E.	Wald	df	Sig.	Exp(B )	95% C.I.for EXP(B)	
							Lower	Upper
Insurance ration	1.768	1.122	2.484	1	.115	5.857	.650	52.773
Income (Middle)			10.79 9	2	0.13			
Income (1) (High)	1.250	.568	4.839	1	.028	3.492	1.146	10.640
Income (2) (Low)	1.510	.475	10.10 7	1	.001	4.527	1.784	11.483
Having schooling child	.069	.225	.093	1	.761	1.071	.689	1.664
location	1.643	.460	12.77 2	1	.000	5.173	2.100	12.740
Housing space per person	.016	.012	1.687	1	.194	1.016	.992	1.041
Living years in current housing	.025	.022	1.218	1	.270	1.025	.981	1.071
Constant	-2.411	.962	6.280	1	0.012	.090		

to unforeseen consequences of largescale projects, whereas, in the second model, all the variables are taken into account. The following discusses which model was chosen to predict household vulnerability, exposing recent developments and trends implying the unforeseen consequences of largescale projects and how it came to be preferred.

## 5.2.1. Model 1: Considering significant variables

In this model, predictor variables are chosen based on their dependency on dummy variables as categorized in Table 3. Income is the only categorical predictor, the reference variable of which is middle (coded zero=middle, 1=high, 2=low) - (Wald=10.799, df =2, p=.013). Low income is defined as a positive coefficient (b=+1.510, s.e=+.475, p=.001) - (OR=4.527 > 1) while the high-income variable is a significant predictor of vulnerability to unforeseen development changes (b= 1.250, s.e=.568, p=.028, OR=3.492>1).

The insurance ratio has a positive coefficient which suggests that households having weak insurance type are more likely vulnerable (b=1.768, s.e=1.122, p=.115) while the odds ratio indicates that vulnerability increases by a factor of 5.857(OR > 1) in case it is a non-significant predictor. In this model, having a schooling child is a positive and non-significant (b= .069, s.e= .225, p=.761) variable with the odds indicating the relationship between the increase of every unit on the predictor variable and the probability of vulnerability for every household. Location (informal settlement) is a positive and significant (b=+1.643, s.e=.460, p= .000) predictor and the odds ratio in-



*Figure 5.* Location of survey points and distribution of dependent variable regarding location.

dicates that vulnerability increases by a factor of 5.173 (OR>1). Housing space per person is a positive and significant predictor (b=+.016, s.e=.012, p=.194) and the odds ratio indicates that vulnerability increases by a factor of 1.016. Living years in current housing is the last predictor in the model with a positive and non-significant coefficient which suggests that households having bigger houses are less likely vulnerable than those who suffer from worn-out houses (b=+.025, s.e=.022, p=.270).

#### 5.2.2. Model 2: All relevant explanatory variables regardless of significance

With this model, the attempt is to model the likelihood of vulnerability to unforeseen effects of large-scale projects in a sample of n=210 inhabitants in Göktürk by the independent variables, referring to socio-economic features. These variables are; having a schooling child, elderly ratio, illiterate ratio, household size, tenure status, income, informal job, insurance type, Living years in current housing, housing per space, and location.

The following model examines the probability of vulnerability to unforeseen effects of large-scale projects in a sample of n=210 Göktürk residents, accompanied by independent variables referring to socioeconomic characteristics. These variables encompass having a school-aged child, an elderly

*Table 5.* Variables in the equation.

Predictor	в	S.E.	Wald	df	Sig.	Exp(B	95% C.I.for EXP(B)	
	10010 0000000					)	Lower	Upper
Insurance ration	2.879	1.460	3.888	1	.049	17.794	1.017	311.17 6
Informal job	.412	.708	.339	1	.561	1.510	.377	6.052
Households' size	.846	.399	4.489	1	.034	2.330	1.065	5.095
Income (Middle)			9.696	2	.021			
Income (1) (High)	1.093	.678	2.602	1	.107	2.985	.790	11.270
Income (2) (Low)	1.697	.555	9.336	1	.002	5.459	1.838	16.214
Having schooling child	589	.420	1.969	1	.161		.244	1.263
location(1)	1.664	.503	10.94 3	1	.001	5.279	1.970	14.147
Illiterate	665	.342	3.795	1	.051	.514	.263	1.004
Tenure status (rent)			2.272	2	.321			
Tenure status (1) -family	.690	.587	1.380	1	.240	1.994	.631	6.303
Tenure status (2)-owner	.646	.544	1.410	1	.235	1.908	.657	5.547
Elderly ration	.652	.948	.472	1	.492	1.919	.299	12.306
Housing space per person	.028	.016	3.274	1	.070	1.029	.998	1.061
Living years in current housing	.019	.024	.585	1	.444	1.019	.971	1.068
Constant	- 4.885	1.559	9.811	1	.002	.008		

ratio, an illiterate ratio, the size of the household, tenure status, income, informal job, insurance type, number of years lived in current housing, number of housing spaces, and location.

Two predictors in the model are categorical: "income" (coded zero=middle, 1=high, 2=low) and housing tenure: (coded zero=rent, 1=family 2=owner), while reference categories (last) are defined respectively middle-income group (Wald=9.696, df =2, p=.021) for income and rent for housing tenure (Wald=2.272, df =2, p=.321). The income variable with the positive coefficient suggests that households in the low-income level are more likely vulnerable to unforeseen effects of socio-spatial development (b=+1.697, s.e=+.555, p=.002) - (OR= 5.459> 1). High income is a positive and non-significant predictor of households' vulnerability (b= 1.093, s.e=.678, p=.107, OR=2.985>1).

In this model, household size is a positive and significant (b= .846, s.e= .399, p=.034) variable with the odds (2.330) indicating the direct relationship between the increase of every unit on the predictor variable and the probability of vulnerability for every household. The tenure status variable is a non-significant predictor for vulnerability to the uncertain status of the environment. According to Table 6.26, the owner variable (coded=2) is a positive and non-significant (b= .646, s.e=.544, p= .235) predictor and the odds ratio indicates that vulnerability increases by a factor of 1.908. On the other hand, living in a shared dwelling is a positive and non-significant (b= .690, s.e= .587, p= .240) predictor in the vulnerability status of households' living environment.

"Having a child enrolled in school" (b= -.589, s.e=.420, p=.161) is a negative and significant predictor variable of household's vulnerability with the OR (=.555>1) indicating that for every one unit increment on the predictor, the odds of vulnerability increase. Informal job ratio is a positive and non-significant predictor variable of household vulnerability (b=+.412, s.e=.708, p=.561) with the OR (=1.510>1). Location as another variable is a positive and significant predictor (b=+1.664, s.e=.503, p=.001) and the odds ratio indicates that vulnerability increases by a factor of 5.279 (OR>1). Households living out of squatter settlements are less likely vulnerable than those who are living in such areas due to the uncertain status of squatter settlements. Housing space per person has a positive coefficient which suggests that households having bigger houses are less likely vulnerable (b=+.028, s.e=.016, p=.070), while the odds ratio indicates that vulnerability increases by a factor of 1.029 (OR>1).

The illiterate and elderly ratio are other two non-significant predictors of a household's vulnerability (respectively, (b=-.665, s.e=.342, p=.051, OR (=.514 < 1) and (b=+.652, s.e=.948,p=.492, OR (=1.919>1). This finding indicates that families with a high ratio of illiterate are less likely vulnerable and elderly members are more likely vulnerable than those who are highly educated or have young members. Living year in current housing is also positive and non-significant (b = +.019, s.e=.024, p=.444) while the odds ratio (OR = 1.019 > 1). Insurance is positive and significant (b=+2.879, s.e=1.460, p=.049) while the odds ratio (OR >1) indicates that for every unit increment on the predictor, the odds of vulnerability increase. Due to the observed OR, Since the abovementioned variables fell between the lower and upper bound for a 95% confidence interval, the compound odds ratio is not significantly different from 1.0 (Table 5).

In the following of this debate, how

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*Table 6. Variables in the equation.* 

Model No.	Constant variables	Value	Test	Value	df	Р	Analysis	Value %	
	в	-2.411	Chi-square (Omnibus)	38.416	8	.000	Sensitivity	95.6	
	S.E.	.962	-2 Log likelihood	191.565					
Model 1	Exp(B)	.090	Chi-square (Hosmer and Lemeshow)	15.144	8	.056	Specificity	24.0	
	Р	0.012	Percentage Correct	78.5 %					
Model 2 (Selecte d)	в	-4.885	Chi-square (Omnibus)	47.383	14	0	Sensitivity	94.3	
	S.E.	1.559	-2 Log likelihood	182.599					
	Exp(B)	0.008	Chi-square (Hosmer and Lemeshow)	8.613	8	0.376	Specificity	38	
	Р	0.002	Percentage Correct	80.9 %					

well the abovementioned model is defined is supposed to be measured with chi-square (Omnibus), -2log likelihood, and chi-square (Hosmer and Lemeshow).

In the first model, the chi-square of the omnibus test is significant with P<0.05 (.000), while the -2 log likelihood value is 191.565, so due to the omnibus test, this model is statistically conventional. The P value of the Hosmer and Lemeshow test (p: .056) also supports the model where the predicted percentage correct is 78.5 %. In the second and preferred model, five other variables are added to the model, which has reduced the -2 log likelihood (chi-squared distribution = 182.599) by 8.966 with 14 degrees of freedom. The p-value for the result of adding tenure status, informal job, household size, elderly ration, and illiterate ration (insignificant variables) to the model is presented in Table 6.26. Hence it can be concluded that the addition of the abovementioned predictors to the model is statistically significant because the p=0.002 value and the overall predicted percentage correct increased to 80.9 % (Table 6).

According to the results of estimating a defined model, insurance ratio, household size, income (middle), income (2)-(low), and location (squatter settlement) are more significant predictor variables in the probability of vulnerability. The abovementioned model is chosen to create the map of the spatial distribution of the probability of vulnerable families throughout the neighborhood in consideration of the households' characteristics and neighborhood circumstances in the case study as well as the significance of variables drawn from related studies (Figure 6).



*Figure 6. Probability of households' vulnerability due to built-up environment.* 

## 6. Concluding remarks and evaluation

The current study sought to determine how vulnerable households in the Göktürk neighborhood are exposed to unforeseen changes caused by largescale urban projects. Vulnerability assessments were obtained based on the degree of the built-up area as determined by changes in land value and residential subareas. The features of 210 households in the area were surveyed, and the results revealed a wide range of life cycle stages. The most notable stages included young couples, young couples with children, and elderly couples with adult children.

The size of middle-income households ranges from 2 to 5, and occasionally they include adults over 60 or children in school. Furthermore, some are classified as nuclear families, with multiple families living in the same house and earning money through informal jobs.

The positive coefficient of the predictor variable of informal jobs implies that any rise in the rate of this factor results in the households' vulnerability, according to the values given in the binary model. The obtained scores of some variables from low-income and high-income households, as well as the significance of their impact on vulnerability assessment, determine the fact that high-income households living in this area have chosen their current residence based on their evaluation of some options. Therefore, high-income households are not deemed as vulnerable in the event of abrupt changes in the city because they can adjust to large-scale enterprises and own highpriced dwellings. Regarding the location variable, the number of vulnerable households accurately decreases with the development of renewed residential areas. In other words, high-income families surround these vulnerable families, who cannot afford to live in the conditions of high-quality residential neighborhoods.

The presence of informal settlements in the north and west parts of the neighborhood exacerbates the impact of development in this area. Rising illiteracy rates have made households more vulnerable because they create fewer employment opportunities, particularly for those living in this area with more school-age children. In terms of housing tenure, tenant households are more vulnerable than homeowners or nuclear families who share a home. As their socioeconomic circumstances have stabilized, families with a high percentage of elderly members find it much harder to move than the rest of the population. Finally, households in smaller housing units are more likely to move due to pressures like escalating land value caused by the effects of large-scale projects.

Middle-income households may not suffer as much as low-income families, for whom home is merely a shelter and whose main source of incomegiven their low levels of educationcomes from labor and service sector jobs provided to high-income groups. Due to their reliance on the socioeconomic and environmental conditions in which they currently reside, middle-class households are also vulnerable to economic changes. Because, unlike the upper class, they do not always have the means to choose the desired residence and they are not as willing to live in any environment with the fewest amenities under any circumstances as low-income families are. A significant finding in this paper indicates that high-income households contribute significantly to the vulnerability of low-income groups during times of crisis as a result of large-scale projects. They may be forced to relocate because they currently live in areas considered to be outside the scope of formal urban regulations and thus not protected by the law. The distribution map of vulnerable households in the neighborhood reveals that these households are dispersed throughout the neighborhood's center (which has a relatively long history of settlement) and in informal settlements in the north and west parts, so their behaviors must be taken into account in any large-scale projects.

Insurance ratio, household dimension, middle and low-income groups, and location (gecekondu or new residential projects) are all significant predictors in model no.2 for estimating household vulnerability in the event of a forced mobility strategy implemented by urban decision-makers.

Large-scale projects with no local planning background that are intended to benefit national economic development affect households that are unable to adapt to new planning settings due to socio-economic circumstances (high quality of neighborhood). Essentially, this acknowledges that the effects of large-scale project development in Istanbul have expanded to the city's countryside, as in the case of Göktürk. In terms of its proximity to Istanbul's city center, the Göktürk neighborhood is regarded as the countryside. By examining the Göktürk neighborhood in terms of the global countryside, it can be stated that one of the consequences of Istanbul's engagement in the globalization network for the neighborhood is the creation of opportunities for investors and the attraction of a mass of wealth, which has increased social polarization.

The transition from a low-income rural texture to a bipolar area of gated communities and the urban poor living in vanishing informal settlements (Gecekondu) is perceptible. Land developers who invested in the development of luxury residential projects profited immensely from the neighborhood's poor governance of the land and housing market dynamics. The neighborhood witnessed the exclusion of the urban poor (residents in informal settlements) and an increase in forced migration for the middle-income of society as a result of one of the principles of globalization. The principle refers to the creation of a competitive environment beyond its location and identity (due to the increase in housing rental and sale values). The economic dynamics affecting the land on the one hand, and the social composition on the other, have reconstituted the neighborhood. Low and middle-income households, who are or will be equally affected by the negative effects, will be the first to be affected by these changes. Identifying the areas affected by the unforeseen consequences of large-scale projects thus contributes to managing the residential mobility of evicted households.

The findings of the current study assist in comprehending the potential eviction processes for vulnerable households while looking at the households' locational-spatial characteristics and their grading in the event of forced mobility caused by large-scale projects. Additionally, determining a household's vulnerability rating contributes to developing a suitable schedule for addressing the issues that would arise from relocating the households.

Further research could be conducted to determine where graded groups would relocate in the event of eviction and, depending on their circumstances, whether they would move around the neighborhood, leave, or stay during the construction of large-scale projects.

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## The daily mobility of residents and retailers during the pandemic in a pedestrianised Paris

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#### Abstract

This study examines pedestrianisation in the context of the dilemma between urban transport planning and everyday urban mobility in Paris. The literature on pedestrianisation warns of the potential for uneven development and gentrification effects of pedestrianisation policies. This study is based on an online survey of Îlede-France residents (119 in total) and a corresponding survey of shopkeepers in three local shopping districts in Paris (121 in total) from February to June 2021. Additional follow-up informal interviews with English-speaking shopkeepers (about 8 out of the total of 121) about mobility and pedestrianisation practices in Paris helped to provide more in-depth insights. The results showed that Parisian residents and shopkeepers continued to be mobile in the city, using different modes of transport, even under pandemic conditions. In addition, Parisian shopping streets performed well in terms of business continuity. However, some shopkeepers opposed the city's pedestrianisation policy for mobility, economic, and political reasons. In order to alleviate these problems, which could exacerbate urban inequalities, this paper suggests that local perspectives on the use of urban space and pedestrianisation should be taken into account in order to achieve more equitable forms of urban mobility in the crisis-ridden cities of the contemporary world.

#### Keywords

Gentrification, Pandemic urban mobility, Parisian shopping streets, Pedestrianisation, Resident and shopkeeper surveys.

#### 1. Introduction

How different groups of people travel in the city to access their jobs, homes, shopping and other personal services, educational, health or cultural facilities, and recreational areas such as public parks is an important issue for their quality of life. Inequalities in people's access to mobility – expressed as "motility" or the ability to be mobile (Kaufmann et al., 2004) – persist despite the "democratization of mobility" in the nineteenth and twentieth centuries (Divall, 2014, p. 40).

In this wider mobility context, transport mobility has become a major policy concern for local governments. This was particularly true in the context of the pandemic, which infected thousands of people, caused many deaths, and severely restricted the daily personal mobility of millions of people around the world, confining them to their homes (Adey et al., 2021), and exacerbating "inequalities in accessing financial and health resources" (Tran et al., 2022, p. 3).

During this period, media discourse in France portrayed walkable cities through headlines such as "Paris mayor unveils '15-minute city' plan in re-election campaign" (Willsher, 2020). This echoes trends in academia that claim that the compact city and the smart city can transform transport practices through planning policies aimed at reducing fossil-fuelled mobility. For example, Zukin et al. argue that "Ideally, to satisfy everyday needs, you never have to leave your neighborhood" (Zukin et al., 2016, p. 4).

This paper presents the results of a case study investigating public perceptions of French urban planning in relation to pedestrianisation policies. It was found that Parisians remained mobile in the city, using different modes of transport, even under pandemic conditions, and that Parisian shopping streets continued to perform well in terms of business continuity. Various implementations of the pedestrianisation policy in Paris, where cars and pedestrians coexisted, supported businesses and created a more sustainable environment. However, there was opposition to the city's pedestrianisation policy on mobility, economic, and political grounds. Furthermore, the determinant role of local government in Paris in pursuing its green urban mobility agenda made this pursuit more controversial. The paper provides a context for the study with a literature review, followed by the methodology. The results are summarised and discussed, and the conclusion points to the implications for improving pedestrianisation practices.

## 2. Pedestrianisation and its impact on commercial urban spaces

Pedestrianisation is defined as the "conversion of a road to pedestrian use, often planted and provided with street furniture and amenities" or the "removal of vehicular traffic to create a pedestrian zone or mall [US]" (Evert et al., 2010). According to Vitale Brovarone and others, "Pedestrianisation consists of the closure of road space to motor vehicle traffic for the benefit of walking" (Vitale Brovarone et al., 2023, p. 2). It takes different forms in terms of space—for example, an entire urban area or a street-and time-either temporary, i.e. for certain hours of the day or days of the week, or permanent (Vitale Brovarone et al., 2023).

Although pedestrianisation is commonly assumed to be beneficial for people's quality of life, for urban life in terms of creating opportunities for socialisation, and for the environment in terms of reducing carbon emissions based on fossil fuel consumption in general, it also has its critics. Blomley (2014) criticises the assumption of the benefits of pedestrianisation, which he refers to as a "pedestrianist logic" (Blomley, 2014, p. 477) or "pedestrianism" (Blomley, 2014, p. 473) in the use of pavements, drawing on Jacobs, Whyte, Goffman and de Certeau. He argues that this pedestrianist logic deprives pavements of their civic humanist logic or the possibility of "mobile (social) encounters" (Blomley, 2014, p. 474) and other uses of them as public spheres.

Stavrides (2016/2018) refers to "cities without qualities" (where contested areas, unpredictable interactions and unregulated encounters would not be possible) that resulted from modernist programmes to separate pedestrian and vehicular uses of the city. Haussmann, Le Corbusier and others planned and established such cities without qualities in the late nineteenth and early twentieth centuries (Stavrides, 2016/2018, pp. 134-135). Similarly, Jacobs (1961/2017) criticises the aforementioned orthodox urban planners for their anti-urban, anti-street and anti-social policies that sought solutions to urban problems outside the city.

Conflicts also arise from the governance of pedestrianisation, which is seen as a political initiative involving multiple actors (Vitale Brovarone et al., 2023). Vitale Brovarone and others see the conflictual nature of the process as normal, as in "any urban planning initiative to transform the status quo" (Vitale Brovarone et al., 2023, p. 2). In the common scenario of pedestrianisation, the question of whose personal mobility is targeted by urban planning activities to improve public transport space is important. For example, a topdown pedestrianisation could have the unexpected result of not opening up the place to public use, but instead producing an overplanned and underused urban space. Cybriwsky described these places as "planned wastelands' or 'new urban deserts'" (Cybriwsky, 1999, p. 229). However, a study in Brussels made it clear that even public participation in transport policy does not always mean that citizens are actually involved in the decision-making process. This lack of participation was due to the limited number of opportunities to involve local residents and the informative rather than interactive nature of these meetings (Kębłowski et al., 2019).

Apart from the existence of similar urban planning contradictions with the daily lives of city dwellers in the history of Paris, for example, in relation to the redevelopment of the Les Halles (Merrifield, 2017; Zetter, 1975), the possible link between commercialisation, gentrification and transport or public infrastructure developments in cities such as Paris is also analysed in current research (Clerval & Fleury, 2009; Doucet, 2019; Enright, 2013; Kębłowski et al., 2019). While some studies take a more positive approach to sustainable urban transport development in collaboration with different levels of government (Halpern & Le Galès, 2016), others warn of the negative gentrification effects of mass transport development projects such as the Grand Paris Express (Enright, 2013), public space improvements (Clerval & Fleury, 2009) and pedestrianisation (Kębłowski et al., 2019).

With regard to the city's commercial spaces, the depiction of retail decline as a prominent cause of inner city decay (Delage et al., 2020) often leads to state-led or state-supported efforts at revitalisation and commercial gentrification. Chabrol and Girou (2022) point to the closure of local businesses and the misdirected social tensions that result from mallification in commercial areas of French cities, such as Berriat in Grenoble. They critically assert that:

(...) the ideal scapegoats for the closure of traditional food businesses are close at hand – they are the North African entrepreneurs. The hypermarkets and megastores, located for the most part outside of the neighbourhood, are not criticized, even though many studies on the structural changes in commercial spaces have for the past thirty years or so unanimously pointed to the role of these big stores (and their successful Internet outlets) in the closure of many neighbourhood stores (Metton, 1998). (Chabrol & Girou, 2022, p. 193)

Therefore, retail businesses in shopping streets are subject to physical and social changes, including pedestrianisation, and they tend to create barriers against these efforts as they perceive them as a threat to their businesses (Parajuli & Pojani, 2018). They adopt conservative attitudes towards such changes in their business environment. However, recent research has found counter-evidence to the common perception that pedestrianisation reduces sales of shops by deterring affluent customers with cars (Soni & Soni, 2016; Yoshimura et al., 2022). It is important to note that tenancy rate mediates the relationship between commercial gentrification of urban commercial areas and pedestrianisation practices (Özdemir & Selçuk, 2017). Furthermore, local shop owners may have a bridging function between different social groups in gentrifying neighbourhoods, as shown by Arisoy and Paker (2019) in their study of Yeldeğirmeni. As a historic neighbourhood in İstanbul's Kadıköy, Yeldeğirmeni first experienced artist-led gentrification in the last twenty years, which later led to a revaluation of the neighbourhood in a

way that displaced these artists and replaced them with foreigners—through Airbnb gentrification (Uzgören & Türkün, 2018)—and other professionals with higher incomes.

Recent research on pedestrianisation of shopping streets also addresses the issue of multimodality, i.e. how the presence of different modes of transport, such as walking, cycling or the use of e-scooters on the same shopping street, affect each other (Spierings, 2023) and the issue of safety (Gössling, 2020). A brief history of the development of pedestrianisation in France is presented in the next section.

## 3. Pedestrianisation in French cities in a European context

Pedestrianisation is not limited to French cities in Europe. Many have European countries been experimenting with traffic calming and pedestrianisation since the second half of the twentieth century, in line with the goal of transitioning to "postcarbon cities" (Ecologic Institute, 2014). European cities also share other similarities that set them apart from, for example, North American and Asian cities. Guillen and Komac point out this difference by saying: "However, the both urban shape of the core city and the patterns of suburbanisation are different in Europe than in America or Japan" (Guillen & Komac, 2020, p. 69). Wayens and others (2020) highlight the fact that European city centres have not lost residents to the extent of North American cities, where suburbanisation after the 1960-1970s led to urban hollowing out and inner city decline, followed by gentrification. The pedestrianisation of French cities such as Paris is therefore part of this common historical background of European cities.

Nevertheless, there are spatial divisions in public space investments, including pedestrianisation, in French cities, for example between the city centre and the suburbs. Clerval and Fleury (2009) highlight the fact that most public space investment in Paris since the 1980s has been concentrated in areas of residential gentrification. This dichotomous vision of the city as the historic centre versus the outer suburbs also limits the possibilities for alternative lifestyle expectations, or what Divall refers to as "counter-hegemonic or 'subversive' – systems" (Divall, 2014, p. 39), such as those against the "automobile habitus" (Flonneau, 2006, p. 102) that has long shaped the urban context in Paris.

Temporally, Feriel (2013) traces the first pedestrian zones for both Europe and the US back to the 1960s, but recognises the 1970s as the key period for the first phase of pedestrianisation in French cities. Feriel distinguishes between these early attempts at pedestrianisation in the 1960-70s and those after the 1980s. While the former were based on an idea of "separation" of functions and different modes of transport, the latter were developed with an idea of "cohabitation" of pedestrians and cars, as in the redesign of Rue Montorgueil in 1991-2 and Place de la République in 2013 (Feriel, 2013, p. 5).

On the other hand, Brenac and others (2013) take a critical approach to pedestrianisation in France, based on a longitudinal analysis of the discourses and practices surrounding the issue. They interpret the pedestrianisation of city centres as an urban marketing strategy that serves to position Paris in competition with other cities and creates patterns of uneven urban development. These arguments underline the fact that the pedestrianisation of the centre can lead to a further automobilisation of the distant peripheries and a reinforcement of class-based understandings of who belongs in the city and who does not. This leads to questions about the socio-spatial sorting of people, vehicles and activities and whether privileged islands of higher urban quality are being created (Brenac et al., 2013).

An example of this is the recent semi-pedestrianisation of Rue des Rosiers by the Paris municipality. This seems to have encouraged the commercial gentrification of the Marais. Again, the work of the Société d'économie mixte de la Ville de Paris (Semaest) led to a similar local state-led gentrification effect, while actually seeking to protect the retail mix of the Beabourg-Temple part of the Marais (Mermet, 2017).

Debrie et al. (2020) argue that there are social and spatial differences and limits to car ownership and use between central Paris, the inner ring and the outer ring, despite a general decline in car use in Île-de-France since the 1990s (Debrie et al., 2020). These discrepancies point to different mobility dynamics between the city centre and the banlieue (suburban Paris). Debates about the centre-periphery dualism have emerged, with attention focused on the riverbank closure project and the optimisation of urban highways among the various groups involved in the transport governance of Paris (Ilede-France) (Debrie et al., 2020).

The city of Paris is currently undergoing urban renewal in preparation for the 2024 Olympic Games. There is also a plan for the complete pedestrianisation of the first four districts of Paris by 2022 (BBC News, 2021); a move away from petrol cars; and the creation of urban forests by 2030 (Oliver, 2021). On 15 April 2021, Google Maps showed 20 pedestrian streets (rues piétonnes) in central Paris. In the light of all these earlier debates and recent developments, it is crucial to examine how policy objectives for the pedestrianisation of central Paris impact on those who live and work in the area and on economic dynamics.

#### 4. Methodology

The primary data for this study were collected in three ways: an online survey in French, a paper survey also in French, and follow-up informal interviews in English. The fieldwork took place in Paris from February to June 2021. The quantitative research method of using surveys was chosen mainly because of the researcher's lack of French language skills. The translation of the surveys was supported by the working team of the Fondation France-Japon (FFJ) de Ecole des Hautes Etudes en Sciences Sociales (EHESS).

Both surveys included multiple-choice questions about the respondent's personal situation, daily mobility habits, and perceptions of the city's pedestrianisation efforts. The personal questions included gender, age, education level, marital status, place of birth, length of residence in Paris, employment status and occupation, and place of residence. Respondents to the shop survey were also asked about the type and size of their business, its location and duration, and their own position in the shop.

In terms of daily mobility habits, residents were asked about their daily outings, their mode of travel—which was also asked of the shop survey participants, the average time taken for these daily outings, and the impact of the pandemic on them in terms of frequency and mode of travel. Residents were also asked how often they left their neighbourhood, for what purpose, and what mode of transport they used. Shopkeepers were also asked about the impact of the pandemic on their opening hours and turnover.

Finally, both respondents were asked about their perceptions of the Paris municipality's pedestrianisation efforts, by asking about their level of support and the reasons for it. Respondents in the shop survey were also asked about the impact of the pedestrianisation of their street on their business results in terms of the number of customers, turnover and value of their shops.

For the online survey, residents of Paris, Île-de-France (n=119) were recruited through online mailing lists such as the EHESS mailing list, the EHESS student email group, and by approaching individuals known from the Foundation Maison des sciences de l'homme (FMSH) or the Turkish community in Paris, in order to reach as diverse a group of Paris residents as possible under the conditions of the pandemic curfew. Although the educational level of the online survey participants appears to be high, resulting in a skewed distribution, this was unavoidable given that the online survey technique requires a certain familiarity with computers and Internet use. Follow-up informal interviews with English-speaking shopkeepers about mobility and pedestrianisation practices in Paris were conducted as a qualitative complement to the survey data, which were analysed to generate descriptive statistics.

The paper survey was carried out among shopkeepers in three local shopping areas in Paris: Rue Montorgueil-Rue des Petits Carreaux, Rue Cler and Rue Daguerre (n=121) (Figure 1). These locations in the centre of Paris were chosen because they are either fully or partially pedestrianised or pedestrian priority areas, and therefore, provide an opportunity to observe the impact of pedestrianisation on retailers who are also residents of Paris, Île-de-France. In addition, these three shopping streets were chosen because of their different locations in Paris and the importance they have for Parisians.

Of the three shopping streets, Rue Daguerre, on the Left Bank, has been the most gentrified since the 1980s, partly because of its famous artistic residents, such as the filmmaker Agnes Varda, who had a house on the western side of the street and even made a doc-

umentary about the neighbourhood called Daguerréotypes (1975), which she described as her "Daguerre-opera" (Daguerréotypes (téléfilm), 2022). The street took its current name in 1867 and the demolition of its covered bazaar in 1994 led to social protests ("Rue Daguerre," 2022). Rue Montorgueil (on the more commercial right bank) and Rue Cler (on the left bank, near the Eiffel Tower) are more similar, with cobblestones, a tourist clientele due to their location, and almost a replica of what is on offer, including "food stores, pastry shops, butchers, delicatessens, cheese specialists, fishmongers, greengrocers, chocolate shops and cafés" ("Rue Cler," 2022), alongside florists and stationery shops.

Iverson (2017) notes of the Rue Cler that its "appeal isn't as readily apparent as that of other famous Parisian shopping streets" but it "has an identity no less distinct, marked by the exigent tastes of some of the oldest, most wellto-do families in Paris." Rue Montorgueil, whose name and history date back to the Middle Ages, is home to heritage sites such as the old Parisian



Figure 1. The locations of the Paris shopping streets surveyed (Prepared by the author on Google Maps).

patisserie Strohrer (1730) and the oyster restaurant L'escargot Montorgueil (1832). The street was mentioned by Hugo and Zola in their novels and was painted by Monet (La Rue Montorgueil) ("Rue Montorgueil," 2022).

The following sections summarise the main findings from the descriptive statistics obtained from both resident and shopkeeper surveys. The analysis of follow-up informal interviews with English-speaking shopkeepers who completed the survey is added to provide additional insights into how they understood and experienced the pedestrianisation policy in Paris.

#### 5. Findings

The profile of the respondents in the online resident survey was predominantly female (63% vs. 58% officially estimated for 2021 (ESTAT, 2023a)), young to middle-aged (73% in their 20s and 30s vs. about 37%<sup>1</sup> in 2021 (ESTAT, 2023a)), educated (95% with a bachelor's degree or higher vs. about 54,4%<sup>2</sup> in 2021 (ESTAT, 2023b)), single (47%) and cohabiting or married (49%), and born in another French city (45%) or outside France (36%). Only 19% were born in Paris. They had mostly lived in Paris, Île-de-France for up to fifteen years (78%), if not more than 26 years (14%). They were mostly employed (63%-mostly civil servants (46% vs. 27% in 2020 (ESTAT, 2023c)) or professionals (26% vs. 20% in 2020)), or unemployed (23%), if not self-employed (8%) or retired. They mostly lived in Paris (80%), compared to the category outside Paris, but in Île-de-France (20%) and in Paris, 46% lived in one of the 14th, 15th, 18th or 20th arrondissements (compared to 35% (Dubois, 2021)), followed by 21% in one of the 3rd, 11th, 16th and 19th arrondissements (compared to 24% (Dubois, 2021)).

In the paper shop survey, 50% of respondents were male, 49% female, 1% preferred not to say. In terms of age, 40% of respondents were in their 20s, with 1% in the 15-19 age group; 27% in their 30s; 16% in their 40s; 12% in their 50s; and 5% in their 60s. In terms of education, 27% had a baccalauréat or vocational diploma, 23% a bachelor's degree or equivalent and 26% a master's degree or equivalent—10% had a bac+2 diploma and 13% had less than a baccalauréat. 44.6% were born in another French city, 25.6% outside France and 29.8% in Paris. Of those not born in Paris, 54% had lived there for up to 15 years, 26% for more than 26 years and the rest in between. However, 53% have lived outside Paris but in Île-de-France, while 47% have lived in Paris. Among those who lived in Paris, 33% lived in the 14th or 15th arrondissement, followed by the 2nd, 7th, 11th and 18th arrondissements (7% each), and the rest in other arrondissements.

## 5.1. Daily mobility of Parisians and the impact of the pandemic

According to the results of the residents' survey, the majority of respondents commute to work, school, and other main places of activity (92%) by train (79%), on foot (57%), by bicycle (38%) and by bus (28%); very few use cars (4%) or electric scooters (1%) for their daily commute. In terms of daily mobility, shopkeepers show a similar tendency to commute by train (63%), walking (30%), cycling (13%) and bus (7%), but unlike residents they also use cars or other motor vehicles to some extent (17%).

Resident respondents commute for journeys of less than one hour (94%), which is related to the efficiency of rail transport in Paris and the compact configuration of the city. Parisians who work far from home prefer to use the train, while those who work close to home can walk. Neither cars nor electric scooters are the preferred mode of transport for Parisians' daily commutes. On the other hand, Parisian shopkeepers indicated that cars are essential for transporting heavy products to and from their shops.

The resident survey also aimed to understand how much of the participants' daily lives were spent in their own neighbourhoods as a result of the city's plans for the 15-minute city. Residents were highly mobile within the city, with 98% reporting that they travelled out of their neighbourhood with varying frequency, ranging from once a week to more than seven times a week. The most common reasons for travelling were work (78%), nature and leisure (70%), entertainment (62%), social (55%) and cultural (44%). For these trips, respondents again used the train (78%), bus (41%) and bicycle (41%), unless they chose to walk (68%). As with their daily commute, respondents made little use of cars or other motor vehicles (10%) and electric scooters (2%) to visit other neighbourhoods. This general tendency to avoid driving suggests that Parisians do not find it convenient to travel around the city by private car. At the same time, electric scooters were not widely used.

Since COVID-19, most resident respondents had reduced their daily commute (63%). Although 50% did not change their mode of transport during the pandemic, 31% walked more and 23% used bicycles or electric scooters more. The results thus show that the pandemic had little impact on the use of cars or other motor vehicles (5%) or public transport (2%) among Paris residents, while active transport modes were used more.

## 5.2. Parisians' ideas on pedestrianisation

Both residents and shopkeepers were asked about their views on recent city initiatives such as Paris Respire, Vélib, and the redesign of streets, shopping areas and/or public squares to make Paris more pedestrian-friendly. Residents (86%) were more supportive of these efforts than Parisian shopkeepers in the shopping districts surveyed (60%). However, both residents and shopkeepers indicated that their support for the policy was based on environmental reasons (66% of residents and 58% of shopkeepers), followed by other reasons such as improved mobility (14% of residents and 10% of shopkeepers) and social benefits (9% of residents and 16% of shopkeepers). A number of shops also indicated support for economic reasons (12%). Conversely, those shopkeepers who did not support these efforts (20%) justified their lack of support on the basis of mobility problems (50%), in addition to economic (33%) and political (13%) reasons.

Although the small sample size of the surveys did not allow for much reliable statistical testing, for residents, length of residence in Paris, Île-de-France had a statistically significant relationship with ideas about pedestrianisation, with an X2 value of 31.12 (degrees of freedom: 12 and critical X2: 21.03) at the 95% significance level (Table 1). Due to the problem of low cell values, a Fisher's exact test was also applied to test the same two variables, and their statistical relationship was confirmed with a p-value of 0.005, lower than 0.05. This means that the opinion of Parisians on the pedestrianisation of their city is related to the length of time they have lived there.

Finally, the majority of shopkeepers surveyed said that the pedestrianisation of their shopping streets had had

*Table 1.* Statistical relationship between duration of residence in Paris and idea on pedestrianisation.

X2		Idea on pedestrianisation efforts						
			No, I don't					
		Yes, I support.	support.	I don't know.				
	Less than a year	0,20	0,29	0,80				
	1-5 years	0,02	1,54	0,14				
Duration of	6-10 years	0,61	0,88	2,41				
in Paris	11-15 years	0,24	0,42	3,00				
	16-20 years	0,28	0,08	2,59				
	21-25 years	0,22	12,25	0,69				
	26 years and over	0,35	3,93	0,17				
X2	31,12	Alfa	0,05	Relationship				
DoF	12	Critical X2	21,03	p-value : 0.005				

a positive effect on the number of customers (65%), sales (68%) and the value of their property (61%)—although some shopkeepers were reluctant to answer the latter question. While some did not personally support the city's efforts to make Paris more pedestrian-friendly, they indicated that the pedestrianisation of the shopping street had been beneficial to business. The pedestrianisation policy was therefore seen as beneficial to the commercial activity, despite the underlying issues relating to the particular difficulties faced by shopkeepers (e.g. in terms of deliveries, transporting heavy goods, etc.).

#### 5.2.1. Lack of parking facilities

A common issue identified by the shop survey respondents was that the removal of car traffic from the shopping streets affected the customer experience, particularly for customers travelling from other areas. A lack of parking meant that large purchases by customers and deliveries were negatively affected by pedestrianisation.

A hotel owner on Rue Daguerre said that his street had been redesigned three or four years ago. The removal of on-street parking, for example, affected the hotel's business, because customers needed taxis, but taxis could not wait outside the hotel for more than two minutes. Similarly, the owner of a second-hand clothes shop said that many customers were discouraged from visiting the shopping street because of the lack of parking. A caterer (traiteur) claimed: "Some customers appreciate the widening of the pavements, especially for the terraces, but this has led to a reduction in the number of parking spaces. So, we have also lost customers who come from far away". Without the trade that used to come from outside the area, support from local residents was not enough to keep many shops open.

While support for pedestrianisation was expressed, contrary to the usual positioning of shopkeepers as opponents of pedestrianisation (Parajuli & Pojani, 2018), common problems were identified in terms of regular product deliveries and when customers wanted to make large purchases of heavy items, such as wine, on the spot. Therefore, a number of shopkeepers supported the integration of pedestrians and cars as the optimal policy goal, as achieved by cohabitation (Feriel, 2013).

### 5.2.2. Planning pedestrianisation without public participation

Some members of the business community in the Rue Cler argued that the municipality employees planned these things in their offices without taking into account all the necessary aspects, such as accessibility, local businesses, etc., and without consulting the community on the matter. This finding parallels the argument of Kębłowski and others (2019) on the limited public participation in transport planning in Brussels.

Despite basic support for policies aimed at reducing carbon emissions by reducing motorised transport, shopkeepers often felt that closing a shopping street to traffic was like 'cutting off the blood flow into that area'. They expressed fears that businesses might end up dying as a result of pedestrianisation policies. In this sense, pedestrianisation carries the much-feared risk of retail decline (Delage et al., 2020) that is mentioned in the literature on commercial gentrification.

Other shopkeepers in Rue Daguerre said that more urgent priorities should be measures to increase the number of buses and to make stations more pedestrian-friendly, especially for the elderly, the disabled, and people with luggage. Disabled people, mothers with prams or people with luggage were not well accommodated in the centre of Paris without adequate parking facilities.

All these comments from shopkeepers point to the importance of local community involvement in urban and transport planning to create a more inclusive and caring city for all (Kern, 2021).

## 5.2.3. Safety concerns in multimodal transport

Shopkeepers suggested that there was a higher risk of injury in pedestrianised areas due to the mixed traffic environment of pedestrians, cars, bicycles and e-scooters. Some shopkeepers suggested that the pedestrianisation policy was more supportive of facilitating the use of e-scooters than of supporting small, independent local shops in Paris. Others pointed out the dangers of unregulated cycle lanes, which make deliveries difficult.

In general, shopkeepers interviewed stated that alternative modes of transport, such as bicycles and e-scooters, often disregard traffic rules, thus increasing the risk of injury to pedestrians. The general dislike and lack of preference for e-scooters as a mode of transport by both Parisian residents and shopkeepers was also reflected in a recent referendum held by the Paris City Council on the use of e-scooters in Paris. In this referendum, the majority of Parisians voted against e-scooters in the city. The Mayor of Paris, Anne Hidalgo, followed suit and considered banning this mode of transport in the city (Giuffrida, 2023).

In a recent paper, Gössling stated that "e-scooters compete over space with pedestrians, cyclists and motorized transport, and they add complexity to transport systems" and proposed "dedicated micromobility streets" (Gössling, 2020, pp. 2, 9) as part of the solution to their less problematic integration into urban transport systems.

#### 5.3. Types of commerce in pedestrianised local shopping streets against touristification and gentrification thresholds

The types of commerce on the local shopping streets in Paris seemed to diverge from Zukin and others' (2016) "ABCs of gentrification", namely art galleries, boutiques and cafés, in the sense that no art galleries were observed on any of the study streets, and there were few boutiques. On the other hand, Parisian streets have many speciality shops (bakery, patisserie, confectionery, butcher's, fishmonger's, cheese, wine, etc.), grocery stores of various sizes, some soft-line retailers (e.g. textiles, cosmetics and pharmaceuticals) and other specialist retailers (e.g. books, handicraft-gifts and musical instruments).

Although some of these Parisian shopping streets, such as Rue Cler,

were already very touristy, especially before the pandemic, they still retain their local shopping street atmosphere because of their special retail mix. This contrasts with the negative picture painted by Chabrol and Girou (2022) of a decline in retail trade due to the development of large commercial areas in French cities. Figure 2 shows the distribution of shopkeepers surveyed in this Paris study by type of retail outlet.

However, it must be said that it is still possible to observe an artificial atmosphere created for the consumption of authenticity (Zukin, 2008) in these Parisian shopping streets, particularly in the Rue Montorgueil and the Rue Cler, which have mostly similar types (and even brands) of speciality shops.

#### 6. Discussion and conclusion

The counter-arguments in the urban literature against pedestrianisation highlight important underlying issues, such as pedestrianisation acting as a lever for gentrification and touristification, increased socio-



*Figure 2.* The distribution of the shops surveyed by type of retail outlet.

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spatial segregation, centre-periphery polarisation and uneven urban development. For example, Brenac et al. (2013) and Debrie et al. (2020) warn of the possible gentrification and (further) touristification effects of such urban mobility practices. They also note that pedestrianisation can be part of broader urban entrepreneurial and neoliberal agendas to create more competitive cities.

This study has also identified a number of objections to the city's pedestrianisation efforts, with shopkeepers' objections mainly framed in economic terms. Nevertheless, the Parisian shopping streets have maintained their business continuity in the face of the pandemic. The predominance of speciality shops on Parisian shopping streets and regulations against large retail stores in the city centre have influenced the comparative success of Parisian pedestrianisation. In addition, the different implementation of pedestrianisation policies in Paris, such as the coexistence of cars and pedestrians rather than full pedestrianisation, has been credited with supporting businesses and creating a more liveable environment.

Although it is difficult to argue that pedestrianisation has led to gentrification in the streets surveyed, all of which are in central Paris, most of which was gentrified long ago, 61% of shopkeepers surveyed observed an increase in the property value of their shop following the pedestrianisation of their street. It is important to note, however, that some of these respondents were only shop workers and had little idea of the property value of their workplace. On the other hand, there were some shopkeepers who complained about the lack of support from the city administration for small independent shops, which are seen as one of the main attractions of Paris for tourists, and the loss of customers with cars. Therefore, it is possible to argue that the pedestrianisation of these central Parisian shopping streets can lead to "super-gentrification" (Gravari-Barbas, 2017) and indirect displacement effects for their shopkeepers due to the loss of customers coming from far away by car, although there is some counter-evidence in the literature for the latter (Soni & Soni, 2016; Yoshimura et al., 2022).

To overcome the potential negative effects of pedestrianisation identified in the literature and by some of the shop survey participants, this paper proposes that pedestrianisation policies in central Paris be balanced with local communities in mind. This means not only considering the mobility of local residents, but also understanding the specificity of small business communities. Pedestrianisation as a strategy to increase active transport and to reduce emissions aims to improve the quality of life for local residents. However, the removal of parking spaces and the exclusion of cars and lorries from certain streets is a cause of concern for small businesses in Paris, in addition to issues of poor urban planning priorities and road safety.

Therefore, this study points to the need for community consultation in the formulation and implementation of urban policies that are not only concerned with the need to improve public health, reduce carbon emissions, or pursue notions of liveable cities, but also consider accessibility for all city dwellers as a key basis for transport equity and inclusion. While this study was based in Paris, it suggests that other geographical areas undergoing pedestrianisation could benefit from further research that examines pedestrianisation policies from a multi-stakeholder perspective.

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#### Endnotes

<sup>1</sup> This is only an approximate figure as there is a mismatch between the age groups for those aged 70 and over in this study (70-75) and those in ESTAT (70-74).

<sup>2</sup> There is also a discrepancy with the official data, as ESTAT uses the International Standard Classification of Education (ISCED 2011), which includes short-cycle tertiary education.

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# 84 years in urban memory: The relationship of Izmir Atatürk High School-Kültürpark

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#### Abstract

The 1922 Great Izmir Fire points to an important historical rupture in urban memory of Izmir by erasing the past and transforming the urban space. After this demolition, Kültürpark was constructed on the fire debris and accepted as the construction of modern Izmir of newly established Turkish Republic. This change has created new spatial relationships and experiences. One of them is Izmir Atatürk High School-Kültürpark relationship which was constantly produced with the help of user practices, created a collective memory about Kültürpark. The physical neighborhood of the park and high school in the city has created a compulsory interaction between high school students and Kültürpark. Daily life in the park was more easily experienced by students than random teenages. Thus, this defined user group has created their own memory of Kültürpark over the years. In the study, "What is the memory of Kültürpark in Izmir Atatürk High School students?" is considered as the main problem. It is aimed to explore different historical, social, spatial layers of Kültürpark and remind the importance of the park once again. A survey was conducted among 302 graduates between 1951 and 2020 to determine the "different Kültürparks" in the memories of Izmir Atatürk High School students. A mixed set of questions was prepared, and a qualitative analysis was carried out. As a result, the various Kültürpark experiences were determined by the help of these dynamic user profiles. Spatial and social changes in both city and country have been discussed in the context of collective memory.

#### Keywords

Collective memory, Urban memory, Izmir, Kültürpark, Izmir Atatürk High School.

#### 1. Introduction

While many devastating events, such as wars and natural disasters, which destroy important parts of cities in the spatial context, cause a big gap in urban memory, it also gives cities the opportunity to rebuild a new urban memory as if they had no past. The 1922 Izmir Great Fire is one of these crucial historical ruptures. After this destruction, the debris field was accepted as an opportunity for a new urban planning process and the appearance of modern Izmir. At the end of the difficult planning process (Karpat, 2009, 49-554; Maruflu, 2019, 29), the idea of Kültürpark created on the area between the survived schools Izmir Atatürk High School (1888) and Namık Kemal High School (1853) came into sight to build an international stage in Izmir and provide new public space to the modern Turkish citizens.

Kültürpark, which was opened in 1936, has been one of the most important living spaces in Izmir because of the natural, social, cultural, and architectural opportunities shaped by the ideological background of the park. Additionally, the park has become a focal point in the city because of the chance to host the Izmir International Fair since it was constructed. Kültürpark became a stage of modern Turkey and Izmir with the features of providing green areas needed in the city, giving chances to join social activities, and witnessing global developments with the help of international fair. However, this area has reached today with the effect of different physical additions-extractions, functional transitions, construction-demolition interferences and thus identity changes (Kılınç et al., 2015, 10). In particular, because of the decision to move the international fair to the new fairground, the construction of which started in 2013, created a new argument. Today, Kültürpark is still an important topic of urban discussions. While these discussions remind once again the importance of Kültürpark for citizens, uncovering the place of the park in urban memory has gained importance. As Benjamin (1968) defines cities as topographies of collective memory, the traces in the memory of the citizens allow us to observe these transformations and changes that Kültürpark has experienced in the historical process, as in many urban spaces. Therefore, reading this "multi-layered memory space" (Kayın, 2015, 35) through collective memory provides new discoveries about Kültürpark. Considering the collective memory is produced by the experiences of the citizens, the user of Kültürpark will be the main actor in a recent memory reading about Izmir. An important part of these users is students at Izmir Atatürk High School which is next-door neigh-



*Figure 1. Izmir Atatürk High School and Kültürpark in the urban context (The aerial photo is taken from Google Earth and has been edited by authors).* 

bor in the urban space (Figure 1). As a result of the physical articulation of park to the high school, a new experience space has also been created for the students. In this way, the study makes discovering Kültürpark possible through the nearby building and finds the meanings of park by neighbor-user experience.

Izmir Atatürk High School, which was founded as a Greek school in Izmir and was nationalized during the Republican Period as a boys' high school, is one of the witnesses of the city's rise from the ashes. Kültürpark and its next-door neighbor Izmir Atatürk High School have a remarkable relationship in the urban space through their missions with the newly established Republic of Turkey. This relationship has provided Kültürpark with a defined user group with different purposes over the years and has made the park a part of the daily life of high school students. The park, which is the closest public open space to the high school, has been experienced for years as not one of the many spatial choices for students, but often the only and permanent option. Particularly, from 1930s to 1950s, then until the 1980s, Kültürpark was the only alternative as a socializing place for the citizens who had just introduced western practices into their lives. Following the reduction of political pressure in the country in the 1980s, people increased their activities in public places, and Kültürpark became the primary venue for these daily practices again. In addition, the introduction of the technological developments from the world at the Izmir International Fair was very attractive to catch up with the global developments. In other words, over these years, this relationship was established as a relatively compulsory state of action. This interaction led to Kültürpark being used for sports or painting classes, or a flyer collection competition among students. It is possible to say that both in-school and out-of-school uses arise from this necessity of physical proximity. However, in the 2000s, the increase in urban public space alternatives, the acquisition of new consumption habits, and most importantly, the change in the understanding of socialization with digital age moved Kültürpark away from daily life. Hence, each student studying at Izmir Atatürk High School has experienced the Kültürpark of their educational period and graduated from high school with a different Kültürpark in their memory. Each student added a different layer belonging to their own period to the collective memory as a user of Kültürpark. Therefore, this defined user profile has more sustainable data about the park than the random students at other high schools or the young population in the city.

A main discussion of this study is the image of Kültürpark in the memory of Izmir Atatürk High School students (as well as the users of Kültürpark), how this image has changed over the years, what memories have survived, and how collective memories are layered in this direction. The aim of the study was to reveal how the perception of Kültürpark changed over time by Izmir Atatürk High School students during this 84-year period, and to show the different aspects of the park that took its place in the memories. The study tries to read the political, economic, and cultural change of the country and the city through the Kültürpark layers, and Kültürpark experiences of these students. Thus, a survey study was carried out with students who graduated from Izmir Atatürk High School between 1951-2020 and was examined how different users passing through a physical-static structure carry and change the symbolic meaning over time (Amygdalou, 2015, 80). Beyond the urban memory studies in terms of historical, social, and economic perspectives, the study will make an important contribution to the literature in the context of creating a layer of experience and discovering hidden values of collective memory. On the other hand, from a general perspective, it is significant to reintegrate the urban space, which underwent a traumatic change after the war and fire, into the city and to interpret what this transformation represents in the light of experiences.

#### 2. Historical background 2.1. From Greek Girls' School to Izmir Atatürk High Scool

According to Augustinos, Izmir became a developing education center in the second half of the 19th century and many schools were founded (as cited by Senocak, 2003, 111). Due to the cosmopolitan nature of the city, each ethnic group established its own educational system. Compared to the schools of non-Muslims and Levantine groups, the educational opportunities of Turkish and Muslim groups in Izmir were inadequate, but improvements were started after the Tanzimat Period (Kerimoğlu, 2013, 87). Evangeliki School (1733), Greek Girls' School (1840), Saint Joseph French School (1881), Cordelio School (1889), American Girls' College (1887), American Boys' College (1891) were examples to the foreign schools, while Izmir Rüştiyesi (1859), Izmir Mekteb-i İdadisi (Izmir Mekteb-i Sultanisi) (1888) and Hamidiye Mekteb-i Sanayii (1891) were the examples for Turkish-Muslim institutions that started education in Izmir in this period (Senocak, 2003, 11-125). Today, it is seen that some of these examples continue their education in their existing structures or by moving to another structure, some of them are closed and their buildings are used for different functions or school buildings are demolished and erased from the urban space. Izmir Atatürk High School (formerly Izmir Mekteb-i Sultanisi) is one of the educational buildings that have survived to the present day by using the building of the Greek Girls' School.

*Izmir Mekteb-i İdadisi* (Izmir Boys' High School, now Izmir Atatürk High

School), one of the first schools of Turkish-Muslim groups in Izmir, was opened in 1888 as a 5-year primary school in the building where the old Izmir Courthouse is located, then it was closed in 1919 due to the Greek occupation (Tinal, 2008, 129). The school building was converted into a courthouse during the Greek occupation and became unusable following a fire in 1922<sup>1</sup>. A large stone building saved from the fire was accepted as suitable for use to continue education (Segmen, n.d.). Thus, the school was renamed as Izmir Boys' High School after the war and moved to its "new" structure in the 1922-1923 academic year (Tinal, 2008, 130).

The stone building that physically hosted the high school after 1922 was the Greek Girls' School. Greek Girls' School (Kentrikon Parthenagogeion) was opened in 1840 with the help of Hagia Fotini Church and used the physical facilities of the church (Papachrysou, n.d.). Because of the increased number of students in 1908, the Girls' School was unable to meet its physical needs, so it searched for a building in the city center to be used permanently (Papachrysou, n.d.). According to this need, the building designed by the Athenian architect P. Karathanasopuolos was built between 1909-1912 at current location (Amygdalou, 2015, 91; Vassiadis, 2007) (Figure 2).

From an architectural point of view, the Greek Girls' School building was designed in Greek Revivalist style defined by Amygdalou (2015, 92) as an architectural style that was frequently used (especially on educational buildings) in the process of Greek na-



**Figure 2.** Left: Greek Girls' School and its students (Izmir Provincial Education History Museum (İzmir İl Eğitim Tarihi Müzesi) Archieve), Right: Main entrance of the school ([Photograph of Ahmet Gürel], n.d.).

tion-identity construction in the last period of the Ottoman Empire. The school building was located between similar neighbors and became one of the institutions expected to lead the Greek nation aimed for independence by educating Greek students (Senocak, 2003, 112). In addition to the ideological meaning it reflects, the building presents a monumental effect with the gallery space carried by the columns in the entrance hall. With these features, this hall is described as a "columned courtyard that continues to exist like an ancient temple" and refers to Ancient Greek architecture (Papachrysou, n.d.).

Even though the school building survived the 1922 Izmir Great Fire, it was faced with a pile of debris. Then, the school was closed after the Turkish army regained Izmir. As Uçman Altınışık (2012, 140) states, any architectural product cannot remain the same without transforming within the ambiguous boundaries of time-space relationships, and physical spaces conceived in time can have different meanings. At this point, it is possible to say that the school building, which is alienated from its environment, needs a new meaning to exist. This meaning, which will recreate the building ideologically, has been the Turkish nation-identity construction. The school became one of the spatial responses of another national claim after 1922. After the liberation of Izmir from the Greek occupation, the school was transferred to Izmir Boys' High School<sup>2</sup> to educate the modern Turkish youth of the period. Hence, the building, whose educational function was preserved, became a Turkish school within the Greek Revivalist style (Figure 3).

In this period, the problem of the relation of the school with the urban space and with the gap and ruins, could not be solved. Except for a small garden at the back, the open space arrangement of the school was severely damaged, and the only way in and out was through the front door, which was surrounded by debris (İ. Tutum, personal interview, January 13, 2021).

The relation between Izmir Atatürk High School and the built environment was ensured in 1936 when Behçet Uz (one of the graduates of Izmir Atatürk High School) put the idea of Kültürpark into practice. Urban destruction, which is emphasized once again by A. Gürel's (personal interview, January 13, 2021) sentence when describing his student years, "The foundation remains of old demolished houses were seen from the dormitory of the school", started to gain a new meaning. Moreover, the planning movements near the park caused the school to build a new context with its nearby environment.



*Figure 3. Izmir Boys' School with students, 1925 (Izmir Provincial Education History Museum (İzmir İl Eğitim Tarihi Müzesi) Archieve).* 

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#### 2.2. Rising of Kültürpark

In the 19th century, the multicultural structure and commercial identity of Izmir where was the one of the most important port cities of the Eastern Mediterranean, was damaged due to the Greek occupation at the end of the 1st World War, the War of Independence, the 1922 Izmir Great Fire, and the population exchanges (Bilsel, 1996, 15). In particular, the fire affected the area where non-Muslim neighborhoods located including I. Kordon and II. Kordon and it erased many traces of the past. Unfortunately, only a small area survived consisted of Izmir St. John's Catholic Church, Hagia Fotini Greek Orthodox Church and today's Izmir Atatürk High School, Namık Kemal High School and Turkish neighborhood (Yilmaz & Yetkin, 2002, 69).

In the Early Republican Period, it became increasingly important to rebuild the destroyed city both physically-spatially and economically-socially. In this context, the first spatial intervention for the reconstruction of the fire area was carried out in 1924 with the Rene-Raymond Danger brothers and Henri Prost. This plan outlined Izmir's planning process, including decisions regarding the port, industry, transportation, and residential areas, along with proposed green axes. On the other hand, the Izmir Economy Congress and Economy Exhibition, which was held on February 17, 1923, has been organized in the city in order to introduce a fully independent country and economic development plan with domestic products and local values (Sönmezdağ, 2013, 123). The congress was an effective place where developments in agriculture, industry and trade were discussed. After this event, which was successfully completed and was met with great interest, Mustafa Kemal's instruction for Izmir as "Establish fairs and open exhibitions in this city" (Kaya, 2016, 11) marked the beginning of a culture of exhibitions that turned into international fairs in the next few years and is still happening today (Altan, 2015, 166-167). This attempt, which aims to promote a new and modern country in the international arena, was supported by the organisations named Izmir 9th September Exhibition and Izmir 9th September Fair until 1935 (Sönmezdağ, 2013, 123-125).



*Figure 4.* Above: 1936, opening ceremony of Kültürpark (looking at Lozan Gate from Izmir Atatürk High School) (Fotoğraflarla\_İZMİR, 2016), Below: Early years of Kültürpark (Mangır, 2021).

In the process, the need for a permanent exhibition space came to the fore to ensure the continuity of the fair. The green axis proposal in the city center by Danger-Prost plan is reserved as a 60,000 square meter park in the fire area. The proposal was carried forward with Suad Yurdkoru's idea of creating a Kültürpark<sup>3</sup> (Altan, 2015, 173). The projected green area of 60,000 square meters was increased to 360,000 square meters, and the foundations of the park, which will both host an international fair and have public space facilities for the citizens, were created. By visiting European countries, Behçet Uz collected data about how a city park should be organized and Suad Yurdkoru produced a project report about Kültürpark (Karpat, 2009, 109-111). As a result of the rubble removal works, the surrounding of the area with a wall, the opening of the boulevards connecting the area to the seaside, the landscaping and the completion of the infrastructure works Kültürpark was opened to the public for the first time on September 1, 1936 (Altan, 2015, 174) (Figure 4).

At the project stage, Behçet Uz emphasized that Kültürpark will be a public university where various playgrounds, summer and winter swimming pools, parachute tower, amphitheater, Aegean Products Museum, Health Museum, Atatürk Revolution Museum, and an attractive urban space where everyone can go (Feyzioğlu, 2011). In the first years of the establishment of Kültürpark, places such as tea gardens, amusement park, zoo, children's playgrounds, casinos/clubs, tennis club, and botanical garden (Bozdoğan, 2015, 95) were arranged in the landscape. In this way, Kültürpark has become an important destination in the daily life of the citizens with its opportunities. Hosting the Izmir International Fair by Kültürpark reflected Izmir's cosmopolitan identity before 1922 and created a shared platform for following and incorporating global economy and technology.

When Izmir was destroyed by fire, the Ottoman traces were erased, and the chance to build a modern city was created (Bugatti, 2010, 55). Kültürpark, built on the debris field, has become

one of the important urban spaces that will form the new memory of the young Republic by rising on the traces of the past. In this sense, Kültürpark has had an important place in the urban memory and has become a "multi-layered memory place" with the transformations it has experienced since 1936 (Kayın, 2015, 35). When looking at this multi-layered memory space, it is seen that the park has different spatial-experiential qualities that reflect the changing economic, political, and socio-cultural past of the country. Until the 1950s, Kültürpark had hosted spaces built in a modern style and an urban life suitable for the ideal of modern life (Altan, 2015, 181). The park has also become a face of Izmir and Turkey, opening to the world, and making an impression on the international scene. Visiting the foreign pavilions and following new developments has become an event that is awaited every year (Durgun, 2015, 138). From the 1950s to the 1980s, Kültürpark had stood out with its entertainment facilities of Kültürpark became important as well as the educational mission brought by the ideology of modernization (Kaya, 2016, 33-38). With the establishment of casino and disco culture in urban life, Kültürpark has become the place of a new practice that did not exist before for the citizens of the city. In the 1980s, Kültürpark provided entertainment to the citizens with its fair organization, zoo, amusement park, casinos/ clubs, and tea gardens (Kaya, 2016, 39). After the International İzmir Fair Organization and Architectural Project competition opened in 1990 and the arrangements made in the area until 2000s, such as the construction of New Fair Buildings (hangarlar) and the demolition of some tea gardens and casinos, changed the spatial organization of the park (Karpat, 2009, 171-175, Durmaz Drinkwater & Can, 2015, 343). During the 2000s, this situation continued with the loss of functions such as the transfer of the zoo to Sasalı, the construction of an underground car park, the damage done to clubs, the establishment of the Izmir International Fair in its new area in Gaziemir. These interventions have damaged the ideological, symbolic, and authentic

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features of the Kültürpark by removing the original structures and landscape arrangements. In this process, the relationship of the citizens with Kültürpark was damaged, as many of the elements that took a place in the memory of the city no longer belong to the park.

#### 3. The relation between Izmir Atatürk High School and Kültürpark

Architecture as a cultural production, shows itself within different forms and meanings by affecting the social and physical conditions. This production is not a time-independent phenomenon that can be repeated in the same ways everywhere and in every period (Uçman Altınışık, 2012, 131). Space and time are interrelated in a mutual transformation; thus, static-physical space is conceptualized by experiences in time. Having these experiences in mind after a while makes memory a part of daily life, and the physical environment in which we live creates the context for individual and collective memories. (Özaloğlu, 2017, 13).

According to Confino (1997), memory defines the feelings that people build for their past experiences. Similarly, Al (2011, 23) describes memory as the emergence of past moments that gain meaning and are wrapped up. With this feature, memory is associated with the physical and social environment of the individual, as well as is contributed by the individual experiences. Therefore, memory is not just an individual phenomenon, it is shaped as a result of interaction with social life. This situation points to the concept of collective memory. The memory, which exists with the temporal and spatial experiences of the individual in the society, is defined by Halbwachs (2019) as a collective memory. Through this approach, memory has been placed

within social and cultural boundaries by removing it from individual boundaries, creating a research area focused on the relationship between memory and people-built environments. (Mutlu et al., 2019, 43).

Having experienced the space, a person reconstructs it with life and makes it part of his/her own memory by moving it beyond being temporal (Kaymaz Koca & Hale, 2017), as well as constructing an active time by connecting to the space throughout the experience (Merleau-Ponty, 2005). As a result of this production, space becomes a suitable environment for the preservation of memories, the formation of memory and the representation of collective thought (Özaloğlu, 2017).

In short, spaces carry the fragments of social events and common experiences gathered in the memories (Mutlu et al., 2019), the built environment records our experiences in our minds and provides the finding a physical correspondence of our memories. The data of collective memory is also transforming with the changes in the urban space, and people forming the collective memory changes over time according to the individual's role and position in society. Similarly, it is impossible to consider a memory apart from its temporal and spatial context when studying the relationship between Izmir Atatürk High School and Kültürpark (Figure 5). It is important to discover the hidden values of the memory in this relation, in other words, to reach the collective memory. At this point, hidden memory between Izmir Atatürk High School and Kültürpark was examined in the context of the question of Amygdalou (2015, 80), "how does the symbolic meaning change while the built forms disappear, reappear o remain the same in the liv-



**Figure 5.** From left to right: Between 1912-1922, Greek Girls' School and non-Muslim neighborhood; 1922 Great Izmir Fire, unused school and fire debris; Between 1922-1936, Izmir Atatürk High School disconnected with the city; 1936, Location of Kültürpark; From 1936 to today, relation between the school and the park (The figures prepared by the authors).

ing socio-political context that consist of different audiences?", with the help of collective memory reading. The symbols of Kültürpark that remain in the memories of users are revealed, and the hidden memory is reached through the experience of Kültürpark.

#### 3.1. Kültürpark in the memory of Izmir Atatürk High School Students

The time-space shift created by the 1922 Izmir Great Fire on urban memory triggered the spatial formations of Izmir Atatürk High School and Kültürpark. This relationship, the foundations of which were founded by such an external force, created a dynamic experience environment within a rigid physical unity. In this part of the study, the rewriting of Izmir Atatürk High School-Kültürpark neighborhood by users in different periods, in other words layers of the collective memory will be made visible. For this purpose, the survey method was used as a data collection tool. The survey was conducted digitally with the graduates of Izmir Atatürk High School. Here, it was aimed that this defined user group, which is necessarily associated with Kültürpark every day, would reveal the changing spatial, social, cultural, and physical characteristics of the park. (Figure 6)

The questionnaire was prepared under these three headings: Kültürpark-city relationship, Kültürpark-user relationship, and Kültürpark-memory relationship. The introduction part of the questionnaire form consists of information such as graduation year,

duration of education at school, and studentship type (stayed at dormitory/ stayed at family house) to determine the participant's profile. The first part of the questionnaire seeks to answer the question of how Kültürpark is involved in the daily life of students in the urban context. The second part tries to reveal which actions are associated with Kültürpark, how it is used and perceived by the students. The last section focuses on finding out what is remembered about Kültürpark. As a result, it aims to determine the place of Kültürpark within the urban environment, the changing functions of Kültürpark, and how these changes affect the user, to obtain information about the memorable Kültürpark, and to monitor how Kültürpark is changing in terms of its physical and social environment.

The questionnaire contains multiple-choice, multiple-selection and open-ended questions. Rather than an analytical analysis with numerical values, the data collected through these mixed questions was used for a qualitative analysis to reach social dimension. The questions asked in all three headings were divided into subgroups, then combined according to similarity of answers. The grouping is organised as "Kültürpark activities" and "Kültürpark gates" in Kültürpark-city relationship scale, "Kültürpark spaces" and "Symbols of Kültürpark" in Kültürpark-user scale, "Meaning of Kültürpark", "Feelings in Kültürpark" and "Kültürpark memories" in Kültürpark-memory scale (Table 1).



*Figure 6.* A view from Kültürpark to today's Lozan Gate and Izmir Atatürk High School (Kaya, 2016).

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GROUPING		QUESTIONS	ANSWER TYPE
CITY	Kültürpark activities	Where would you spend your free time after school?	Multiple choice
		Where would you take your guests from different cities first?	Multiple choice
		How often did you go to Kültürpark?	Multiple choice
		How long would you spend in Kültürpark?	Multiple choice
		What were the purposes of going to Kültürpark?	Multiple-selection
	Kültürpark gates	Which gate did you use when entering Kültürpark?	Multiple choice
		Which gate did you use when leaving Kültürpark?	Multiple choice
USER	Kültürpark spaces	For you, what are the structures/spaces that symbolize Kültürpark?	Multiple-selection
		Where would you spend most of your time in Kültürpark?	Multiple choice
		If the pavilions, which one?	Open-ended
		If the casinos/clubs, which one?	Open-ended
		If the tea gardens, which one?	Open-ended
	Symbols of Kültürpark	What would you show first when you take your guests to Kültürpark?	Multiple choice
		What comes to mind first when you think of Kültürpark?	Multiple-selection
		Is there a subject that you identify with Kültürpark?	Multiple-selection
MEMORY	Meaning of Kültürpark	What did Kültürpark mean to you?	Multiple-selection
	Feelings in Kültürpark	How did you feel at Kültürpark?	Multiple-selection
	Kültürpark memories	Tell us which word comes to mind first when you think of Kültürpark.	Open-ended
		Tell us which place comes to mind first when you think of Kültürpark.	Open-ended
		Tell us which subject comes to mind first when you think of Kültürpark.	Open-ended

*Table 1.* Questionnaire and grouping of the questions.

#### 3.2. Findings and discussion

The survey was conducted with the participation of 302 Izmir Atatürk High School graduates, whose age range was between 19 and 81. According to the data collected from the introduction part of the questionnaire, between the participants, 2 in 1951-1960 (the oldest graduates who were reached during the survey), 11 in 1961-1970, 59 in 1971- 1980, 98 in 1981-1990, 47 in 1991- 2000, 33 in 2001-2010, 52 in 2011-2020 graduated from the school. 162 people said 3 years, 120 people said 4 years, 11 people said 5 years, 5 people said 2 years, 2 people said 1 year and more than five years as answer to the question of the duration of education at the school. Lastly, 57 people reported that they stayed at the school's dormitory, while 245 people reported that they stayed at family house during their education. At this point, it is possible to say that the diversity of the participant profile will make it easier to reach different layers of Kültürpark. In line with these data, the participants were divided into three groups according to graduation date as "Period 1" 1951-1980, "Period 2" 1981-2000 and "Period 3" 2001-2020. This periodization is made through the reflection of the political and socioeconomic changes in the country and the city on the spatial experiences of Kültürpark in the temporal context.

Users between 1951-1980 are those who can relate to the founding ideology of Kültürpark and experience modern practices. The users between 1981-2000, who witnessed the changes in Turkey because of the 1980 coup, experienced Kültürpark with the effect of relief, entertainment practices and new consumption habits. In addition, they strived to follow the technological developments in the world and adapted to the era. Finally, users between 2001-2020 differ from other periods both in terms of accessing information and in daily life practices. Benefiting from the opportunities of the digital age, this group has many alternative socialization tools and alternative spaces to Kültürpark. From this point of perspective, it is also possible to say that these periods match the historical thresholds of Kültürpark<sup>4</sup>.

To reach the collective memory of these periods, the first three answers given to the classified question groups were evaluated. It is accepted that the results will not only reveal the historical layers of Kültürpark but will also create an important main source for interpreting the value of the park on both the city and country scales.

While evaluating the results, primarily, the first part, which explores the way Kültürpark accompanies daily life in the urban context, is focused on. First, when the results of the usage rate of Kültürpark are compared, it has been determined that the rate of preferring the park for urban activities has decreased since 1951. While Period 1 and Period 2 visited Kültürpark almost every week, it is seen that this rate changed to once a year in Period 3. Similarly, although there was a majority from Periods 1 and 2 stating that they spent 3-4 hours a day in Kültürpark, this time was limited to 1-2 hours a day in Period 3. Therefore, it was concluded that the habit of going to Kültürpark was abandoned with the emergence of various urban public spaces over time. Afterwards, in order to question the location of the park in the urban space, the gates were investigated. The results are listed as Lozan Gate, Montrö Gate and 9 Eylül Gate according to frequency of use. The reasons for this accumulation are two important points, including the entrance to Izmir Atatürk High School from Lozan Square, where the Lozan Gate opens, and the location of another boundary on Montrö Square, where the Montrö gate opens. At the same time, the connection of the Lozan Gate with Vasif Cinar Boulevard, the Montrö Gate with Şehit Nevres Boulevard, and 9 September Gate with Basmane Train Station, made these gates more visible. Moreover, it is possible to say that the Cumhuriyet Gate and the 26 Ağustos Gate did not find a place in the results due to being service doors of the park (Figure 7).

In the second part of the questionnaire, firstly, the Kültürpark-user relationship was examined. It was determined that the actions of "spending time with friends", "going to the amusement park", "visiting the pavilions", "watching concerts-shows" became prominent. Then, the places and symbols of Kültürpark associated with these actions were analyzed. At this point, it was determined that Period 1 and Period 2 focused on the "Parachute Tower" and "Pavilions". The Parachute Tower described as "Izmir's new aviation monument" in Arkitekt Journal (Tümay et al., 1938, 40) took its place in Kültürpark due to the importance given to Turkish Aeronautical Association by the Republic administration (Kayın, 2015, 50) (Figure 8a). As can be understood from the results, the act of flying and Parachute Tower, which are important symbols of Republican ideology, have received a great deal of attention from the public because of their architectural and innovative qualities. Also, the tower has been a part of the memories of young people who have not experienced flying before and have tried it for the first time with this tower. On the other hand, when air travel became widespread in Period 3, the Parachute Tower was not used as flying was not a new practice. Thus, it could not



*Figure 7.* Gates of Kültürpark (The aerial photo is taken from Google Earth and has been edited by authors).

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take a place in the collective memory of this period. The Parachute Tower, which has an important place in memory, has become a cultural heritage that needs to be preserved for today. As well as welcoming and following pavilions built to keep up with innovations in fields such as industry, trade, art, and fashion in the international arena, visitors also expressed a great deal of interest in the developments at the national level, which was also supported by the survey results (Figure 8b). During the second half of the 20th century, these temporary structures became a permanent part of the collective memory. For instance, USA and USSR pavilions, which "turned the Izmir International Fair into an arena in which the opposing ideologies of the Cold War clashed (Gönlügür, 2015, 101)" drew great attention. Apart from that, Pakistan Pavilion with its eclectic elements and orientalist style, was distinguished from other buildings in Kültürpark and excited the citizens (Kayın, 2015, 48), so as one of the rare examples of pavilions that have survived to the present day, it has remained in the memory of all three periods. Unlike Period 1 and

Period 2, which follow the worldwide technological developments through pavilions, Period 3 accesses information much more easily with the possibilities of the internet age. Therefore, it has been determined that the pavilions for Period 3 have no symbolic value but are only seen as an architectural structure.

When Kültürpark is evaluated in the context of entertainment, it is possible to say that the casino culture and famous artists remain in the memories for Period 2 (Figure 8c). The casinos/ clubs, which are seen as a culturally important part of modern life, have also been embraced by the citizens and their experience has almost turned into a ritual. Therefore, it has been clearly seen from the survey results that the casinos are one of the haunts of modern Izmir citizens (M. Gürel, 2015), especially the Göl Casino and the Ada Casino.

On the other hand, it is clearly seen that the modern places of its time, such as country pavilions, casinos, or the Parachute Tower, did not have the same value for Period 3. The results demonstrate that the amusement park, which



*Figure 8.* a. Parachute Tower (Tümay et al., 1938), b. Sümerbank Pavilion (APİKAM Archieve) and pavilions from Kültürpark (A. Gürel, 2019, 14) c. Entrance of a casino with a Zeki Müren poster (Akay, 2017) and Göl Casino from 1970s (Eski İzmir, 2017), d. An old view from the amusement park (Akçura, 2017, 20). (The aerial photo is taken from Google Earth and has been edited by authors).

is a different way of having fun, is one of the most important elements for Period 3 (Figure 8d). In addition, seeing Lozan and Montrö Gates as the symbols of Kültürpark, unlike the previous periods, shows that Period 3 perceived the boundaries rather than park's public facilities and found interest outside rather than the inside.

Finally, the results of the Kültürpark-memory section were examined. First of all, the meanings of Kültürpark took a place in the memories, and were found out as "green space", "fair" and "fresh air" for all three periods. At this point, having green space and hosting international fairs both come to the fore at similar rates. Continuity of public features offered within the scope of the fair is equally important as preserving a green area that breathes in the city for the user. Similarly, happiness, peace and comfort are expressions that reflect the common feelings about Kültürpark of the three periods. In addition, the fact that there are people who feel "insecure" in Kültürpark among the Period 3, once again emphasizes the qualities lost over time and the park's changing role in daily life for the citizens.

When focusing on the Kültürpark memories, it is possible to find the unique Kültürpark meaning of each period. Here, mini golf came to the fore as one of the important Kültürpark memories of Period 1. This result was also an indication that the youth of the period were interested in new, modern, and different activities. Furthermore, Period 1 was the group that spent the most time in tea gardens such as Akasyalar and Menekşe indicated as memory places. Kaskatlı Havuz, which was often used as a drawing figure in the art class or was used as a background of souvenir photographs taken (İ. Tutum, personal interview, January 13, 2021), is also an important memory element for Period 1. Kaskatlı Havuz (Figure 9a), an example of the original landscaping practices applied with "geometrically shaped pools with fountains in the middle, neat flower beds, regularly planted trees (Bozdoğan, 2015, 94)" in the Republican Period, created a visual richness for the public and as an educational tool. In addition



**Figure 9.** a. Kaskatlı Havuz (with Inhisarlar and Spain Pavilions) (Akay, 2017), b. Jogging in Kültürpark (https://www.kulturparkizmir.org/tr/Spor/15/79) c. Mogambo Disco Poster (Yeni Asır, 1956 as cited by M. Gürel, 2015), d. A newspaper article on new consumption habits (Yeni Asır, 1955 as cited by Durgun, 2015) e. Ege Güneşi (Daştan, 2022) (The aerial photo is taken from Google Earth and has been edited by authors).

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to that, Period 2 focused on the runs in Kültürpark as part of the Physical Education course. Similarly, Period 3 focused on jogging and sports activities in the park in their answers (Figure 9b). At this point, it is important that Kültürpark is a stakeholder in school lessons and is involved in different daily practices. Another focus of Period 2 has been disco places (Figure 9c). It is not surprising that discos became a focus point in this time when the change in understanding of entertainment in the 1980s led to Kültürpark becoming more of a magazine image instead of a fair during this period (Kayın, 2015, 58). The acceleration of the entertainment life in Izmir, the increase in entertainment venues that will operate all year, and the preparation of special programs for the fair period of these venues (Savur, 2017, 163-167) have affected urban practices and made discos a part of Kültürpark memories. In particular, Mogambo has been a frequent destination for young people to socialize, meet their friends or dance for both Periods 1 and 2. Parallel to the changing in entertainment approaches, the beer-pasta duo of Period 2 described a new eating-drinking habit and a way of being together with friends. These new consumption habits, introduced during the fair periods, are unforgettable for the citizens (Durgun, 2015, 158)

and entered into daily life (Figure 9d). The changing socialization routines of the country and experiencing western practices left its place to a consumption habit that permeated the entire urban space in Period 3. Therefore, what was new for Period 2 has become ordinary for Period 3, and these qualities of Kültürpark have lost their importance.

In addition to the Kültürpark memories of Period 1 and Period 2, the answers given by Period 3 reveal that the experiences about the park have changed. The Book Fair has been one of the most important organizations that helps Period 3 to relate with Kültürpark. However, the fact that this organization is active in a limited time has limited and weakened the bond between Period 3 and Kültürpark. Another symbol in the Kültürpark memory of Period 3 is determined as the Ferris Wheel (Ege Güneşi) (Figure 9e). This can be interpreted because of the amusement park still being active during this period and the Ege Güneşi visible from outside the park.

#### 3.3. Evaluation of findings

Kültürpark is a platform where many relationships on the scale of peoplecity-country-world can be read beyond its park feature. With the findings from three periods, the survey created a basis for understanding all the contextual



Figure 10. Findings from the survey (The figure prepared by the authors).

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values this platform represents locally and globally. Also, these findings became a mirror on which Kültürpark's nearly 84-years-old story is reflected (Figure 10). Looking at this mirror, Kültürpark between 1950-2000 as described by Period 1 and Period 2; has regained the cosmopolitan city identity that Izmir lost; has undertaken the task of not only seeing and learning from the world, but also showing and proving oneself; has been a meeting platform for the modern youth of the modern country; has allowed western entertainment practices with discos; has provided a teenager with experiences beyond time with parachute tower; has supported the country's goal of raising healthy young generations by facilitating sports activities; has enabled its users to have modern practices such as playing mini golf like their peers around the world; brochures collected from the pavilions have brought many young people to the global information provided by television and the internet today; has allowed consumption opportunities new triggered by liberal economic policies with the help of casino culture and discos, and introduced young people to global brands; has made it possible for young people to reach many artists and performance art activities; created the stage for the relaxation and entertainment practices of the society after the martial law of 1980s. On the other hand, between 2001-2020 defined by Period 3, Kültürpark has been perceived not as a socializing place but as an urban void; has become a place that feels unsafe in daily life; has fallen behind many public spaces within the urban space; mostly has been visited during special occasions such as Book Fairs or concerts; and has named not as Kültürpark but according to the functions in it, such as "going to the amusement park".

#### 4. Conclusion

The great fire of 1922 ruptured urban memory in Izmir, and the neighborhood of Atatürk High School-Kültürpark, which was shaped on that break, has hosted a dynamic network of spatial experiences and relationships. As Tanju's (2005) said that production

continues as long as life lasts, in a sense, life is exactly this production, the relationship between Izmir Atatürk High School and Kültürpark creates a collective memory by constantly being produced with user practices. The study on the place, meaning, and layers of Kültürpark in social life, based on the notion that space produces new syntheses by deriving from context and constructing new relationships over time (Kaymaz Koca & Hale, 2017, 489). The purpose of this study is to open a new door to all the discussions about Kültürpark in recent years through the perspectives of the users at Izmir Atatürk High School.

Socio-cultural practices (Tanju, 2005) as productions added later to nature are produced repeatedly with historical differences, continuities or breaks, change depending on time and rewrite the space. Thus, the space-time relationship, as an effective concept in giving meaning of social practices, is important for explaining the changes, crises and revolutions experienced by the society (Giddens, 1996, Kern, 1983; Mumford, 1934; Simpson, 1995 as cited by Uçman Altınışık, 2012, 9). At this point, the research on the collective memory of Kültürpark allowed us to explore the meanings of the new historical-spatial context written on the space-time shift created by destructive factors such as fire, war, and population exchange. Every clue that was discovered in this context has proved the importance of the park in terms of urban history once again. Kültürpark whose future is often discussed, again revealed its place in the urban memory by making the user experience visible.

Kültürpark has been the leading actorand venue of all political, economic, and social changes since the day it was built. Until the 1980s, as almost the only public open space in the city, it became the socializing place of the citizens and witnessed many experiences. The original spatial features of the Kulturpark made this experience unique. However, the developments experienced in the 2000s greatly affected the place of Kültürpark in daily life. Since the 1990s, shopping centers have provided citizens with a variety of activity opportunities and a new platform for

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meeting (Sayar & Süer, 2002). Aside from that, the organisation of Alsancak Kordon as a green area in 2000 has generated a great deal of publicity in Izmir and people have accepted this area as a gathering, meeting, and recreational area. Over time, these urban facilities have damaged the popularity of Kültürpark, which was the only equivalent of spending time in the public space for citizens until the 2000s. Parallel to this, it can be observed that the park is no longer preferred by the users caused by developments such as the reorganization of Kültürpark and the loss of its functions such as the casino, tea garden, Zoo, Izmir International Fair. Over the years, the feeling of spending time in Kültürpark has started to be described as unsafe, indicating that the park has moved away from being a socializing place like in previous years and has become desolate. At the same time, the hope of the past to be modern and to catch up with the age has been lost by the speed of accessing the information provided by digitalization. By changing daily practices and interventions towards the park, Kültürpark has lost many meanings, so that it has become something quite different from what it was in the past. Despite these changes, the recent Covid-19 pandemic has once again highlighted the importance of using Kültürpark as the largest open-green space in the city (Gülber, 2022, 59).

As a result, the article demonstrates that the students at Izmir Atatürk High School have carried different Kültürparks shaped in their memories by witnessing the history of the park, and Kültürpark has become a part of the collective memory by going beyond its temporal context with user experience. Thus, this study opens a new discussion topic for a collective memory reading process with the park's past and daily users. As a result, the relationship between Izmir Atatürk High School and Kültürpark makes it possible to interpret the park's significance in the city's memory, to explore its recent past, and to read the park's layers of history.

#### Endnotes

<sup>1</sup>In line with the information of Izmir Governor Izzet Bey on May 14, 1919, that the Greeks would land soldiers in Izmir, the intellectuals of Izmir met at the Corps Headquarters, Sarı Kışla and Provincial Hall in Konak Square to decide the steps to be taken against the occupation. Later, upon the invitation of Mustafa Necati, one of the teachers of Izmir Mekteb-i Sultanisi, they used the school building as a meeting place (Tinal, 2008, 24). However, when the occupation began on the morning of May 15, 1919, the Greek Flag was raised in *Izmir Mekteb-i Sultanisi* like in other public buildings (Turan, 1992, 142, as cited by Tinal, 2008, 24). After the occupation forces left Izmir, the building was used as a courthouse by the Turkish government (Seğmen, n.d.). The Courthouse, the Government House and the building were badly damaged by the fire that broke out on July 31, 1970, and the building was demolished a few years later.

<sup>2</sup> The building, which was put into use by Izmir Boys' School, was repaired by Behçet Uz and made suitable for education (A. Gürel & İ. Tutum, personal interview, January 13, 2021). It was renamed Izmir Atatürk High School in 1942 and continued its education life in the campus where this building is located (Tinal, 2008, 131).

<sup>3</sup> Suad Yurdkoru, who was sent to Moscow as the head of the group for a sports competition, was very impressed by the Maksim Gorki Park and the public opportunities it offered to the citizens during the city tour. During his stay in Moscow, he received information about the projects of the park and took photographs. When he returned to Izmir, he told Behçet Uz, "This park suits us." He introduced Gorky Park and put forward the idea of Kültürpark. (Maruflu, 2019, 31)

<sup>4</sup> Kayın (2015), in the article titled "Representations of Remembering and Forgetting: Izmir International Fair and Culture Park's Memory Layers", categorizes the layers of Kültürpark in four topics; from the 1940s to the 1950s (an ideal stage for the modernization of the Republic), from the 1950s to the 1980s (frayed out ideal, settled habit), from the 1980s to the 2000s (Popular culture and "consumer" consumption) and from the 2000s to the present (Searches for representation of the past and build of the future).

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# A multi-layered reading on the salon-vitrin coupling: Domestic staging in modern apartment in Türkiye

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#### Abstract

This paper focuses on the modern living room, which is appropriated as a salon by the socio-economic middle class in Türkiye, and where vitrin is a furniture set in which spectacular objects are staged. Revealing hybridity in the ways the imposed westernization is appropriated and expressed by the inhabitants, the salon becomes a contested space for the multi-generational dwellers in their role of power. Instead of accommodating the everyday practices of the family, the salon is reserved for guests only, like a "museum". Its contextual extension, vitrin, as an interface nested within its interior wall with multiple layers, offers staged communications between the household and the outside world. This study offers a multi-layered reading to trace the hybridity of expressions created by the inhabitants through this salon-vitrin coupling. It elaborates on domestic staging practices by focusing on the relationship between subjects of dwellers and guests, their representations constructed with the agency of objects, and their immersed environments of windows, screens, and stages. As different generations live in the same house, a specific form of dwelling has emerged. The sociocultural, material, and technological layers of staging practices form a suitable physical environment for the emergence and sustenance of the domestic staging practice. This study concludes that these practices contribute to capturing the transformation of everyday domestic life, in which vitrin has evolved as an inter-facade that produces new meanings from the interior to the exterior, exceeding its original intentions.

#### Keywords

Agency, Domestic staging, Interface, Living room (salon), Vitrin.

#### 1. Introduction

This paper aims to bring a multi-layered reading of the living room practices when domestic life has been laden with the publicity of social life and work. It invites us to rethink the living room in the current age of digitalization by focusing on a local example: the salon of the modern apartment block (apartman) typology in Türkiye. The Turkish living room, being excluded from everyday domestic life and yet being the public face of the household, mediated the relationship between the public and the private for decades by regulating the behavioral patterns of dwellers across generations. We aim to unfold the living room practices by reconsidering the domestic stage and staging the public image of the household in the salon of the Turkish modern apartment typology. The discussion will be established by identifying the originality of the salon as the domestic space of "struggle" and pinpointing the periodical and generational shifts to acknowledge the altered conditions producing the inter-facades and their transformation. Concerning the predisposition of objects and the agency of things, the paper will elaborate on the domestic staging practices by focusing on the relationship between subjects of dwellers and guests, their representations constructed with the agency of objects, and their immersed environments of windows, screens, and stages.

The paper indicates the formation of the salon as a unique physical environment for the emergence and sustenance of the domestic staging practice and to follow the transformation in building law and rapid urbanization leading to apartmentalization and technological developments especially accessibility of television in the domestic life in Türkiye after the 1950s. The study also deals with the vitrin as an important element and the contextually indispensable extension of the salon in modern Türkiye. The study assesses vitrin as an interface that offers staged communications between the household and the outside world.

Drawing upon a material-semiotic approach, the research takes into account both material (physical and organizational aspects) and semiotic (symbolic and socio-cultural aspects) dimensions of the salon coupled with vitrin as a relational matter of concern. Recalling Donna Haraway's methodological approach, this study aims to provide a multi-layered reading of salon-vitrin coupling, regarding not only tangible components including objects, technologies and physical environment (salon house) but also the narratives, and representations associated with it through signs and interpretations (Haraway, 1991).

Rather than defining salon and vitrin as objects in their own right, this paper intends to explain them in a relational condition, as material and cultural companions: Salon is defined as the physical environment of vitrin and the relational space in which the arrangements of the objects and subjects change through staging practices. Since it is possible to refer to the literature addressing the historical and conceptual background of the salon, which is not available for vitrin, the study aims to build upon a historical transformation of the salon to come up with an authentic contribution to the conceptualization of vitrin and to speculate on its spatial and social transformation in context.

In the first part, the paper unfolds the socio-cultural, legal, and technological context that creates peculiar manifestations of salon in the apartment blocks through hybrid expressions in its formation, salon. Then, the text extends towards the significance of vitrin in the domestic staging practices in Türkiye which challenges some binary concepts such as interior-exterior, publicity-privacy, real-virtual through complexities of the lived experience. Building upon vitrin as a body of "situated knowledge" (Haraway, 1988) shaped in its particular social, cultural, and historical context, the final part discusses the global condition of immersed environments through digitalization.

# 2. Apartmentalization and the particular manifestations of the *salon* in modern Türkiye

Before discussing how the modern apartment typology redefined the boundaries between private and public life within the dwelling, it is essential to clarify the particularity of the context and present a brief insight into how the concept and space of dwelling were constructed in modern Türkiye. Following the foundation of Republican Türkiye in 1923, there had been revolutionary approaches in every field of everyday life for the sake of an "enlightened society" as a part of the nation-building project of the state running parallel to the transformations in societal, cultural, and economic spheres (Bozdoğan and Kasaba, 1997; Bozdoğan, 2001; Akcan 2012; Bozdoğan and Akcan, 2013; Kezer, 2016; Deriu, 2013). Informed by this modernization project carried out by the state, which adopted the concepts and patterns of the western way of living, the city and architecture were subject to a modernist construction on different scales, redefining public, and private space from the city to the interior. The role of power in building a new way of living for a developing nation was distributed among the industry, capital, and the state, operating hand-in-hand for the first half of the twentieth century Türkiye.

The aftermath of World War II, in which Türkiye did not participate, led to an atmosphere of recession and austerity in building construction, carrying out low standards: With the accumulation of capital and the rise of civil enterprise in the 1950s, the rapid development in housing projects was on the agenda when the Turkish architects, with a modernist fashion, had a notable agency in terms of improving standards and implementing cutting-edge technology in building dwelling units and settlements (Kılınç, 2012; Batuman, 2013). Nevertheless, the west-oriented international style could be regarded as the dominant line in the architectural and planning practice. An ecology of architects, civil entrepreneurs, and contractors of that particular era contributed to the canon with many inventive and high-quality buildings informed by the spatial organization, plastic formation, and structural-material technology of the modernist tradition, with a local twist.

According to Esra Akcan (2021), "although the Turkish house and the

cubic house stood out as the two main models among architects in Türkiye; there was also a desire for a rational house that would apply the effects of industrialization to the modern dwelling". The Turkish house, which was different from its European counterparts in terms of spatial organization and produced as a hybrid and modernized expression of the "old Turkish house", remained as a valid model together with the cubic house as an imported form of West European house in the early republican period. In contrast, the rational house, as mentioned by Akcan, refers to interrelatedly with the "idea of industrial housing" and "principle of rationalization", which were "designed to be functional, efficient, small and rational". The cubic house, as a part of the Garden City Movement of the new modern capital envisioned by the 1928-1932 Hermann Jansen Ankara Plan, stood for the single-family private house, rooted in the ground (so in the identity of the country) and attributed great importance and symbolic meaning to the garden (Akcan, 2012).

Akcan sheds light on the failure of the private house and the disappearance of this ideological model by mentioning Yücel Uybadin's new master plan of Ankara in 1957 that gave way to an extension of zoning laws and an increase in the height limit of the houses. She states that "many families were seduced by the idea of financial profits into tearing down their houses and gardens and replacing them with taller and bigger multi-family apartment blocks".

However, the change in the "Land Registry Law" (Paylı Mülkiyete Dayalı İrtifak Hakkı) in 1954 and afterwards the "Flat Ownership Law" (Kat Mükiyeti Kanunu) in 1965 led to a standardization and anonymization process, corresponding with "anonymous users" rather than civil entrepreneurs and their families (Tekeli, 1979). Sibel Bozdoğan (2001) emphasizes the significance of the legislation of 1965 not only in registering the term "apartment" -as referred to in this paper- indifferent from its early republican period meaning, but also their outbreak in continuation with an already evident

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demand. Accordingly, in the 1970s, rural-to-urban migration and overpopulation due to the new capitalist order brought forth the emergence of the middle class and the housing problem, which gave rise to a rapid "apartmentalization" (*apartmanlaşma in Turkish*) in the urban context; while this new rising middle class in the cities soon became the anonymous user of those standardized spaces for dwelling (Bozdoğan, 2001).

One significant determinant of the 1970s for domestic life is the economically accessibility and therefore spread of television for the middle-class families in Türkiye. Indifferent to the western context in which TV was publicly introduced in the late 1930s and early 1940s and became widely adopted in American and Western-European households in the post-World War II era, it wasn't until the late 1960s and early 1970s that television became a common presence in the context of Türkiye. The first years of the 1970s are critical in terms of determining the limits of television broadcasting in Türkiye since the spread necessitated the control of broadcasting by the state (İlaslan, 2014). The awareness of the outside world and the desire of appropriating Western lifestyle was a trend, and owning a TV became a status indicator. Although the global television industry started to produce colored TVs, the national television industry prefers to produce devices that can only receive black and white broadcasts, rather than producing color devices that can receive black and white broadcasts. In the 1980s, the blackand-white switched to partially colored TV broadcasting, yet again two decades after color television was introduced in the West. The asynchronous integration of technology into domestic spaces has emerged as one of the reinforcing layers of situated knowledge that this research places significance upon within the context of Türkiye.

To understand the development of urban apartment housing in Türkiye, Mehmet Emin Şalgamcıoğlu (2013) proposes 1930-1954 and 1954-1980 as two phases. Although the study focuses on İstanbul, the periodization and shift leading to apartmentalization is ap-

plicable to the other cities. The author bases his periodization on the changes in technology (heating systems and TV), building laws (regulations and codes) and society (cultural and socio-economic), and analyzes the transformation in plan organizations. The study measures the change in the specialization and integration of spaces in living, service, and bedroom zones in these two periods and concludes that the initially separated living and dining rooms and entrance halls become more integrated in the second phase while the bathroom and bedrooms become deeper in the plan location. The kitchen, which is considered part of the service zone and initially deeper in plan, gets closer to the living zone in the second phase. The analysis reflects both how the top-down decision making, and the outer conditions define the limits for habitation, and how the organization of domestic spaces shapes everyday life.

### 2.1. Everyday habits for uninhabited spaces

As George Teyssot discusses (2013): "any history of the theory of the dwelling wishing to analyze it in terms of a response to needs, to see the house as the relational planning of space as a response to new ends, new functions, and new uses, must also take into account the role of power [...] in controlling interpretation and definition of those needs". Bozdoğan (2001) claims that the top-to-bottom "civilizing mission" could not reach all layers of the society and failed to create a fundamental change in the lives of "ordinary people". In this sense, the cultures of inhabitation had a twofolded structure; one was the new form of dwelling imposed by the state, while the other was a heterogeneous form of dwelling exposed through the middle class' domestic culture and behavioral patterns. Kıvanç Kılınç (2012)identifies the "indigenous" forms of modern architecture and urbanism in the early republican era and questions how the "middle class ideal domesticity imported from Central and Western Europe" was transformed through appropriations in relation to different social classes. As argued by Kılınç, the presence of the extended families in lower-income classes other than the ideal modern nuclear family shifted this ideal image of the household and led to a multiplicity in the models of dwelling. Further, Bozdoğan seizes on this conflict that can be traced from the 1950s onwards when the standard apartment life became the residential norm and states:

"Both the designs of the apartments and the manner in which they are inhabited often show little resemblance to the thoroughly Westernized models that the 1930s 'cubic apartments' displayed. Many aspects of traditional domestic life (such as a separate ceremonial guest room, family eating in the kitchen, or a Turkish style toilet in addition to a Western-style bathroom) are incorporated (sometimes forced) into these modern apartments. Rather than modern architecture transforming its inhabitants into Westernized citizens, it was often the inhabitants who transformed modern architecture into hybrid expressions defying the early republican belief in the social engineering power of architecture" (Bozdoğan, 2001).

This paper identifies one of those "hybrid expressions" to instantiate the disposition of objects and meaning produced through the *salon*. Initially designed as a living room, this space becomes a "ceremonial guest room" for the middle socio-economic class. Salon, whose origins are from the French salon transferred to Turkish with the same cultural connotations and practices, has been transformed through generations in the Turkish context<sup>1</sup>. The bourgeoisie character of the *salon* as a culturally specific room to welcome the guests to the house is altered in the Turkish context as related to more traditional patterns of domestic life, which create a hybridization in the way the families of the middle class appropriate the spaces of modern apartments. Representation of the inhabitants through material culture and the relationship between salon and display remains parallel with the European discourse, but in a hybrid version through the peculiar socio-cultural patterns attributing different meanings to the objects and furniture staged in those spaces. Since it culturally distinguishes itself from the other rooms and spaces, like the bathroom or kitchen -which facilitates "cooking and eating food" and is associated with the acts and spaces of food in the dwelling common to all cultures-, it cannot be compared with -or simplified into- its universal predisposition (Lawrence, 1983). The *salon*, the so-called living room of the apartment, which was expected to function for the household to "live in", unexpectedly became a locked room that nobody would be using except for the guests and occasional family events. However, the behavioral pattern of the middle class and their improvised practices of living in the modern apartment appeared to be reversing the enforced culture of living.

In A Topology of Everyday Constellations, Teyssot (2013) refers to ethnological methods proposed by Durkheim, Mauss and Levi-Strauss for alternative analyses of the history of inhabited space; and also, to Pierre Bourdieu's "theory of practice" to address the historical construction of the 'habitat', which could be found in the "practices of everyday life" of inhabitants. As cited by Teyssot, Bourdieu's definition of the Latin habitus is "as an ensemble of unconscious patterns able to generate practices and representations", being "improvisatory, operating through human practice rather than through prior conscious thought". Informed by Bourdieu's expanded definition of habitus addressing social status, style, and uses of practices in the action of dwelling, Teyssot reframes habitus in terms of "acquisition of habits" and notes that:

"In this view, the act of inhabiting would consist in the production of regimes of habitudes, as well as in the transposition of these regimes when in contact with extraordinary situations or non-customary events, such as an invasion of other humans, a change of climate, or the spread of unusual diseases...Habitus is a social construction that generates cultural practices, which are regulated without being directed by any force, power, or authority" (Teyssot, 2013).

Extending Bourdieu's emphasis on improvised practices, Teyssot's remarks remain relevant for the analysis and speculation of the formation of inhabitation and *salon* in the apartment producing its unconscious types and

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*Figure 1.* Photographs showing the vitrin as an extension of the inner facade of the salon in the 1970s in Türkiye (Bahtiyar & Yaldız, 2021).

improvisational orders regarding inhabitation, objects, and subjects.

David Seamon (2010) presents a psychological approach to domestic space and draws attention to Gaston Bachelard's topoanalysis, in which Bachelard theorizes home and inhabitation as the "sites of intimate life". According to Bachelard (2014), the house is "a lived whole unified by its whole character" and "a lived dialectic founded in a twofold significance involving internal diversity and versus external connectedness". According to Seamon, "this lived dialectic exists for home as it is a place unto itself but also as it exists in relation to the larger world of which it is both apart and a part". In this regard, the Turkish middle-class apartment typology could be discussed as having such internal diversity; simultaneously, the salon is a space where particular forms of "external connectedness" are created.

When talking about the "lived space", the salon becomes a controversial space for the dwellers, a space for guests only instead of accommodating the everyday practices of the family. This conflict stimulates this study to conceptualize such an architecture of dwelling when the so-called "living room" is a room that no one lives in.

### 3. *Vitrin* as an agent of domestic staging

Like the images of Loos's interiors, the locked salon exists as a still image, which is created by the woman-of-thehousehold for the guests behind the closed door and will be animated once guests enter. The distribution of the furniture, which turned their back to the windows, directed the view inside as Colomina refers to Loos's interiors in which "the window does not frame a view but is merely a source of light" and "the exterior view depends on a view of the interior".

The still and silent image of the salon, defined and "faced" by the vitrin<sup>2</sup> that coexists with the unoccupied furniture and unused things, recalls the photographic images of Loos's "staged" interiors. As discussed by Colomina (1990), the way Loos represents his interiors seem like stages waiting for their users to step in and animate them. She notes: "Looking at the photographs, it is easy to imagine oneself in these precise, static positions, usually indicated by the unoccupied furniture, and to imagine that it is intended that these spaces be comprehended by occupation, by using the furniture, by entering the photographs, by inhabiting it".

Salon's improvisationally constructed face, *vitrin*, becomes an interesting pinpoint to read the living room practices leading to "hybrid expressions", particularly domestic staging in the Turkish context. It is constructed for and displayed to the guests from the outer world. Vitrin is large three-dimensional furniture with smaller display spaces. Photo frames, books, decorative objects collected by the family members from their travels or brought by the guests as presents, and upscale tableware that the guests would only use are arranged and staged in these spaces (Figure 1). This study claims that *vitrin* has a significant agency in terms of the Turkish appropriation of the salon and intentionally uses the Turkish word originating from the French vi*trine* (the storefront) instead of using the term "sideboard" as it is used in the design literature (Nişanyan Sözlük). The etymological connotations are es-

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**Figure 2.** Photographs as evidence of domestic staging: Vitrin as a background for family events, celebrating and posing for the birthdays of the child in front of the same vitrin, facing towards the camera and the probable guests (Used with the permission of the family).

sential since the act of displaying and staging are relevant for considering the *vitrin* as an interface or facade where we can trace everyday domestic life.

In the case of Türkiye, the curtain, as a cultural material, represents codes of intimacy in the domestic environment. Thus, in the salon, windows are mostly tightly closed with the curtains to the gaze of the outside world. Through the staged face of vitrin, visitors/guests are offered not a view of the outside but the householder's "outside" -a world of meanings and representation.

In the Turkish pre-modern dwelling, the production of meaning is materialized through the decorated objects and architectural elements, which are simultaneously functional. The setting, which modern architecture imposes on the pre-modern meaning-function integrity of things, separates the meaning from the function. While the living room becomes a stage full of decorated, expensive items unavailable for the use of the household, the other rooms are part of everyday life with frequent usage.

The literature lacks a thorough reading on this furniture in the context of Türkiye, neither historical research available nor its domestic use. Gürel (2009) mentions it as a part of the new scheme of 1960's built-in furniture and by referring to Orhan Pamuk as "always-locked glass sideboards stuffed with Chinese porcelain, cups, silver sets," things "displayed not for life, but for death". Beyond being furniture, this paper defines it as an interface nested within the interior wall that offers controlled communications between the household and the outside world. It is no coincidence that in most of the photographs from the family albums, having captured the meaningful events of

the household such as birthdays, anniversaries, and occasional family meetings, *vitrin* appears as an unchanging element of the frame in front of which the family poses, -a background. In other words, it is rematerialized within each photograph, signifying the meaning attributed by the household as well (Figure 2). Indifferent to Teyssot's reading of the domestic space through the routines, habits and repetitions, the salon holds an interrupted, irregular, and idiosyncratic life cycle bypassed by the family in the apartment typology, and the woman-of-the-household is in control and power.

Thinking about power and regimes of control in the household, the salon is a base for the woman where she habitually assembles and reassembles the objects such as the furniture and decorative pieces, but most importantly, the facade or public face of the dwelling through the vitrin<sup>3</sup>. In an assemblage of the objects participating in the habitus created by the subject in control, vitrin, as a cultural and material practice, suggests an agency producing new meanings from the interior for the exterior. The given functional meaning of the modern way of living in the house calls for the family to spend the day in the most spacious room of the apartment. However, the woman-ofthe-household breaks with this spatial narrative to curate her own space open only to the guests and attributes the space a new symbolic meaning through staging the public image of the household. The middle-class Turkish salon is a "window to the world" for the woman-of-the-household and "a form of transition to public life within the home" (Özbay, 1996 cited in Erdaş and Özmen, 2019). She communicates through her arranged screen of vitrin,

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Figure 3. A typical salon section facing vitrin with a TV (Source: Salt Online: Ev-Kesit).

while meaning is constantly produced with the order of things in its depth.

In the scope of a research exhibition, "One and the Many", a project "Home-Section" samples an imaginary urban dwelling (apartment) to represent a domestic setting in an urban context of Türkiye (Salt Online). A continuous section reveals the staging and distribution of the low and high-technology items common to urban households in the 80s Türkiye. A typical vitrin is presented in the salon with the staged objects on lacework, including TV and speakers, in relation to other furniture (Figure 3). Materially and symbolically, vitrin is a signifier of the social and economic status of the family with an ordering of things by the woman-of-the-household; it works both as a physical extension of the wall and a constructed public image of the household.

Concerning the impacts and manifestations of socio-cultural structure on domestic space and furniture in Türkiye, the body of literature on the modernization period and its influence on domestic life develop around the living room's quality of being highly attached to middle-class families' production of social status. Representation of domestic space in media contents had also a strong agency in addressing this social status in the process of apartment buildings becoming a symbol of luxury living (Şahin and Şener, 2021). According to Meltem Gürel (2009), furnishing in the domestic space had an agency in the westernization process and "modern socio-cultural distinction in Türkiye." However, its promotions and receptions were multiple in different social classes. Esra Bici Nasır has conducted an extensive study where she relates the living room decorated with eclectic furniture and accessories using Orhan Pamuk's "museum" metaphor and conceptualizes the sterilized living rooms in Türkiye as "museum-salons" (Bici Nasır, 2016; Pamuk, 2006). The specific practices associated with the *salon* are profoundly widespread for the middle socio-cultural class throughout the country and are distinguished by their "expensive, low usage" staged objects (Ayata, 1988).

Regarding the socio-economic conjuncture of Türkiye, the metaphorical condition of objects staged in the living room can be related to Colomina's identification of the modern house as the container of the image of the "good life" for a traumatized nation (2019). The aforementioned challenging atmosphere during and after World War II and political and economic pressure led to an in-between context that consistently shaped the behavioral patterns of the middle class. As different generations live together in the same house for extended periods, their living room practices interpenetrate. Even though they lose their original meaning, staged objects continue to pass generations. Therefore, it does not seem possible to isolate and examine any generation free from its charges.

In her paper, Esra Çalış (2021) performs a comparative analysis of living room decoration patterns of two generations, revealing Türkiye's social structure and informing that the salon and vitrin practices disappear in the young generation house owners. She states that the younger generation furnishes the rooms inside the residences with similar functions, albeit at different prices, using all the rooms of the house. The study exemplifies that meaning and function are getting closer to one another again in the domestic practice of the young generation.

As different generations live together in the same apartment for extended periods, the living room practices interpenetrate. Besides the spectacular objects, technological tools and communication devices, such as radio, TV, and speakers, have also found a place within the vitrin's design and interior design of the salon in time. The introduction of radio (the late 1930s) and TV (1970s) to the domestic space initiated the second stage in the formation of vitrin. When the TV and radio are projected onto, the materiality of vitrin dissolves as outsider visuals and audio enters the salon. This condition leads vitrin to become a screen bringing virtual guests into the *salon* to be viewed by the household. The living room's inner facade displaces what once was the stage for the household with the decorations, medals, ancestors' portraits, handmade objects - and many more- as the decoration wall transforms into a TV-wall. With the broadcasting of movies and news, the TV-wall becomes the interface for life outside the house. With the entry of the TV into the living room, the decoration wall does not necessarily disappear, but rather the technological facade superimposes on the existing structuring of the room.

#### 4. Connecting to the already immersed worlds through the immaterial formation of the everyday life practices

Inviting us to question the "shifting limits between the privacy and

publicity opened up by new media," Teyssot (2010) proposes to discharge the spaces from their traditional definitions of inside and outside. At the turn of the millennium, Terrence Riley (1999), in the Un-Private House, poses a fundamental question: "If the private house no longer has a domestic character, what sort of character will it have?" Riley questions the vague definition of the "private" in an era when the "private house" is no longer isolated from the public; through the technological events manifested in various forms of architectural experimentation, the private starts dissolving into the public; accordingly, "the private house has become a permeable structure, receiving and transmitting images, sounds, texts and data". He refers to Heidegger's concept of *Dasein* (being) and its expansion in daily life due to the overtaking "speeding" and "remoteness" effect of media's articulation (Heidegger, 1962 cited in Riley, 1999). The idea and reflections of "distancelessness" once detected by Heidegger as a threat to the dwelling have "become commonplace, and Heidegger's unease has been replaced by an equally common awareness of the distinction between the real and the virtual" (Riley, 1999).

In a similar vein, critically thinking about the concepts of speed and distance and the immediacy of the redefined surface, Paul Virilio (1991) argues: "Each surface as an interface between two environments is ruled by a constant activity in the form of an exchange between the two substances placed in contact with one another". He defines this exchange by the term "commutation", emphasizing the necessity of a crossing or transition, along with an experience of alienation, yet problematizing "the boundary, or limiting surface", which has become "an osmotic membrane". In Lost Dimension, Virilio connects the disappearance of the architectural dimension of the boundaries with their replacement by "the interfaces between man and machine", thus facades of the buildings are no longer in force as limiting surfaces. Teyssot (2013), recalling Virilio, corresponds this dissolution with the "electronic topology" that replaces "the

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previous conception of private and public, or the differentiation between house and street", "with an overexposure that cancels the sharp distinction between proximity and distance".

Considering the living room practices and the architecture of dwelling, we might follow this overexposure that overtakes the divisions between interior-exterior, publicity-privacy, and real-virtual in architectural, technological and social transformations through displacements of the window: Architecturally, with the glass walls, as theorized by Colomina with x-ray metaphor, the wall itself as a floor-toceiling extended window have become a screen making the domestic space a part of the public space. Technologically speaking, with the radio and the television in the living room, another window was introduced in the domestic space, opening to an outer reality through sound and numeric images. Immersion of the workspace into the domestic space creates another form of dissolution of the private. According to Virilio (1997), television screens or computer interfaces hold "a secret transparency, a thickness without the thickness, a volume without volume, an imperceptible quantity."

Staging backgrounds have been accelerated with a more global change that frees our built environment from the infrastructural fixes. The multiplication of digital screens and mobilization of information processes lead to an immaterial formation of the everyday life practices in the topographies of the digital. As the relocation of privacy and publicity through social media is inevitable, the domestic conflict between the living room and other rooms transforms into a new tension area via this new inter-facade. However, interestingly, the modern Turkish living room was already an Instagram profile page of the dwelling and household, representing the family's so-called social status and public image.

On the camera's intrusion, the transparency becomes a literal one that immerses different environments on the screen, and "our windows on the world appear as multiple, portable, and nomadic screens" in Teyssot's words (2013). It can be argued that, through cheap and available infrastructural mobility, the interfaces have become thresholds to accommodate multiple environments or in other words multiple interrelated faces of different pieces of everyday life practices. However, as a threshold, the interface allows for acts of movement that are already embedded in the word etymologically; Walter Benjamin (1999) notes:

"The threshold must be carefully distinguished from the boundary. A Schwell -threshold- is a zone. Transformation, passage, wave action, are in the word of schwellen, swell, and etymology ought not to overlook these senses".

The emphasis on the movement and transformation, both physical and metaphysical terms, is significant to address the movement of the gaze throughout the screen since the corporeal participation is limited to the positioned face and the directed gaze. The gaze moves through the new spatial construct that multiple windows open through the "virtual terrain or digital topographies", as Teyssot calls it (2013). He comments on the social and immaterial formation of the everyday life practices in the topographies of the digital and states that:

"Today, one's quotidian experience is effectively characterized by the notion of a virtual ambient reality, an expression that evokes the capacity to remain in contact with people on a regular basis by using different websites –a social practice that helps one to live a somewhat disembodied connectedness" (2010).

Neideck et al (2021) also refer to the window as a powerful metaphor for a better understanding of the digital screen, focusing on Zoom as the media. The authors claim that "nits embodied and activated form, because, like an actual window, it is designed to be used two-ways, for gazing and witnessing simultaneously". Attributing an agency to the digital window in control of "time, perspective and participation", they define the zoom interface as a "real place of the digital window", where "at least two bodies in mutual gaze" come together despite their distant existence in different environments. However, the blurred lines between the real and virtual spaces also begin to speculate on the "reality" of



*Figure 4.* Shifting conditions of the subject-object positioning and its dissolution. Image produced by the authors.

the dwelling spaces since they become flattened images where the concept of inhabitation is vague. In his recent speech on his new book Imagining for the Real, Tim Ingold (2022) mentions his critical stance towards the concept of "inhabiting space" in architectural terms and asks: "How is it different from inhabiting the air?" His question becomes very relevant when thinking about the virtual ambient reality and its atmosphere of electricity and triggers discussions on the polemical status of dwelling, where the act of inhabitation is distributed among subjects and objects with flat and symmetrical ontologies.

One may find extensive literature in media, culture, and technology studies concerning the ubiquity of digital screens and everyday practices. Considering the ways media screens have transformed day-to-day life through our engagement with them, Ingrid Richardson (2010) wrote about the historical and ontological affinity between faces, windows, frames and screens. She stated that "the incorporation of screens into our corporeal schemata is also determined by cultural, environmental, spatial and historical specificities - by the habitudes of practice that have developed within the contextures of everyday life". She further notes that the introduction of early conventional television into the living space has transformed its experience and function into a "viewing space"; new media asking for new definitions of the face-interface coupling and architectural considerations. In parallel to Richardson's detection that "our contemporary media experience unhinges preceding face- and body-screen couplings" (2010), Nitzan Zilberman

(2019) identifies a popular turn regarding the museum space, which can also be correlated with the change in the way the *salon* is practiced. She states that: "from the display of objects to the display of environments, a change that blurs the line between the body and the display, and questionably absorbs the subject into the object".

By influencing the social, cultural, and technological layers, the Covid-19 pandemic, as an extraordinary happening, has transformed the domestic practices unprecedentedly (Alawad, 2021; Cuerdo-Vilches et al., 2021). Accelerating and amplifying this formation, working and schooling from home led to a recent transposition of the living room practices in Turkish and global contexts. Integration of mobile phone screens and cameras into the living room flattens the viewing subject and viewed object dichotomies and related hierarchies caused by bodily positioning and distance in the space. Through the camera, the very public facade of our homes becomes the background to be viewed by the others. Vi*trin* has mainly disappeared in the current condition, except for some in the second-hand market as a nostalgic object. Nevertheless, in the digital staging of the living room, as a mirror image, subjects become a part of the inter-facade through their faces on Facetime, Zoom, and many other video-oriented online meeting platforms. The staging started again by shifting the former facades—this time not a foreground but a background (Figure 4).

#### 5. Final discussions and conclusion

The *vitrin* rooted in everyday life practices in a local context, namely Turkish apartment typology as a form of dwelling, becomes an architectural metaphor for a better understanding of local echoes of the global socio-cultural condition. The conceptualization of this peculiar setting, where various social and technological layers are embedded, has been operative in crosscutting architectural history and everyday life studies concerning sociology, media, and technology. The Turkish salon case was, already, a "viewing screen", not intended for the dwellers but for the guests to view the image of the dwellers projected onto the vitrin. The introduction of early television in the the 60s and industrialization and intrusion of TV into domestic life in the 1970s' Türkiye has reversed this relationship, as it is placed among the staged objects, and the household starts to view the guests on the TV screen on the stage.

The cultural and technological shifts alter the living room practices across generations. In the recent past, referring to pandemics as well, the representation of the domestic living space has turned inside out, and in this specific time of *now*, we can observe this reversal superimposed on the existing living room practices. Once the foreground became the background, we started to design and stage backgrounds for our online self-displays in calls and meetings. As our ways of connection and experience move into the digital world -and very soon into the Metaverse-our living rooms are obliged to move into the soft space -indifferent to worldly objects and orientations -requiring only a techno-infrastructure. Flattening the way any physical space is practiced, the media screens have transformed day-to-day life by providing instant engagement with the outer world. Through the video-oriented communication technologies and ubiquity of the camera, multiple but peculiar inter-facades become connected and gathered on the screen next to another in a virtual vitrin that attributes flat and symmetrical ontologies to each one. However, the "displayed environments" emerge as the objects of another digital topography of everyday constellations.

This paper has presented the formation of the salon-vitrin coupling as an authentic case offering connections and engagement between the outer world and the constructed-and-flattened image of the dwelling and dwellers. Concerning the predisposition and agency of things, we aimed to unfold the living room practices through the spectacular objects at the domestic stage, where the ubiquity of cameras and virtual self-displays at home have flattened their order. Vitrin and media screens have been conceptualized as inter-facades offering connections and engagement between the outer world and the constructed-and-flattened image of the dwelling and dwellers. Overlaying the social, technological, and material layers of the dwelling, vitrin, as the inter-facade of the cultural and material practice, has been suggested to have an agency producing new meanings from the interior and towards the exterior.

#### Endnotes

<sup>1</sup>According to Nişanyan Sözlük, the word *salon* was first used in the mid 19th century archival documents related to modernisation of education in the Ottoman Empire referring to gathering spaces, and in late 19th century manuscripts on Ottoman dialect referring to exhibition place.

<sup>2</sup> The word "facade" is etymologically rooted in "face"—*vitrin* as the dwellers' face and the inter-facade of the dwelling between private and public life.

<sup>3</sup> The book by Gürbilek (1992), *Vitrinde Yaşamak: 1980'lerin Kültürel İklimi* can be noted here, as it evaluates the new cultural environment experienced in Türkiye in the 80s as a response to the global change and local dynamics and political conditions.

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