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Prof. Dr. Ayşe SİREL

Practical Evaluation of Light Pollution Problem in Urban Lighting with “Decision Tree” Method



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Abstract: *Light pollution, which started in the late 20th century and spread more rapidly than predicted, is an environmental problem. Due to the increasing city life, urban lighting become essential to continue social daytime activities at night. In addition to visual lighting, with the evolution of "the image of the city" concept, the lightening process of the components that constitute the perception of the city image has begun. Unplanned and uncontrolled urban lighting applications have increased. Since light pollution is an interdisciplinary field in terms of its cause types and outcome effects, varied researches have been conducted on light pollution control techniques, and a number of standards or reports have been published by public authorities and international organizations. Today, light pollution control recommendations have increased and become more complex. A simplification of the subject is needed in order to evaluate the light pollution problem in urban lighting projects practically. The decision tree is a solution model that simplifies a problem involving a large number of factors, through the sequential evaluation of multiple decisions and using graphical support. In this study; forms of light pollution are explained, lighting principles and limit values that will reduce light pollution are reviewed in accordance with the standards and reports published by international organizations, and a practical guide that could be utilized in urban lighting projects is formed by using the "decision tree" developed in the light of this data. This study aims to contribute to increased architectural participation in solving the light pollution problem.*

Keywords: *Light pollution, urban lighting, decision tree*

Işık Kirliliği Sorununun Kent Aydınlatma Projelerinde “Karar Ağacı” Yöntemi ile Pratik Değerlendirilmesi

Özet: *Işık kirliliği; 20 yy’ın sonlarında başlayan ve öngörülenden hızlı bir şekilde ilerleyen çevresel bir sorundur. Artan kent hayatı sebebiyle kentlerin gündüz işlevlerinin gece de devam etmesi toplumsal bir ihtiyaç haline gelmiştir. İşlevsel aydınlatmanın yanı sıra; “kent imajı” kavramının gelişmesi ile kent algısını oluşturan ögelerin aydınlatılması süreci başlamıştır. Kent aydınlatma uygulamaları plansız ve kontrolsüz bir şekilde artmıştır. Bu sebeple; nedenleri ve sonuçları itibariyle interdisipliner bir alan olan ışık kirliliği önlemlerine yönelik çok yönlü araştırmalar yapılmış, kamu otoriteleri ve uluslararası organizasyonlar tarafından çok sayıda standart ve rapor yayınlanmıştır. Günümüzde, ışık kirliliği önlemlerine yönelik veriler artmış ve karmaşıklaşmıştır. Işık kirliliği sorununun kent aydınlatma projelerinde pratik bir şekilde değerlendirilebilmesi için konunun sadeleştirilmesine ihtiyaç vardır. Karar ağacı; çok sayıda değişkene bağlı bir problemi grafik desteği ile, birden fazla kararın ardışık değerlendirilmesi sonucu sadeleştirerek sonuca ulaştıran çözüm modelidir. Bu çalışmada; ışık kirliliği biçimleri açıklanmış, uluslararası kuruluşların yayınladığı standartlar ve raporlar doğrultusunda ışık kirliliğini azaltacak aydınlatma ilkeleri ve sınır değerler irdelenmiş ve bu bilgiler ışığında geliştirilen “karar ağacı” aracılığıyla kent aydınlatma projelerinde kullanılabilecek pratik bir rehber oluşturulmuştur. Yapılan çalışma ile; ışık kirliliği sorununun çözümüne yönelik mesleki katılımın artmasına katkı sunulması hedeflenmiştir.*

Anahtar Kelimeler: *Işık kirliliği, kent aydınlatma, karar ağacı*

1. INTRODUCTION

Environmental conditions are described by individuals through their sensory systems. Perception of these conditions is formed by analyzing visual, auditory, and thermal signals based on personal subjective criteria. Daylight, which provides visual perception, disappears with the onset of night, unlike other environmental conditions. Since moonlight does not provide sufficient visual conditions, artificial light sources have been used throughout history to brighten the night. The first light source used for this purpose was fire. Later on, oil lamps, torches, candles and gas lamps were used. Starting at the end of the 20th century, electric power became the primary means of lighting, followed by the invention of the incandescent lamp. Lighting technology has continued to develop rapidly to the current day [1].

The advances in lighting technology have expanded the capacity to illuminate cities, thus making them safer and more secure, while also enabling the continuation of daytime activities such as shopping, education, entertainment, and transportation during the evening hours. During the second half of the 20th century, there was a growing recognition of the importance of the urban image. The purpose of the lighting is not only to serve functional needs, but also to highlight prominent features, such as iconic buildings, streets, trees, or sculptures, that constitute the image of the city, in order to visualize the identification of the city that is perceived both during the day and at night [2]. Over time, there has been a significant increase in the number of objects and areas that are illuminated, almost resulting in a contest for lighting between cities. The uncontrolled and unconscious utilization of lighting techniques, compounded by the growing urban population and the development of lighting technology, has brought the problem to a faster pace than predicted, and the darkness of the night has been substituted by the glowing nights [3]. In addition to skyglow, light trespass, energy waste, and glare caused by inappropriate lighting fixture selection or uncontrolled night lighting designs that are not appropriate in terms of quantity and quality are also considered light pollution. In addition to sky glare; light trespass, energy-waste, and glare, which are caused by improper luminaire selection or unregulated over-lighting designs with high levels and poor quality, are also defined as light pollution [4]. Many studies reveal that light pollution has several negative impacts on astronomical observations, human health, and the ecological system [5-8]. This demonstrates that urban lighting should be organized in a planned manner, limit values should be determined, and appropriate lighting techniques should be utilized [9-11].

Light pollution is a multidisciplinary problem in terms of its causes and consequences. Illuminated streets and avenues to ensure safety and security, leaking lights from factories and workplaces due to night shifts, lightening of parks, squares and walkways to perpetuate day-time urban activities, facade lighting that continues urban memory, billboards, vehicles, greenhouses, improperly installed direct lights, reflected lights and passing lights all cumulatively cause light pollution [12]. From an outcome perspective, there is a large amount of research on the effects of light pollution on astronomical observations, human health such as cancer, obesity, sleep disorders, or environmental issues related to biodiversity, food security, energy consumption, or economic and environmental sustainability [5, 13-19]. The illumination of building facades and recreational areas is critical for architectural studies. However, today, the problem of light pollution, which is interdisciplinary in terms of its causes and consequences, has turned into a comprehensive problem that cannot be analysed in architectural design phases. In order to increase awareness and architectural participation in this problem, there is a demand for simplified methods where lighting luminaries, techniques and regulations can be evaluated in a practical manner from the perspective of light pollution [20].

This study, presents the explanations of sky-glow, glare, light trespass, and energy-wastage that are terms revealed by light pollution, has a review of the lighting principles to reduce light pollution. In view of these notions, a practical guide is established for urban lighting projects by means of the "decision tree" developed in this study.

2. FORMS OF LIGHT POLLUTION

Light pollution is defined as artificial lighting which alters the level of the natural light sources and, may result in sky glow glare, light trespass and excessive illumination [21]. Unplanned or inadequate light use,

such as over-illumination of a building facade or urban area with improper location and orientation, causes this problem.

2.1. Sky-Glow

The first term used to define light pollution was "sky glow" which caused discomfort glare occurred by the excessive use of light through astronomical observations, and this definition was synonymised with light pollution till the early 21st century [22-24]. The light emitted upwards from lighting fixtures and reflected from the ground into the sky is transported to the sky through dust and air molecules in the atmosphere. From a distance, this phenomenon is visible like a luminous dome and described as "sky-glow." (Figure 1).

Figure 1. "Sky glow" caused by the unshielded upward lights to the sky [25]

2.2. Glare

Glare is described as the perception of visual discomfort caused by high luminance contrasts which the system of vision can not accommodate [26]. Glare is considered in two types: "direct glare" caused by direct light emitted from the light sources and " reflected glare" caused by the light reaching the eye by specular reflection through glossy surfaces [14]. In both cases, due to the eye's accommodation to high levels, the immediate peripheral surfaces are perceived as dark and visual comfort is deteriorated (Figure 2, Figure 3).

(a) *(b)* *(c)*

Figure 2. Visual discomfort caused by "direct glare" (a) "reflected glare" (b) The immediate peripheral surfaces are perceived as dark, the vicinity environment can be seen clearly after redirecting the light to the target area (c) [27]

Figure 3. Inability to identify horizontal and vertical surfaces of stairs due to glare [28]

2.3. Light Trespass

Light trespass is defined as the disruptive effects that occur as a result of undirected lighting in non-targeted neighbourhood areas [29]. Light trespass is observed commonly in dwellings which are close to inappropriate shielded street lightings and in closely located neighbouring buildings [30] (Figure 4). Light trespass is one of the most important notions in raising social awareness against light pollution since the number of people affected in daily life, especially residential users, is high [31].

(a) (b)

Figure 4. Light trespass caused by door lighting (a) [32] and caused by unshielded street lighting (b) [33]

2.4. Excessive Lighting

Excessive lighting refers to lighting higher than required levels, which are recommended/limited by standards and regulations for optimal visual conditions, or prolonged lighting due to not using control systems with daylight/motion sensors [34].

3. LIGHTING PRINCIPLES TO REDUCE LIGHT POLLUTION

The social activities that brought with urban life, the use of roads at night, entertainment culture, the demand to make cities safe and secure, the concept of "city branding" that began after the 18th century, and the awareness of generating tourism revenue have turned the illumination of cities into a social necessity [35]. Therefore, the way to prevent light pollution is not to darken cities by not illuminating them, instead, it should be to design dark-sky-friendly cities. Since light pollution is the excessive use of light for an unnecessary area or building with design flaws that cause energy waste, the designer should make a 3-step questioning before starting the lighting design in order to avoid causing light pollution.

- Is this lighting design needed?
- Are the appropriate lighting fixtures selected?
- What are the illumination thresholds?

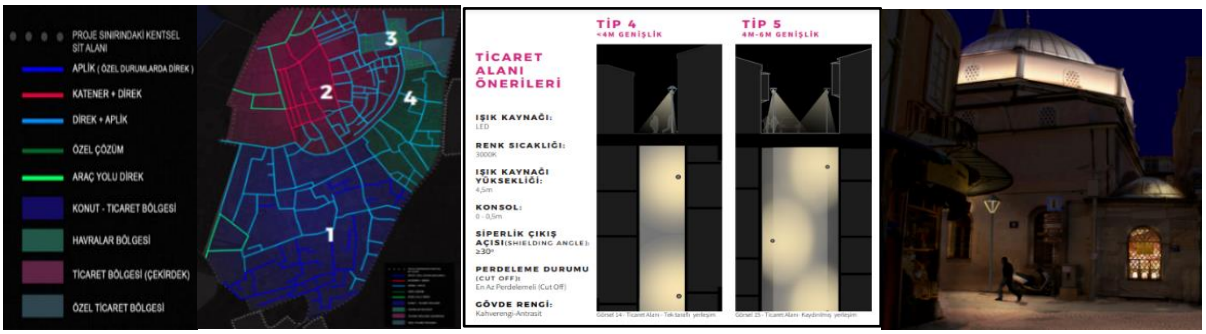
To achieve dark-sky friendly urban lighting; zoning regions or designing a lighting master plan, proper lighting fixture selection, and not exceeding the limit values is essential [36].

3.1. Lighting Master Plan

Similarly with several forms of urban design, a comprehensive approach is crucial for urban lighting. Haphazardly prepared, individual lighting designs that are incoherent and without an integrative design approach do not contribute to making the city an attractive or safe place, since they are not perceived as a part of the whole. Therefore, decisions on urban lighting should be made according to the "lighting master plan", which is prepared by considering zoning, appropriate lighting techniques and limit values based on economic, social and environmental analyses extending from the macro to the micro scale. The lighting master plan consists of analysis, design and simulation phases. In the analysis phase, existing lighting conditions are studied, regionalization is carried out considering the elements that constitute the perception of urban identity, and individual buildings with urban character are identified. The following elements play an important role in the perception of urban identity, which allows the continuation of the daytime urban experience at night [2];

- Zones determined by functional characteristics such as commercial, residential, industrial or historical background.
- Boundary lines that constitute zones such as wide highways, rivers, forests
- Transportation arteries with varied intensity and time span of occupancy such as roads, streets, squares
- Historical artifacts, commercial or public buildings that contribute to urban memory
- Landmarks such as statues, bridges, mausoleums

In the design phase, a lighting hierarchy is defined for zones, lighting scenarios are created for individual buildings, technical specifications of the luminaries that do not cause light pollution are determined and installation proposals are prepared. In the simulation phase, calculations and visualizations of the design proposals are complemented through software (Figure 5).



(a) (b) (c)

Figure 5. Phases of lighting master plan (a) Determining lighting hierarchy for zones (b) Technical properties and installation recommendations for luminaries (c) Simulation of lighting scenarios for individual buildings [37]

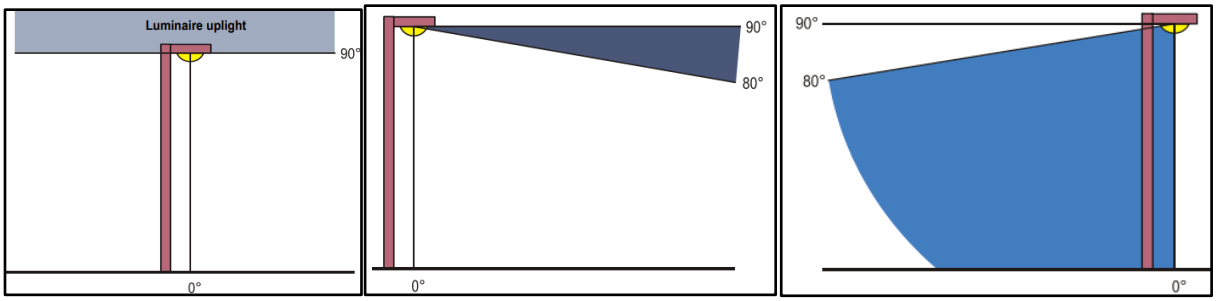
3.2. Selecting Appropriate Lighting Fixtures

In many cases, the light emitted from the lamp is not oriented to the target area and cannot provide good visual conditions or avoid energy wastage. Therefore, lighting fixtures (luminaries) that redirect the light are used. The technical requirements differ depending on whether the luminaries are used in indoor or outdoor environments. In order to select the appropriate fixture that will not cause light pollution from a large number of options available in the lighting industry, technical features such as spatial light distribution, cut-off angle, light colour, luminaire efficiency, protection class, and scotopic/photopic ratio should be evaluated.Spatial light distribution refers to the distribution of light from a light source into an equidistant sphere and is crucial for avoiding lighting of untargeted areas as well as achieving uniformity of illumination. The aim of illumination is to make an object or its surroundings visible by applying light [38]. Therefore, the target is the area to be illuminated. Light scattered outside the target area constitutes light pollution, by causing sky glow, energy-waste, light trespass and glare. The spatial light distribution of a luminaire used for outdoor lighting is evaluated in Figure 6. The target area to be illuminated is the walkway where the pedestrian is standing and its surroundings. This means that only 50% of the luminous flux emitted from the lamp is directed to the target area. 10% of the light is directed like a torch shining from a high altitude, causing direct glare for pedestrians or vehicles outside the target area and light trespass for nearby buildings. The remaining 40% of the luminous flux is directed upward, illuminating the sky and causing sky glow. Therefore, 50% of the light emitted from the fixture is scattered in the off-target area and causing energy waste. This indicates that all forms of light pollution can occur as a result of fixture selection with inappropriate spatial light distribution.

(a) (b) (c)

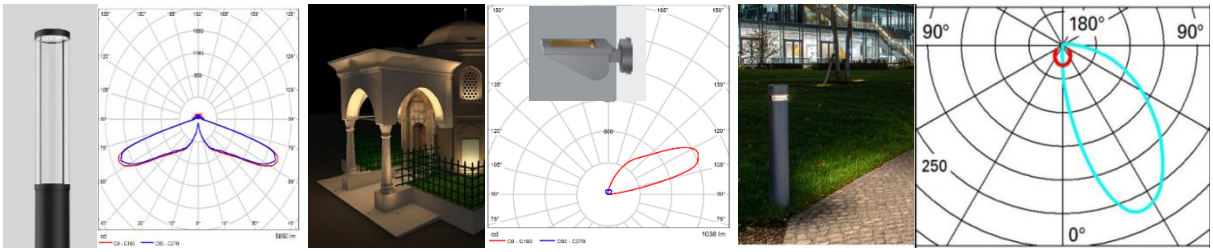
Figure 6. Evaluating spatial light distribution (a) Useful luminous flux for target area (b) Luminous flux cause direct glare like a high altitude torch (c) Upward light that occur sky glow [27]

Spatial light distribution should be specific for each architectural project and designed in line with the lighting intent. The target area for illumination has to be defined clearly. The luminous flux should not be directed upwards or backwards to the area that is not intended to be illuminated, or to the area at an angle of 80° - 90°, which will cause glare (Figure 7). The luminous flux should not be redirected to the area that is not intended to be illuminated upwards, backwards or to area at the angle of 80°- 90° which causing glare. While upward lighting is not preferred for roadways because it is a source of light pollution, it is preferred for architectural facades. In this point, luminaries with asymmetric intensity distribution should be used for façade lighting, which illuminates the target surface but does not emit light to the sky. Figure 8 demonstrates various outdoor lighting scenarios featuring luminaires possessing significantly different light intensity diagrams. This phenomenon demonstrates the importance of evaluating the light intensity diagram on a per-project approach.



(a) (b) (c)

Figure 7. Forms of lighting not to target area (a) Causes sky-glow (b) Causes glare (c) Causes light trespass [39]



(a) (b) (c)

Figure 8. Luminaries and light intensity diagrams for diverse activities. (a) Two-sided walkway lighting [40] (b) Arched building lighting [41] (c) Single-sided walkway lighting [42]

Upward light ratio (R_{UL}) varies between 0-25% in EN 12464-2 European Committee for Standardization [43] "Light and lighting - Lighting of work places - Part 2: Outdoor work places" standard and the limit values increase from rural areas to the town centers or commercial areas (*Table 1*).

Table 1. Limits for upward lighting according to European Committee for Standardization [43]

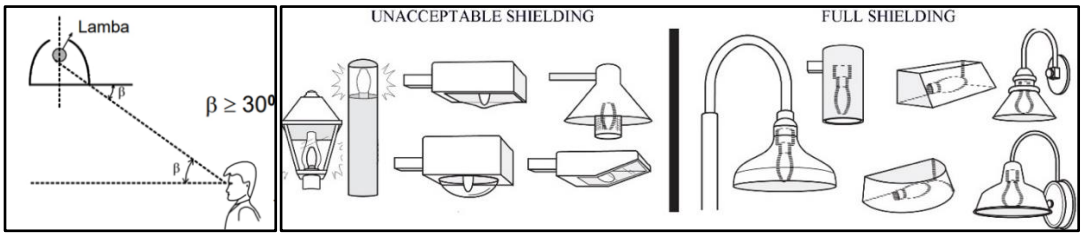
	Dark areas, such as national parks or protected sites	**Low district brightness areas, such as industrial or residential rural areas**	**Medium district brightness areas, such as industrial or residential suburbs**	**High district brightness areas, such as town centers and commercial areas**
R_{UL}	0%	5%	15%	25%

In the classification made by the Illuminating Engineering Society of North America (IESNA), the ratio of upward light, which causes sky glow, and the ratio of light emitted in the area between 80°-90°, which causes glare, are taken into account [44, 45]. Luminaries are categorized under 4 groups: full cutoff, cutoff, semi-cutoff, non-cutoff (Table 2). Today, due to the increasing awareness of light pollution, the options for fully cutoff fixtures have increased and their accessibility has become easier. Considering the increasing rate of light pollution not only in rural areas but also in city centers and the availability of cutoff devices, it is concluded that following the IESNA recommendations instead of the EN 12464 standard is more convenient in terms of sky glow prevention.

Table 2. Cutoff classification of IESNA (Adapted from IESNA-RP-8-00 [44] and IESNA-RP-33-99 [45])

	Full cutoff	**Cutoff**	**Semi-cutoff**	**Non-cutoff**
The ratio of upward lighting	0%	2,5%	5%	More than 5%
The ratio of light emitted into area between 80°-90°	10%	10%	20%	More than 20%

Uniformity of illuminance (U_0) is determined by the ratio of the lowest illuminance level to the average illuminance level. This ratio should be in the range of 0,25-0,40 according to EN12464-2 [43] and 0,17-0,33 according to IESNA-RP-8-00 [44] for pedestrian paths.
The shielding angle is the angle between the horizontal plane and the boundary line that the light source in the fixture can be observed. It is usually provided via an opaque or translucent material in order to block the light emitted from the lamp and reaching directly to the eye. While the spatial light distribution of a fixture is appropriate, the perception of the light source in the viewing field may cause direct glare and light pollution. For equipment using high luminance light sources (>500kcd/m²) and the area from which the luminous flux is emitted is left open or covered with materials generating direct transmission, the shielding angle should not be less than 30° to avoid direct glare [14]. However, it would be more prudent to prefer solutions where full shielding is provided (Figure 9).



(a) (b)

Figure 9. a) Determining shielding angle (b) Acceptable and full shielding examples [46]

Light color is associated with the spectrum (wavelength) of light and is quantified by there metrics, correlated color temperature, color appearance and color rendering [47]. Correlated color temperature refers to the temperature of the blackbody (Planck radiator) whose perceived colour is the same as the light source under specific measurement conditions [48]. It is expressed in Kelvin, a unit used to measure temperature.

As the color temperature of light emitted by a light source increase, the blue light component intensifies and the potential for harm to human health and the ecological system increases.
Color appearance is the intuitive expression of the light perceived as, such as warm, intermediate, or cool. Light with a color temperature below 3300 K is considered "warm", between 3300-5300 as "intermediate", 5300 K and above as "cool" colored light [43] (Figure 10). The choice of color temperature is a design issue. However, considering the effects of blue light on human health, the benefits of choosing a warm colored light are appreciated [49]. Warm colored lights are reminiscent of the color impression of light sources such as fire, candles, gas lamps, incandescent lamps used in night lighting. Therefore, it is recommended to use warm colored light sources in harmony with human history and that do not cause as much damage to public health as blue light [50].

Figure 10. Color temperature and color appearance of light [51]

Color rendering indicates the light source's ability to display objects in their original color. It is measured with the Ra index, with values from 1 to 100, where 100 represents the best color rendering. As the color rendering index (Ra) decreases, objects appear more faded and grayed out, losing their original color. The color rendering index (Ra) values of lighting fixtures in the range of 20-40 is classified as "poor", those in the range of 40-60 as " moderate", those in the range of 60-80 as "good", those in the range of 80-90 as "very good" and those in the range of 90-100 as "excellent". In the literature, it is recommended that lighting fixtures with poor or moderate color rendering class may be used for road lighting [43, 52]. However, current research indicates that the color rendering class is also important in street lighting. ARUP [37] specified that sodium vapor lamps with low color rendering class cause changes in the color of vehicles or clothing. In the report published by International Commission on Illumination [53], it is noted that monochromatic light sources with low color rendering should be avoided, especially in pedestrian path lighting. TS EN 12301-2 [54] the Road lighting - Part 2: Performance requirements standard, stated that high color rendering contributes to face recognition. The EN12464-2 [43] standard states that high color rendering contributes to good visual environment. In addition, the color change in architectural buildings, which are illuminated in order to perpetuate urban character, is incompatible with daytime memory and does not contribute to the purpose of illumination. It is recommended that the Color Rendering Index (Ra) should be greater than 60 in order to perceive the original colors of objects, distinguish color differences, and ensure safety in public spaces [52]. Also, fixtures with a "poor" or "moderate" color rendering class should not be used in areas where color vision is important [55]. In the context of these considerations, choosing fixtures with a color rendering index higher than 60 is advisable to provide good visual conditions, create urban lighting, which is compatible with daytime memory, and ensure safety in public spaces.

Efficient energy use can be defined as reducing energy consumption without compromising good visual conditions. Energy efficiency in urban lighting is achieved by reducing the energy consumed for unit area and turning off or dimming the light when it is not needed. Therefore, the luminous efficacy of the lamp and the efficiency of the luminaire should be high, also control systems with daylight and/or motion sensors should be used. While the luminous efficacy of a 100W incandescent lamp is 13.8 lm/W, the luminous efficacy of a halogen lamp is 15-16 lm/W, and the luminous efficacy of a fluorescent lamp is in the range of 65-80 lm/W depending on the phosphor type. Today, thanks to the technological development in the lighting industry, the luminous efficacy of LEDs has increased up to 130 and is still growing. When choosing

a lamp, high luminous efficacy should be taken into account. Luminaire efficiency is the ratio of the luminous flux emitted from the fixture to the luminous flux emitted from the lamp [38]. Energy consumption decreases as the luminaire efficiency value approaches 100%. Therefore, when comparing fixture options, the one with the closest efficiency to 100% should be preferred. In order to avoid redundant energy consumption, exterior lighting should be dimmed by 50% after 02:00 and should be turned off after daylight levels reach a required level [56]. This requires the use of automation systems with "dimming" capability and timed settings. Also, automation systems that can be controlled from the central system through wireless networks may be considered for outdoor lighting [57].

The protection classes of the fixture should be tailored to the physical environment such as temperature, humidity, and dust. These classes are determined in accordance with the two-numbered IP (Ingress Protection) system in TS 3033 EN 60529 [58] standard and the IK system in TS EN 62262 [59] standard. The IP system consists of two numbers. The first number indicates protection against solid objects such as rock, soil, dirt or dust and the second number indicates the protection class against liquids. The IK system refers to the protection class against mechanical impacts measured in "joules". At least IP54 class, partially dust-proof and protected against splashing water from all directions, must be provided for exterior lighting equipment [60]. In the 2013 Lighting Regulation, it is stated that the fixtures should provide long-term protection against dust and contamination [56]. The Lighting Handbook prepared by SLL notes that as the IP rating of equipment decreases, the maintenance factor value decreases, and that at least IP55 should be provided for exterior conditions [52]. IP55 and IP54 classes are not dustproof, but partially protected against dust. Considering the conditions of the outdoor environment in urban areas, it is considered preferable to use IP65 or IP66 protection classes, which are available today in many companies of the lighting industry, having full protection against dust and water jets, and IK08 class with 5 joule impact resistance against mechanical impacts, in order to avoid reducing the maintenance factor value [58, 59].

The scopic/photopic (S/P) ratio is an index that quantifies the difference in the perception of illuminance level under daytime-seeing (photopic) and night-seeing (scopic) conditions, depending on the adaptive mechanism of the eye optic. The cones and rods in the human eye are active at different illuminance levels. The cones are active in daytime seeing (photopic) at illuminance levels of 10 cd/m² and above, whereas the rods are active in nighttime seeing (scopic) at illuminance levels of 0.001 cd/m² and below [61]. Cases between these two conditions are defined as evening seeing (mesopic) [62]. In photopic seeing, the highest sensitivity in the relative responsivity curve of the eye is at 555 nm. Under night vision conditions, the relative spectral responsivity moves towards shorter wavelengths and the sensitivity differs from day seeing conditions [63]. This causes changes in the luminous flux values and precepted luminance levels. The light containing blue light in its spectrum is perceived with higher luminance, than the others even if the color appearance is the same. However, lamp lumen output is a function of photopic conditions. The report published by the CIE draws attention to this situation and states that mesopic visual conditions should be taken into account in street lighting to ensure good visual conditions, reduce light emissions and save energy [53]. Since S/P ratio measuring fixtures are not yet widely available, measurements related to exterior lighting designs are based on photopic evaluations without considering the physical behaviour of the human eye [64]. Today, LED technology makes it possible to provide luminaires that have the same color rendering and color appearance with different S/P ratios thus it is possible to save energy by using luminaires whose S/P ratios are high [37]. The table in BS EN 5489-1 [65] , which recommends illuminance levels for road lighting with different densities, presents gradually decreasing "average illuminance level" and "minimum illuminance level" values for light sources with S/P ratios, unknown, 1,2 and 2,0. [65]. As the S/P ratio is a new approach, studies to determine limit values and measurement methods are ongoing. Manufacturers do not yet share the S/P ratio of their products as widely as other technical specifications. Even though this situation makes evaluation of the S/P ratio difficult in luminaire selection, this innovative approach should not be ignored. In case the S/P ratio is known, the values given in BS EN 5489-1 [65] standard should be taken as reference and the developments on the subject should be followed.

3.3. Limit Values for Illuminating

Since urban lighting has become a public need, it is not possible to switch the exterior lighting off. Nevertheless, considering the effects of light pollution, it is essential to limit unplanned and uncontrolled

lighting. In this context, international organizations and public authorities set limit values for the illumination of pedestrian paths and building facades, which concern the discipline of architecture. In standards and regulations, the CIE's environmental zoning is considered, thus taking a stance towards the protection of dark areas with high sensitivity [52]. In EN 12464-2 [43] standard, lighting limits are determined according to the environmental zone classification and the before/after curfew time. The curfew starting time is set as 02:00 in the Lighting Regulation [56]. Whereas the regulation states that the blackout should be 50%, higher values are recommended in the standard (Table 3).

Table 3. Recommended limits for exterior lighting in EN 12464-2 [43] standard

Zone	**Definition**	**Maximum vertical Illuminance on properties (lx)**		**Luminance on building façade (cd/m²)**
		Pre-curfew	**Post-curfew**	
E1	Dark areas, such as national parks or protected sites	2	0	0
E2	Low district brightness areas, such as industrial or residential rural areas	5	1	5
E3	Medium district brightness areas, such as industrial or residential suburbs	10	2	10
E4	High district brightness areas, such as town centres and commercial areas	25	5	25

For pedestrian paths, the visibility of the walkway, the perception of approaching pedestrians and the discrimination of obstacles are important. Hence, in addition to the horizontal illuminance level achieved on the floor, the vertical illuminance at eye level and semi-cylindrical illuminance for face recognition should also be considered. [53]. TS EN 13201-2 [54] has specified illumination limits for pedestrian paths at floor level and for the plane 1,5 m above ground level (Table 4).

Table 4. Limit values for pedestrian paths [54, 66]

Zone	**Definition**	**Horizontal illuminance on road level (lx)**		**Illuminance at 1,5 m above the road level (lx)**	
		Average	**Minimum**	**Vertical**	**Semi-cylindrical**
P1	High prestige roads	15	3,0	5,0	3,0
P2	Heavy night-time use by pedestrians or pedal cyclists	10	2,0	3,0	2,0
P3	Moderate night-time use by pedal cyclists or pedestrians	7,5	1,5	2,5	1,5
P4	Minor night-time use by pedal cyclists or pedestrians solely associated with adjacent properties	5,0	1,0	1,5	1,0
P5	Minor night-time use by pedal cyclists or pedestrians solely associated with adjacent properties. Important to preserve village or architectural character of environment.	3,0	0,6	1,0	0,6
P6	Very minor night-time use by pedal cyclists or pedestrians solely associated with adjacent properties. Important to preserve village or architectural character of environment.	2,0	0,4	0,6	0,4

4. SIMPLIFYING THE LIGHT POLLUTION PROBLEM WITH DECISION TREE METHOD

Decision making is the process of determining the most appropriate option for a given purpose from a set of possible alternatives [67]. Today, people or businesses are faced with the necessity to make decisions based on more than one objective or metrics. A decision tree is a solution model that enables the sequential evaluation of multiple variables and provides decision support by simplifying them graphically [67, 68]. As mentioned above, light pollution is a multidimensional problem in its forms, causes and consequences. However, urban lighting is an indispensable social need today. Lighting techniques to prevent light pollution are based on many standards and criteria. There is a need to simplify the problem in order to prevent time losses and possible negative architectural applications.

In creating a decision tree, the root node, the internal nodes (branches) and the terminal nodes (leaves) are all crucial. If the tree becomes complex and the data sets cannot be tracked, the tree loses its functionality [68, 69]. Based on these considerations, the root node of the tree was the question " Is this design avoiding light pollution? The internal nodes are the basic questions mentioned above, "Is this lighting needed?", "Are the appropriate lighting fixtures selected?", "What are the illumination thresholds?", and the necessary terminal nodes are created for each question. "Yes" and "No" prompts on the branches of the tree direct the designer to decision support information according to the recommendations of relevant standards and reports (Figure 11).

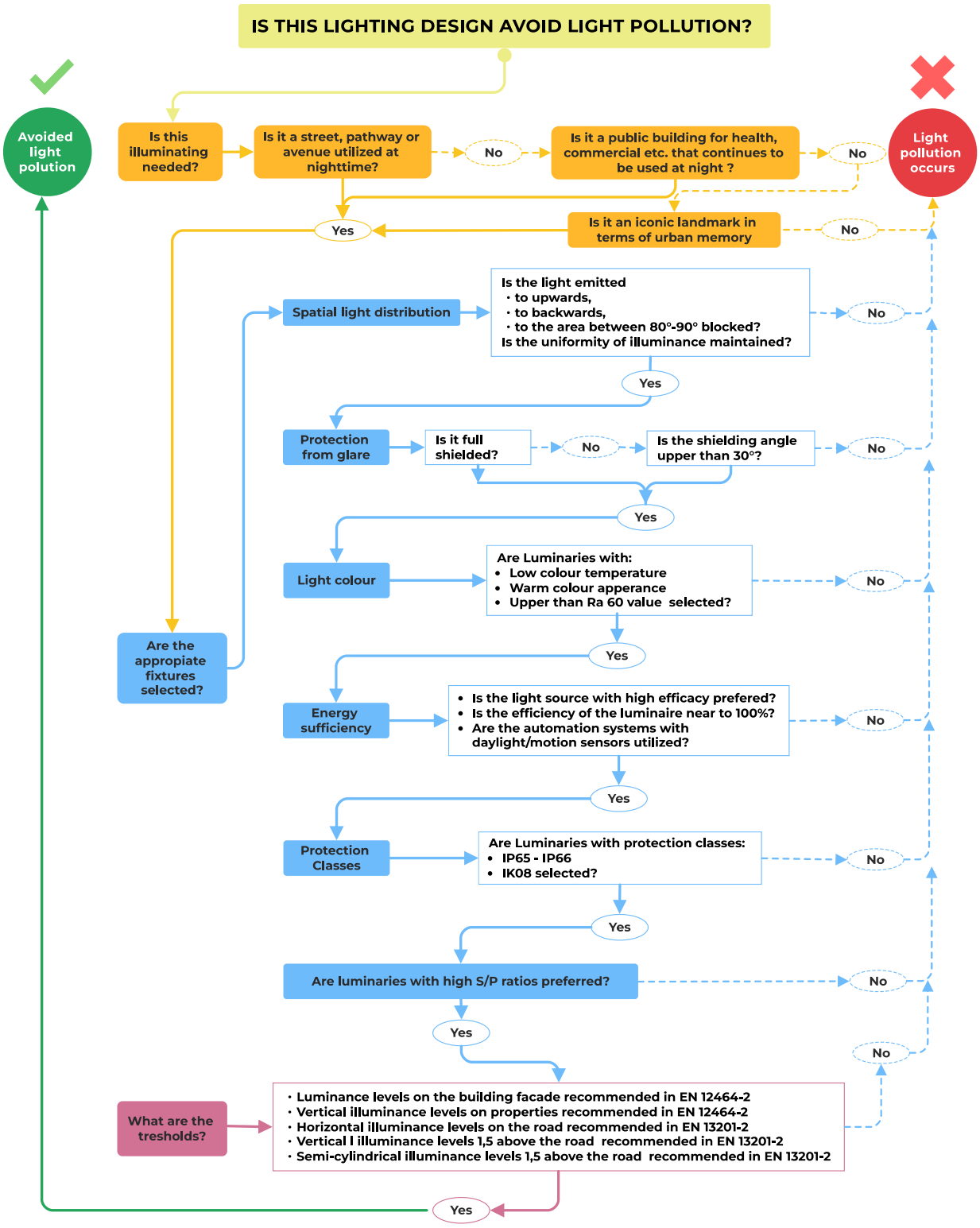


Figure 11. Decision tree for urban lighting design to avoid light pollution

5. CONCLUSION

Urban lighting means illuminating the city for users to fulfill several activities in security and safety after nightfall and to make the city more appealing. As daylight disappears, the functional and architectural illumination of cities becomes more prominent. However, lighting designs that is not in accordance with the technique and/or has a prolonged illumination period cause some drawbacks. Light pollution and increased energy consumption, which affect bioecology are the most important of these concerns.
In order to minimize light pollution, in the form of sky glow, glare, light trespass and excessive illumination, the limit values of the standards and recommendations prepared by the organizations should be followed in functional and architectural urban lighting instead of arbitrary individual designs. Fixture selection should be project-specific and compatible with architectural design and function. In addition to aesthetic requirements, technical features should also be considered. In addition, it is crucial to prepare master plans tailored to each city or to different zones within the city. It is vital to consider technical and aesthetic merits in establishing a lighting master plan, to approach the problem from a comprehensive perspective, and to organize public audits of the applications.

Lighting techniques and limits for the prevention of light pollution, which is a multidisciplinary problem with its forms, causes and consequences, have been linked to many standards and regulations. This study presents a decision tree model by systematizing and simplifying the steps to be followed in order to prevent light pollution in urban lighting design. The model decision tree is intended to establish a simplified method for taking proactive measures against light pollution and energy consumption at the beginning of the design process, and also to develop a preliminary study that can be used in the preparation of lighting master plans.

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Investigating Female Accessibility and Prayer Space in Mosque Architecture: A Case Study in Dhaka, Bangladesh

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Abstract: *The paper aims to investigate the spatial quality and availability of prayer space and accessibility for females in mosques of Bangladesh. The paper examines Islamic scriptures and argues that it is fundamental to consider designing accessible prayer spaces for women while designing mosques. The study proves that despite having religious instructions to allow women in the mosque, women prayer spaces are unavailable in most of the mosques of Dhaka city, resulting women not be able to enter the mosques. Seven sample mosques were selected in total for study within walking distance from a central location point of Kafrul residential area among which, one mosque is under cantonment authority nearby. Non-participant Complete Observation methods were applied for the study of the cases. The study shows that none of the six community mosques have accessibility or prayer space for females, which prevents female worshipers from attending. Only the mosque in the nearby cantonment area has a female prayer space, which was also analyzed to represent the provision for women in the city's mosques where it is available.*

Keywords: *Muslim urban community; community mosque, Dhaka mosque architecture; female prayer space*

Dhaka, Bangladeş'te Cami Mimarisi İçerisinde Kadın Erişilebilirliği ve İbadet Alanlarının İncelenmesi: Bir Vaka Çalışması

Özet: *Bu makale, Bangladeş'teki camilerde ibadet mekanlarının ve kadınların erişilebilirliği konusundaki mekânsal kalite ve kullanılabilirlikleri incelemeyi amaçlamaktadır. Makale, İslami metinleri incelemekte ve cami tasarlanırken kadınlar için erişilebilir ibadet alanlarını tasarlamanın temel olduğunu savunmaktadır. Çalışma, camilere kadınların girmesine izin verilmesi yönünde dini talimat olmasına rağmen, Dhaka şehrinin çoğu camisinde kadın ibadet alanlarının bulunmadığını ve bu durumun kadınların camilere girmesini engellediğini kanıtlamaktadır. Kafrul konut alanının merkezi bir noktasına yürüme mesafesinde toplam yedi örnek cami seçildi, bunların arasında yakındaki bir kantonment yetki alanındaki bir cami de bulunmaktadır. Vaka çalışmasının incelenmesi için Katılımcı Olmayan Tam Gözlem yöntemi uygulanmıştır. Çalışma, altı topluluk camisinin hiçbirinin kadınlar için erişilebilirlik veya ibadet alanı sunmadığını, bu durumun kadın ibadetçilerin katılımını engellediğini göstermektedir. Yalnızca yakındaki kantonment alanındaki camide kadınlar için bir ibadet alanı bulunduğunu, bu durumun şehirde bulunduğu yerde kadınlar için sağlanan imkânı temsil etmek üzere analiz edildi.*

Anahtar kelimeler: *Müslüman şehir topluluğu; topluluk camisi, dhaka cami mimarisi; kadın ibadet alanı.*

1. INTRODUCTION

Accessibility for women in South Asian community mosques slightly contradicts the guidelines of Islamic origin, including in Bangladesh. Women are not generally allowed to enter any mosque and pray; rather they need to make sure that there is dedicated space for women to pray. Islam is the fastest-growing religion in the world in the 21st century in terms of percentage and worldwide spread [1]. Bangladesh is a Muslim-majority country containing 150 Million Muslims, which is 91.04% of its total population according to Bangladesh Population Census 2022 [2]. Not only that, the Muslim population has been increasing in the country compared to other religious followers in this country according to Population and Housing Census-2022 of Bangladesh [3]. Accordingly, with the growth of a huge population, the need for congregation, contemplation and prayer space for both Muslim men and women is always increasing in this country. Unfortunately, despite being more than half of the population (50.46% according to the Bangladesh Bureau of Statistics) [4], females in Bangladesh are being deprived of getting into most of the mosques only for not having urban accessibility to the mosques as the consequence of social discrimination. Whereas, most of the scholars of Islam state that women are not prohibited, but rather exempted from going to the mosques for daily prayers, keeping in mind their child-rearing and other domestic responsibilities.

Being a mosque and knowledge-based religion, it is equally important for Muslim females to enter the mosque to learn about the religion which can have a profound impact on their personal and psychological development, enlightenment, and purification. Although women don't need to compulsorily pray at mosques like men, they are unquestionably allowed to enter any mosque, by maintaining the religious norms and etiquette. Women can attend daily prayers with the congregation and take part in the learning and sharing of knowledge according to Islamic guidelines [5]. And thus they need proper space and provision provided in every mosque. Moreover, especially while travelling outside, female accessibility in mosques is highly needed by the female Muslim segment of the country to perform the mandatory prayers at the right prayer schedule [6].

But the practice of women's accessibility as well as participation in the Salah/prayer in the mosques is very rare in Bangladesh. Women in the society are asked not to go to the mosques where there is no separate space allotted for the female Muslims. Mosques that have separate female prayer spaces only allow Muslim women to enter the mosque for prayer. Other mosques do not forbid it though; it is not socially practised. Muslim families even teach their children that a mosque is only for men, whereas women are only allowed if there is a separate prayer space allotted for women. Such Mosques sometimes also consist of a separate entry gate for the women. The architectural design of the mosques along with the entry gate plays an important role in this social practice of no or less participation of women in the mosques of this state. However, being the capital and center of the nation, Dhaka has few Jaam-e-mosques that have female accommodations for prayer in the mosques.

This paper aims to represent the current status of female accessibility in the built community mosques in the capital city of Dhaka. To narrow down the research area, a central residential area near Kafrul Thana was chosen which accommodates a mid-income neighborhood. The research outcome shows that none of the community mosques architecturally have accessibility or allocated space for females, which means women are not allowed to enter those mosques. At the same time, a mosque located in a more planned area, i.e. in the nearby restricted Cantonment area, containing a dedicated female prayer space beside the main prayer hall, was also presented in the paper to represent the characteristics of such mosques in Bangladesh.

The objective of this paper is to highlight the absence or lack of female prayer space in the mosques of the state. Another objective of this research is to ascertain the Islamic regulations regarding women's involvement in the mosque by thoroughly examining the Quranic and Hadith sources in the literature review, which will help to set out religious guidelines for designing mosques with female accommodation.

1. HISTORY, LITERATURE & PERCEPTIONS

This literature review aims to examine the root historical evidence to compare with the current practices in Bangladesh. It also showcases the current research on women's prayer spaces in mosques and their impacts on the experiences and perceptions of Muslim women. The overall historical background analysis and studies from the literature are structured in the following chart to determine the research question and objective of the research.

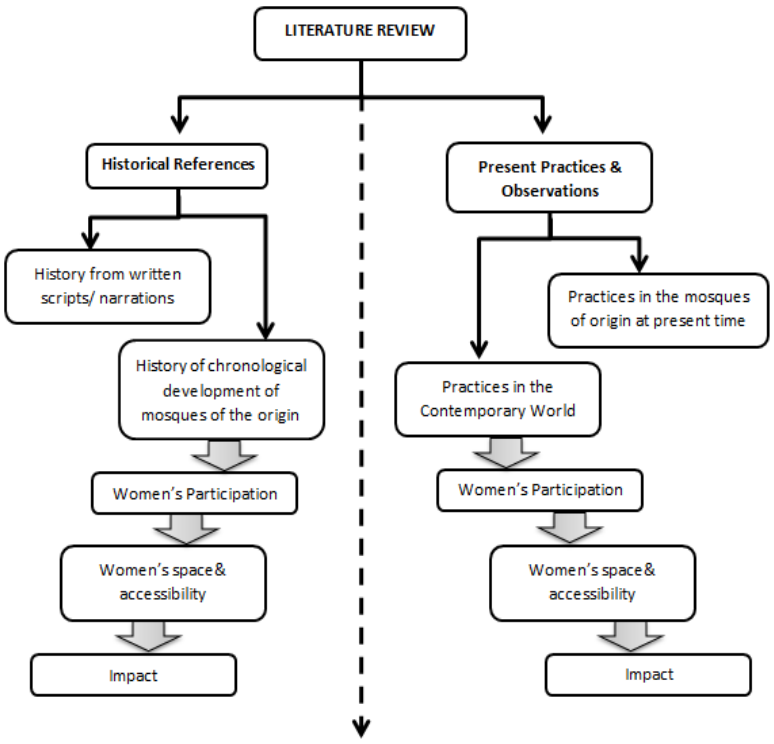

Figure 1: Structure of the Literature Review.

2.1 Historical References

Islam does not directly ask for separate female prayer spaces for the women inside the mosque. This is why the basic mosque architecture consists of a large courtyard at the center of the mosque to gather people for the congregation. "The Messenger of Allah Muhammad(ﷺ)[1] said: Do not prevent the maidservants of Allah from going into the mosque." This is what we learn from the pure Hadith[2] as a statement from the Prophet (pbuh) narrated by Ibnu Umar (rah). So, if we want to know the foundation of Islamic Architecture based on its religious ground, we have to know how it was directed and practised during the time of Prophet Muhammad pbuh and his companions, and their direct followers.

'Salah' (or Salat) is the fundamental prayer that needs to be performed 5 times a day by every eligible Muslim. It is very important and sometimes mandatory to perform Salah at the mosques for the Muslim males, but it is optional for the Muslim females as they have to take care of the family and little children.

And there is no objection or prohibition for the females to enter the mosque for prayers with proper coverings, norms, and etiquette. For which we get references from pure hadiths from the hadith collection

[1] ﷺ is the Arabic form of 'peace be upon him' (pbuh)

[2] Hadiths are the narrations of the companions and witness of Prophet Muhammad (pbuh) which are the fundamental guidelines for Islamic religion.

books. Hadiths are the authentic sources of narrations of the teachings, activities, and history of Rasul Muhammad (pbuh), by his companions and witnesses. Below are some Hadiths collected from authentic sources regarding this topic:

a) Hadith regarding women's participation at mosque during Prophet Muhammad's (pbuh)

The following hadiths are from 'The book of the Times of As-Salat' from the translation of the book 'Sahih Al-Bukhari' which is recognized as the most authentic among all hadiths of Prophet Muhammad pbuh to know about the root practice of Islam taught by him. According to Hadith no. 578, 'Aishah (rta)[3] reported that the women who believed in Islam used to wear veiling sheets and go to the Fajr prayer with Allah's Messenger. After the prayer, they would go back to their homes and no one could recognize them because of the darkness [7].
In Hadith no. 899 Narrator Ibn 'Umar reported that Prophet Muhammad (pbuh) said, "Allow women visiting the mosques at night." [7].

In Hadith no 900 Ibn 'Umar(rta) narrated that one of the wives of 'Umar(bin Al-Khattäb)(rta) used to attend congregational prayers in the mosque, despite 'Umar's dislike for women attending. When asked why she had come out for the prayers knowing 'Umar's great self-respect, she countered by asking, what prevents Umar from forbidding her directly? Then the narrator replied by citing a hadith that forbids stopping women-slaves from going to Allah's Mosques -the statement of Allah's Messenger prevents him [7].

Also, there are several similar authentic hadiths in 'the Book of Salah', Sunan Abu Dawud, regarding what has been narrated concerning women leaving their houses for the Masjid, and it establish the practice and permitting the women to go to the mosques for prayers during the time of Prophet Rasul Muhammad pbuh (Hadith no: 565) [8]. There is also a Hadith in Sunan An-Nasa'I narrating that women went to mosques at the darkness of fajr time with properly 'covered' in dress in Hadith no 546 & 547 [9].

b) Hadith regarding women's attire, manners, and etiquette in the mosque

Sunan Nasai, Chapter 37, Hadith no.5131 reports that Abu Hurairah narrated that the Messenger of Allah said women who have perfumed themselves with incense should not attend 'Isha' prayer. (Sahih) [9]. Also, there are Hadiths (Hadith-1334) regarding etiquettes of men sitting for a while after finishing the prayer, so that women could get up behind and leave the mosque beforehand, so no mixing in the crowd happens on the gate while leaving [9]. Another Hadith collection book of Imam-Muslim compiled many Hadiths that prove the presence of women in mosques and their manners while praying behind men in congregational prayers [10]. So it was not prohibited, rather a set rule was guided to the believer women about how to get prepared for the mosque.

c) Hadith on women's activities in the mosque

There are hadiths in Sahih Bukhari- '8- The Book of Salat' Hadith no. 458 & 460 and Sunan Nasai- 'The Book of Masjid' Perfume in the Masjid: Hadith no 729 proves that women are allowed to do cleaning work in the masjid. On the other hand 'The Book of Menstruation' contains hadiths Hadith no 383, 384, 385 that prove even menstruating women are allowed to enter a mosque while not participating in the prayers. Which proofs that women used to clean and sweep the main hall room of the mosque at the time of Prophet Muhammad pbuh [7]; [9]. So it wouldn't be possible to happen if women were not at all allowed to enter the main hall room of the mosque.

[3] rta= Radiallahu ta'la 'anhu means may Allah be pleased with him

d) Hadith on women's participation in the Eid Congregation

Prophet Muhammad (pbuh) encouraged women to go for participate in the Eid Congregation at Eidgah[4]. There are several Hadiths as proof of this.

The Book of Jami' At-Tirmidhi, which is another source of authentic hadiths of Prophet Muhammad, contains hadiths that establish that the Prophet Muhammad pbuh encouraged young and mature women, even the menstruating women to participate in the Eid Congregations. The Hadith itself indicates the great importance of this participation [11].

Umm 'Atiyyah narrated that Prophet Muhammad would instruct women, including virgins, mature women, secluded, and menstruating women, to attend the two Eid prayers. Menstruating women were to refrain from entering the Musalla but could still participate in Muslim supplications. When one woman asked what to do if she did not have a Jilbab, the Prophet responded by suggesting that she borrow one from her sister [11, 7].

So we can see that the root practice of Islam always allowed women to participate in the congregations with proper dress codes and never thought it as a 'prohibition'. At times, during the Eid Congregations, when it is a matter of a big social gathering, even then women are advised and encouraged to participate in the congregation prayers by the noble Prophet Muhammad pbuh.

e) Hadith about the entrance gate and accessibility of women in the mosque

Although there is no evidence of separating the room of prayer in the main hall room of the mosque, it has been reported by Prophet's companions in hadith that Prophet Muhammad (pbuh) asked them to separate the entry gate of the women to enter the mosque, so that women do not get disturbed or get crowded with the men to avoid impudence and indiscipline, and practised it throughout his lifetime [8].

In the 'Book of Salat' of Sunan Abu Dawud, in chapter 17, titled 'Separating the Women from the Men in the Masjid' contains Hadiths that prove women used to enter the mosque at the time of the Prophet Muhammad, and the Prophet asked to let one door of the mosque assigned only for the women [8].

In Hadith no 462, A narrator named Abdul Warith reported from Nafi' from Ibn Umar that, The Messenger of Allah asked to leave one door solely for the women, and for this reason his companions did not enter from that door until they died [8]. This indicates that the Islamic ruling for women to enter the mosque is not only permissible but also has been given such importance that they deserve a separate door for undisturbed and uninterrupted entry.

f) Hadith regarding objection on women's going to mosque without proper dress code

Sunan Abu Daud, described in his Hadith compilation book this issue as 'a severity case'. In Hadith no 569 in his book, according to 'Amrah bint 'Abdur-Rahmãn, 'Aishah (RTA) said that if the Messenger of Allah saw what women are doing now, he would have prevented them from going to the Masjid, like the women of the Children of Israel were prevented. (Sahih) [8].

Hadith no. 570: Abdullah bin Mas'ud narrated that the Prophet said, "The prayer of a woman in the innermost room of her house is better than her prayer in the middle room, and her prayer in the middle room is better than her prayer in the outermost room." [8].

[4] Eidgah= A place set apart for public prayers on the two chief Muslim feasts.

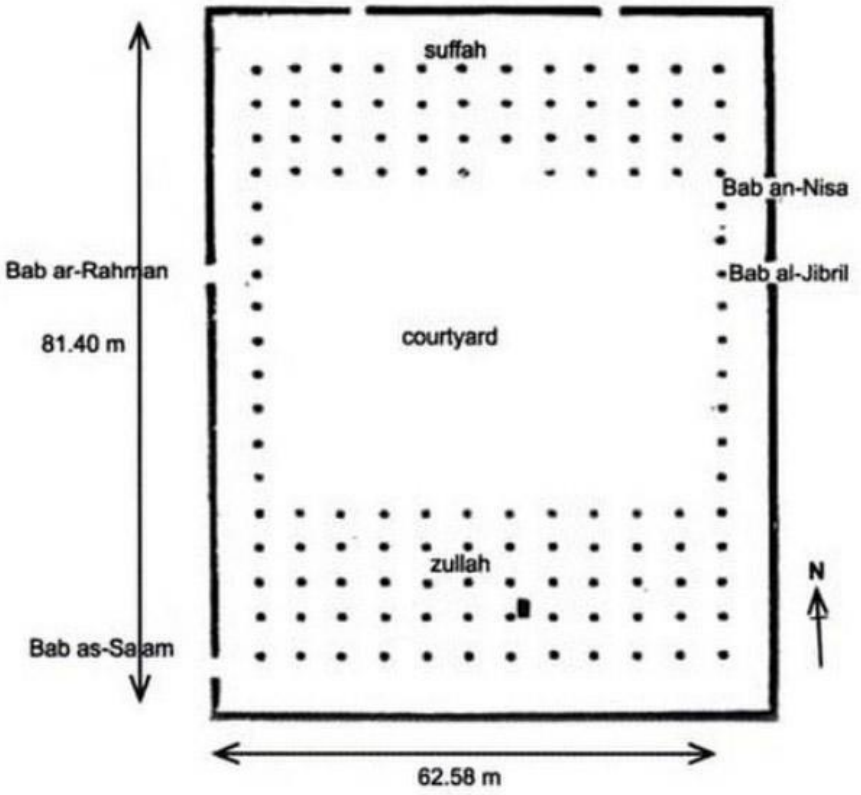

Figure 2: Plan of the Prophet's mosque, Masjid an-Nabawi in Medina, during the time of the Prophet's companion and 3th Caliph Uthman in 650 AD; the entrance gate of women is named as 'Bab-an-Nisa'. Source: HajjUmrahPlanner.com [12].

Despite many Hadith reports that women used to go to the mosque and attend everyday prayers during the Prophet's time, the mentioned alike few Hadiths are present which claim that women can be prohibited from the mosque if the authority thinks there is a chance of disrespecting the mosque environment due to lack of discipline. But only one or two hadith in a severity case, do not diminish other hundreds of hadiths that prove the participation of women in the mosque activities and prayers during the Prophet's time. So this must be also a part of practice among the Muslim communities in the mosques.

So from these guidelines of the Islamic teachings, we can come to the point that women should not be prohibited from attending daily or congregational prayers in any Masjid, as long as they follow proper dress codes and refrain from using perfumes. An architectural planning solution of the entrance gate, accessibility and covered (separated) or uncovered prayer space allocated for women is important to provide this facility in every mosque according to the Islamic teachings.

2.2 Present Practices & Observations

The role of women in mosques has been a topic of debate within the Islamic community for centuries. The concept of having a prayer space for women in mosques is a controversial issue within the Islamic community. While some argue that women should have equal access to prayer spaces in mosques, others believe that separate spaces for men and women are necessary for cultural and religious reasons. Many Muslim communities have historically designated separate areas for women in mosques, which were often smaller and lacked the same facilities as the men's section. During the 20th century, some mosques began to create separate spaces for women that were more accessible and accommodating.

A variety of studies have explored women's experiences and perceptions within mosques. These studies prove that the quality of women's prayer spaces in mosques is a significant factor in determining their overall satisfaction with the mosque experience. Women who have access to high-quality, well-maintained spaces with good lighting, air circulation, and proper ventilation are more likely to feel comfortable and welcome in the mosque.

In addition, studies have shown that women's prayer spaces that are physically separated from the men's section are perceived as more inclusive and welcoming. This is because women who are able to pray in a space that is not visible to men can focus on their worship without the distractions or potential harassment from men.

However, other studies have indicated that women who are not physically separated from the men's section may feel uncomfortable or unwelcome in the mosque, especially if they are subjected to unwanted attention or discrimination.

The research paper "An Analysis of Women's Access and Participation in the Mosques in the Contemporary World" comprehensively examines women's access and participation in mosques globally [13]. The authors begin by acknowledging the historical and ongoing debates over women's place in the mosque and present an analysis of the current state of women's access to mosques and their participation in religious activities in a variety of cultural and regional contexts [13]. The article has given great emphasis on the importance of the participation of women at mosques in religious activities as well as prayers by reference to authentic historical sources. According to the Authors [13] in Muslim countries, mosques have designated prayer areas for women, which may be in small rooms in the basement, on the ground floor, on a closed balcony, or in a small building attached to the mosque. That is also a practice in the mosques that give female provisions for prayer in Bangladesh.

The findings of the study indicate that despite progress in some areas, women still face significant obstacles in securing equal access and treatment in mosques. Cultural norms, religious interpretations, and political considerations continue to shape the experiences of women in the mosque, and there is a need for ongoing activism and advocacy for women's rights in religious spaces [13].

In a different study, Dr. Line Nyhagen conducts research on the participation and influence of women in modern mosques located in Western Europe. According to the study, Women's participation in mosque prayer is influenced by social, cultural, and religious factors. The study, published in the journal ‘Religions’, provides a comprehensive examination of the experiences of Muslim women in different cultural and regional contexts, shedding light on the diverse practices and interpretations of Islamic teachings regarding women's participation in prayer [14].

The author notes that while some women can participate fully in prayer at mosques in some countries, others face significant obstacles in accessing these spaces or are restricted to separate or inferior areas for prayer [14]. Dr. Line argues that these differences in access and participation reflect broader gender inequalities in Muslim societies and that there is a need to increase awareness and promote greater equality and dignity for women’s space in the mosque.

Overall, the study by Nyhagen offers crucial insights into the ongoing challenges Muslim women face in accessing and participating in prayer at mosques. It underscores the need for greater awareness and advocacy on the issue and highlights the important role of women's activism in challenging gender norms and promoting greater equality and dignity in religious spaces. However, the study somehow overlooked the norms and regulations women need to maintain for participation in prayers at mosques, which is necessary to understand why women are restricted in such a way at mosques in most countries.

Nawawi et al. (2017) studied the mosques located in Malaysia, which is another contemporary Muslim country in the world, to investigate the character of the space provided in the mosques for women [15]. The study aims to investigate the space requirements for women in mosques based on the original sources of Islam, such as the Quran and Hadith, and how these requirements are applied in mosques in Malaysia. The

review is based on qualitative research methods, including analytical analysis of layouts and observations of traditional and contemporary mosques in Malaysia.

The study finds that the design of mosques in Malaysia is often gender insensitive towards women. There is no specific guideline on space provision for women in mosques, which results in obscured access, temporary prayer spaces, and a lack of accessibility for disabled and elderly women. The review also highlights the importance of women's participation in mosques, as they are an integral part of the community and engage in various activities such as education and socializing.

The study suggests that the design of mosques should take into consideration the needs of women, such as segregation and privacy. It is important to provide proper spaces and access for women, including separate entrances, prayer areas, ablution areas, and toilets. The review also emphasizes the importance of maintaining hijab (modesty) and privacy for women in their movement from ablution to prayer space as it instructed by the Islamic teachings [15].

If we look at the practices in the two holy mosques of Islamic origin, Masjid Al Haram at Mecca, and Masjid-un-Nabawi at Medina, and also the other mosques in Saudi Arabia, have separate entry-exit gates for the women to enter the mosques and separate prayer spaces for praying the everyday salah [16]. Whilst during the weekly Congregation on Friday and also in the Eid congregations, women are used to pray behind the men's last line, or there is a separate rowed section for the women to pray in the mosque courtyard or on the Eidgah[4] courtyard.

In summary, according to different studies, the contemporary practices of women's participation in mosques do not always completely follow the root practice guidelines of Islamic origin.

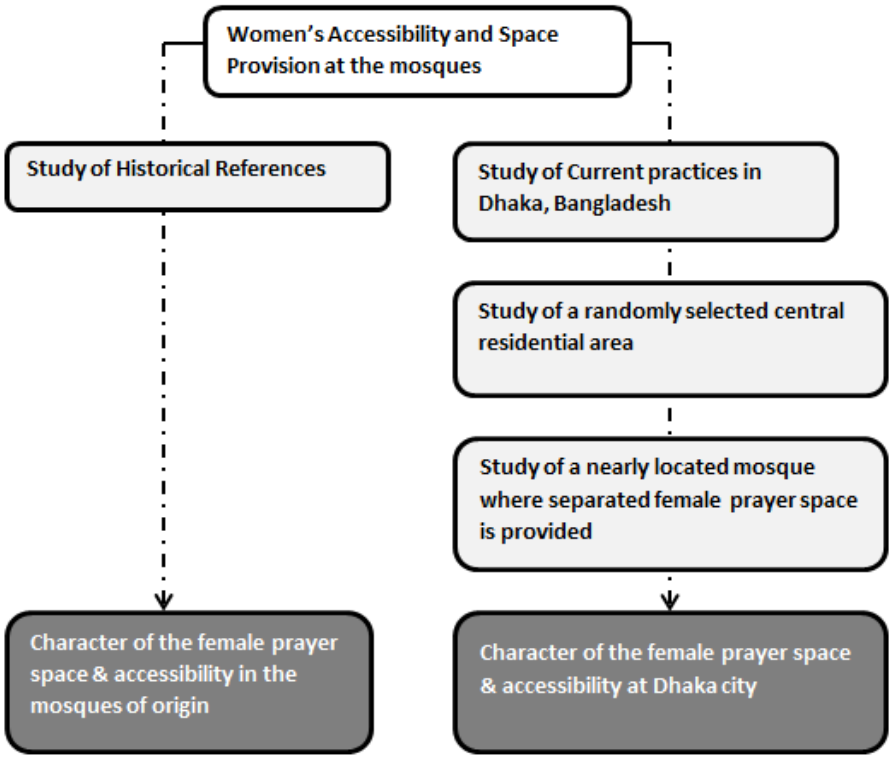

Figure 3: Step-by-step phases of the literature study

2. METHODOLOGY

A covert type non-participant complete observation method [17] was chosen to observe available samples of community mosques within walking distance from a central residential area in Dhaka. The reason behind the selection of a study area within walkable distance is that communal mosques need to be within walking distance for the ease of access of the community people and sustainability [18]. A randomly selected central point was chosen inside the residential area to start from and a circle of 10-15 min walking distance was drawn around it to determine the walkable area. The study was conducted by selecting the mosques around that point and as such we found 7 mosques around that walkable area. The data collection method includes covert type Non-participant observation of the cases [17] of the seven selected community mosques. The data was gathered within a period of around 14 days. The objective of the research is to investigate if the mosques welcome or have accessibility for females in the common prayer space or have separately allocated space for females. The evaluation was based on the following specific criteria:

1) Whether the mosques have allowance or accessibility in the main hall room for women.
2) Whether there is a designated area for women to pray during regular or Friday prayers.
3) In case women have access to a prayer space, the assessment considers evaluating the percentage of female prayer space compared to men's prayer space and what amenities are available for the female.

3.1 Selection of study area

Dhaka, the capital of Bangladesh, is one of the world's largest Muslim cities. Kafrul is located almost at the center of Dhaka metropolitan city. The Kafrul Thana area covers 7.89 square kilometres and is situated between 23°45' and 23°49' north latitudes and 90°22' and 90°23' east longitudes. It is surrounded by Cantonment Thana to the north and east, Tejgaon Thana to the south, and Mirpur Model and Sher-e-Bangla Nagar Thana to the west. The area holds a residential mid-income community consisting of a total population of 272939; among which males 147793 and females 125146 [19]; Hence female population is 46% of the total population in this area. The total Muslim in this community is 269163 which is 98.6% of the total population of the area [19].

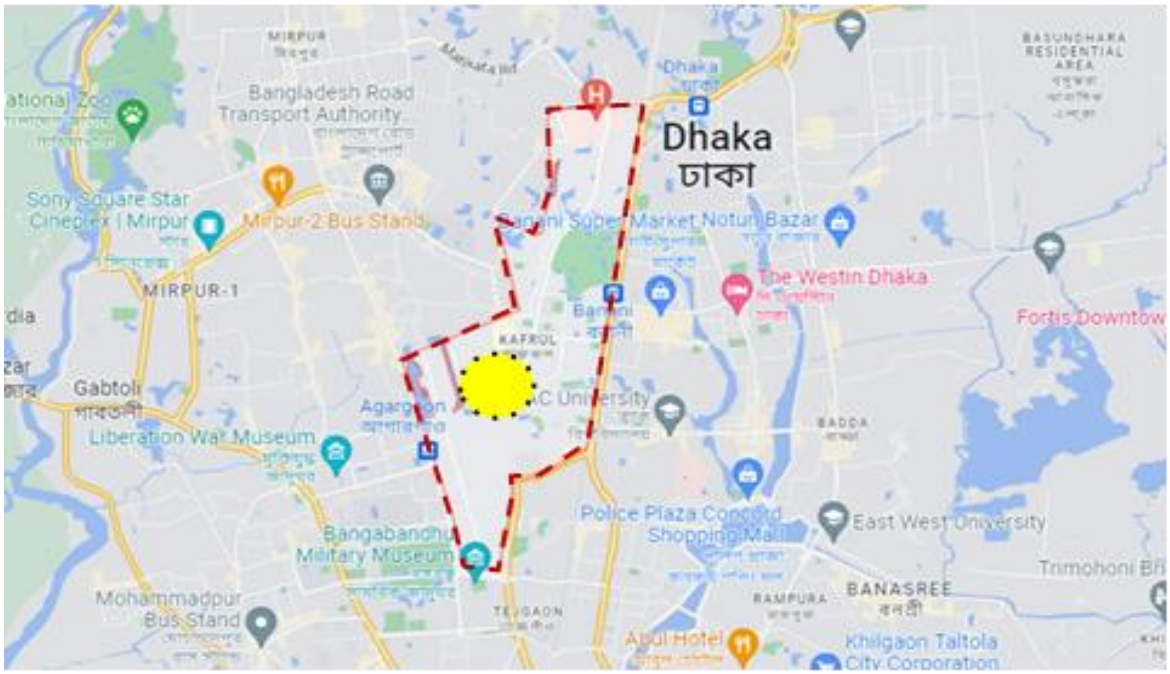

Figure 4: Kafrul Thana in Dhaka City, the yellow marked zone is the study area. (Illustrated from Google Map by authors)

2.2 Selection of sample mosques

To narrow down the vast research area, seven mosques were chosen within walking distance from the central residential area of Kafrul Thana. The mosques were selected within a 10–15-minute walking distance based on information collected from Google Maps and the Mosque Directory of Bangladesh [20].

According to the mosque directory of Bangladesh, in Kafrul Thana there are a total of 109 mosques, among which some mosques are located in the nearby cantonment area [20]. Among the seven selected mosques, the mosque named Rajanigndha Officer's Quarter Jam'e Mosque is situated in the nearby Cantonment area and is restricted for the civil people to enter at specific times. The selected seven mosques are shown in Figure 5 and are listed below:

1. North Kafrul Central Jame Masjid
2. Ahmodia Jame Masjid
3. Purbo Kafrul Kendriyo Jame Masjid
4. Tara Masjid
5. Uttar Kafrul Jame Masjid
6. Baitun Nur Jame Masjid
7. Rajanigandha Officer's Quarter Jame Mosque (located at Cantonment area)

2.3 Data collection method

From the central point of the residential area, 7 mosques were in walking distance, so at first the mosques were visited through the process of site reconnaissance method [21] either by walking or by rickshaw to observe if any women get access to the mosques. As for women's participation in daily prayers mosques are needed to be within walking distance, so the distances were counted by walking time. The mosque authorities were asked if women have space for prayer inside the mosque or not. The mosques were also checked during random prayer times to see if any women participated in daily prayers.

A non-participant complete observation was done to examine Rajanigandha Officer's Quarter Jame Mosque, which has a female prayer space in it. The Mosque is situated in a restricted zone under Dhaka Cantonment, which is restricted for the common people at times but opens at scheduled times. The observation included (1) plan analysis, (2) measurement of the male and female prayer spaces, (3) the availability of facilities such as ablution areas and restrooms, (4) women's participation during daily prayers and Friday Prayers, and (5) the overall accessibility of the mosque for women.

3. FINDINGS & RESULTS

The research outcome shows that only the mosque located in the nearby cantonment area has a female prayer space, but that is usually restricted to entry for the public. Except for that one, none of the selected six communal mosques within walking distance of this residential area have a separate space dedicated to women. Consequently, women cannot participate in daily 5 times prayers in those community mosques or Friday prayers because of the social practice or prohibition. Also, women are not used to participating in the Friday congregations or daily prayers by making separate lines behind the men's line according to the narrations on hadith in these general mosques. There is even a lack of space for the male on Friday prayers. Male devotees need to stand for prayer on the outside of the mosque due to the limitation of space during the Friday congregation (Figure 6). The reason behind this is not having adequate space for the mosque territory due to the lack of space and population density in the residential area in the overcrowded city.

On the other case in Rajanigandha Officer's Quarter Jam'e Mosque, located in Dhaka Cantonment Rajanigandha Residential Area in Kafrul Thana, which is partly restricted for civil people, has separate accessibility and prayer space for females to attend daily prayers and Friday congregations.

The female prayer zone in Rajanigandha Officers' Quarter Jam'e mosque is enough to accommodate 65-70 females. The quality of the female prayer space is good and well-maintained. It also has separate female

ablution space and washrooms attached to the outdoor of the female prayer room. But the female prayer space is so small that one has to pray outside the mosque in case women worshipers come over 70 persons, whereas, the male prayer space includes the whole main hall room of the ground floor of the mosque as well as the first floor of the structure. During the Friday congregations, the corridors and sometimes the outdoor spaces are also occupied by the males as it is mandatory for the males to come to the mosque for prayer on Friday. Female prayer space is not fully occupied on daily or Friday congregations may be because of lesser accommodation and restriction on public access.

The percentage of female prayer space (including the services) compared to the whole territory of the mosque (including the outside courtyard) is less than 4% whereas women's count is 46% in this residential area (Figure 9). It is visibly clear that on Fridays, women do not feel the urge to go to the mosque as there will be a shortage of space for prayer. The shortage of space indicates that women are not welcomed or encouraged to come or participate in daily and Friday prayers.

The summary of the findings is, firstly, none of the six community public mosques within walking distance in the selected study area had any separate spaces for women. Women do not pray their daily prayers or participate in Friday congregations in these mosques. The findings represent the scarcity of female prayer space in the mosques of Dhaka. Secondly, the research included a case study of a mosque that has a separate prayer space for women. However, women were confined to a small area beside or adjacent to the mosque and they were not allowed to enter the main prayer hall. The area given for the female prayer zone does not reflect the female population of the area either.

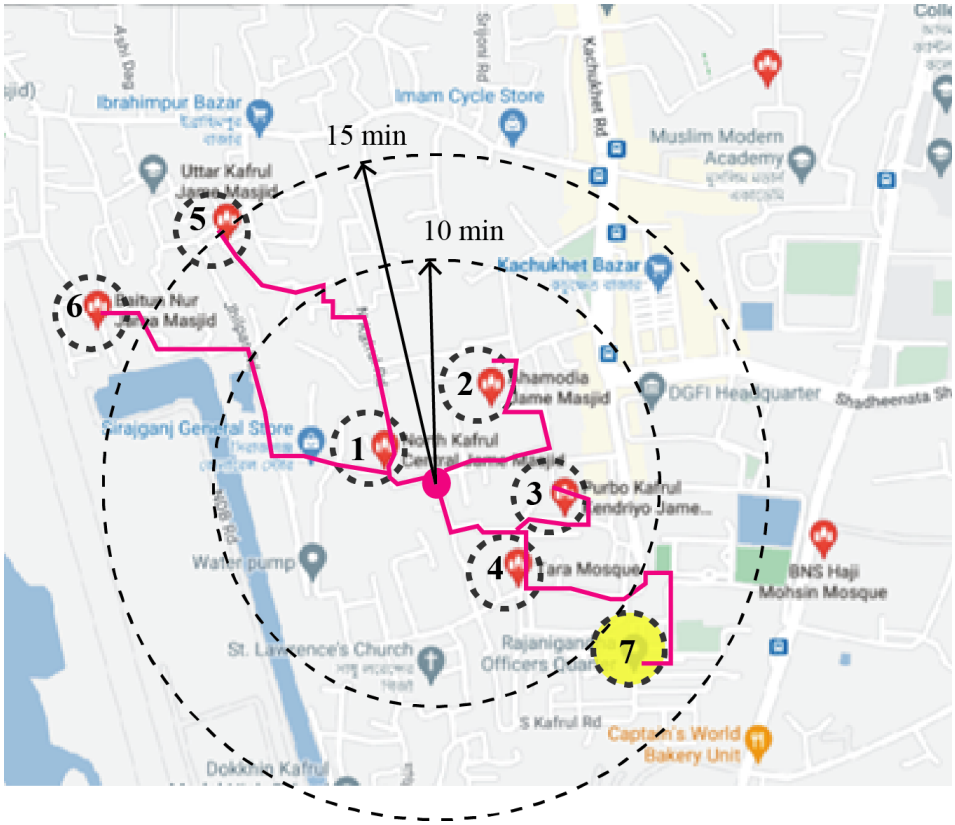

Figure 5: Selected six mosques' locations within 10-15 min walking distance from the center point of Kafrul residential area; the yellow circle denotes the location of Rajanigandha Officer's Quarter Jam'e Mosque which contains a well-maintained female prayer zone. (Illustrated from Google Map by authors)

Figure 6: Selected sample mosque pictures; the last one is the entry road in front of Tara Masjid, which is occupied by the Musallis[5] during Friday congregational prayer. (Bird's eye view images sourced from Google Map, perspectives images are taken by the author)

Figure 7: Female prayer space quality of Rajanigandha Officer's Quarter Jam'e Mosque. [From left: separate access, separate entry gate, separated prayer space, separate toilet and ablution space for the females. (Photo credit: Authors)

Figure 8: Top view of Rajanigandha Officer's Quarter Jam'e Mosque. (Source: Google Earth)

[5] Musalli means one who performs Salah prayer.

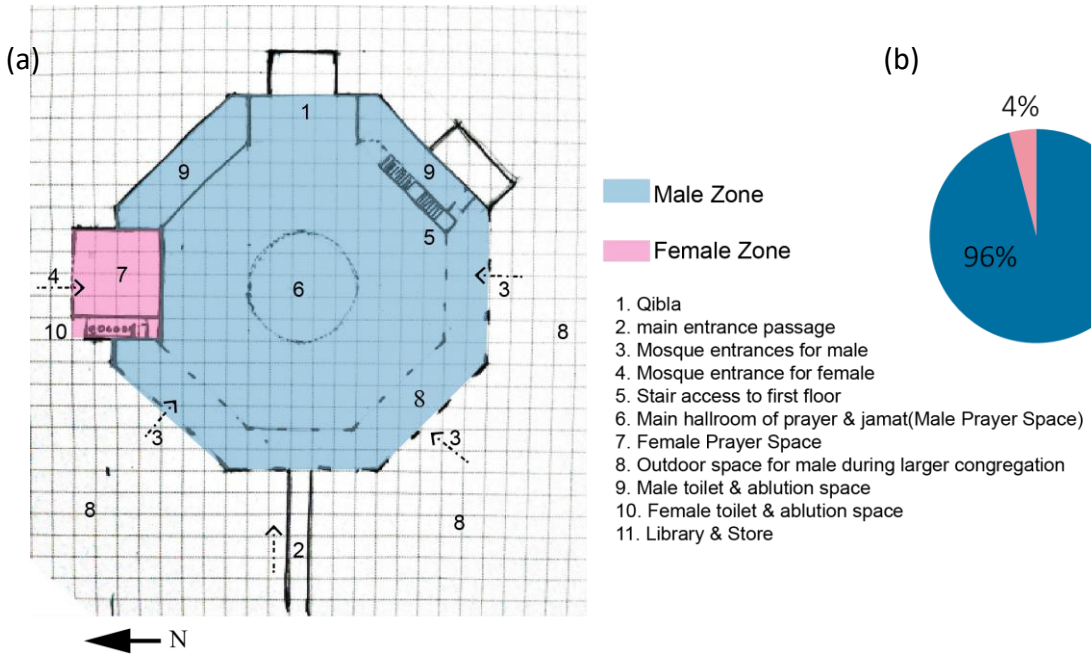

Figure 9: (a) Schematic plan of Rajanigandha Officer's Quarter Jam'e Mosque; the color code shows male and female prayer space divisions in the mosque. (b) The ratio of female and male prayer spaces. (Both are developed by the authors)

4. LIMITATIONS AND SCOPES

The research only could cover the mosques within walking distance from the central residential area of Kafrul. A larger study area could sum up a greater view or result of the overall situation. There was only one mosque for study as an example of a women's prayer space in the mosques of Bangladesh. There are the number of big central mosques in the city of Dhaka which include female prayer spaces, which are not included in the study.

5. DISCUSSION

The study highlights the lack of female accessibility in mosque architecture in Bangladesh and the importance of incorporating separate female prayer spaces in the design of community mosques. Not all the mosques have accessibility options for the females to enter the mosques as directed by authentic Hadiths.

In this regard, the question may arise, is the practice of mosque architecture in this region solely liable for this situation? The answer might be both yes and no. Scholars back in the past eras when Islam was flourishing in this region established that women did not need to go the mosques, and believed women needed to stay at home as they could not wear proper coverings and were not aware of the proper Islamic attire. Consequently, Muslims in this subcontinent generally believed that women are not allowed to go the mosques. But with time people have gained knowledge and especially women in this region are now aware of their religious right to go to the mosque and participate in prayers and congregations. People are getting more educated in this regard, and thus the demand and requirement for providing space for Muslim females in the mosques is getting high in the educated Muslim societies of Bangladesh.

The literature reviews and thorough study in this paper indicate that the quality and accessibility of women's prayer spaces in mosques are important factors in determining women's participation in mosques for religious dedication. When women have access to high-quality, well-maintained spaces that are separate from the men's section, it can lead to increased attendance and participation in mosque activities by devoted women with utmost comfort. On the contrary, when women's prayer spaces are limited in size or quality, it can have a negative impact on the mosque community, leading to decreased attendance and participation by women.

At present situation, due to the dense population in the city, Friday congregational prayers attended only by males is a rational consideration for existing mosques for limited space. However it is important to set guidelines for including female prayer spaces in mosques, considering the privacy and basic rights of Muslim women in the community.

The outcomes of this research also indicate a need for more research in this area to develop guidelines and standards for the design of female prayer spaces in the mosques of Bangladesh. Additionally, the paper exemplifies the implications of the social and cultural bindings of Bangladesh, which limit the accessibility of Muslim women to residential, social, and public spaces for daily prayers and congregations.

6. CONCLUSION

A mosque is a social hub for Muslim communities to acquire knowledge and wisdom which can help build a better society by the development of mental and psychological well-being for individuals and society. Islamic religious education focuses on building strong moral character, emphasizing both personal and national values [22]. Scholars proved that an Islamic religious setting with the practice of mosque-based daily praying habits and other Islamic activities can help prevent childhood obesity [23]. Scientific studies have also found that Islamic education positively influences motivation to prevent suicidal behaviours in society [24]. A mosque is a place of knowledge sharing and space for inspiration, motivation, and contemplation. Overall, a mosque has huge benefits and positive impacts on society if used appropriately by the community people and the young generation. While men are often engaged in outdoor activities or long-distance employment, women are often left alone with their children in the house, leading to unproductive use of technology and smartphones.

Instead, they could use their time more productively by visiting the mosque every day for self-enlightenment, improvement, and social interaction. If girls, virgins, pregnant women and women in society are abandoned from participating in this place of sanctuary, the kids i.e. the future generation will not learn to accommodate this culture into their life too. Excluding Muslim women from mosques deprives the feminine society and young children i.e. the future generation of Islamic teachings, ethics, beliefs, social activities etc. Above all, entering the mosque is an Islamic and religious right for women in a society that we cannot obstruct just by ignoring their space and accessibility in designing a mosque architecturally or socially. Urban planners and designers should also keep in consideration the inclusion of women’s participation in the mosque while designing and planning roads and pathways surrounding the mosques within the housing estates and public places which is usually not in practice in the country.

In conclusion, this study provides valuable insights into the current status of female accessibility and prayer space in mosque architecture in Bangladesh. The increasing need for research on women's prayer spaces in mosques and their impact on Muslim women's experiences and perceptions is undeniable, particularly among educated Muslim families and females in this region. Further research is needed to understand the challenges Muslim women in Bangladesh face while accessing mosque spaces and to develop strategies for creating inclusive and welcoming environments for them. Additionally, research can be conducted to explore how women perceive, participate in, and experience this issue in the country. Design guidelines and standards should be established for female accessibility and prayer spaces in mosques, based on information from scriptures and historical sources such as Hadith and the Prophet's biography, many of which are already cited in this study.

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Rural Vernacular Heritage and Strategic Design: Matmata as an Example of Sustainable Development


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Abstract: *This paper explores the vernacular architecture and sustainable design strategies of Matmata, a small town located in southeastern Tunisia that stands as an emblem of Berber architectural heritage. It provides an opportunity to analyze and discuss the building strategies of the past that remain relevant. The significant potential of Berber originality is evident in the troglodytic (underground) architecture found in the town. Besides, the article aims to showcase Matmata's originality and present underground living as a cultural heritage, which has recently faced a decline due to various socio-economic changes in the region. Additionally, the paper delves into the development of hotels in Matmata.*
The research is organized as follows: The initial phase involves interpreting the basic theoretical and methodological concepts of sustainable design. Subsequently, a geo-historical study of the region is introduced. Afterwards, an analytical study is conducted to research Matmata's troglodytic architecture.

Keywords: *Matmata; rural vernacular heritage; troglodyte; strategic design; integrated tourism; sustainable development*

Kırsal Yerel Miras ve Stratejik Tasarım: Sürdürülebilir Kalkınma Örneği Olarak Matmata

Özet: *Bu makale dağların yerel mimarisini ve sürdürülebilir tasarımını incelemektedir. stratejileri. Sonuç olarak, Tunus'un güneydoğusunda yer alan küçük bir kasaba olan Matmata, Berberi mimari mirasının mükemmel bir örneğini temsil etmekte ve geçmişin hala geçerli olduğu düşünülen bina stratejilerini analiz etme ve tartışma fırsatı sunmaktadır. Dolayısıyla, bu Berberi özgünlüğünün büyük potansiyeli trogloditik (yeraltı) mimaride kendini göstermektedir. Bu makale, Matamata'nın özgünlüğünü vurgulamayı ve bölgenin geçirdiği sosyo-ekonomik değişimler nedeniyle son zamanlarda büyük bir düşüşe tanık olan yeraltı yaşamını kültürel bir miras olarak sunmayı amaçlamaktadır. Araştırmanın ilk aşaması, sürdürülebilir tasarımın temel teorik ve metodolojik kavramlarının yorumlanmasından oluşmaktadır. Ardından, bölgenin jeo-tarihsel bir incelemesi sunulacaktır. Daha sonra, Matmata'nın trogloditik mimarisini araştıran analitik bir çalışma yer alacaktır.*

Anahtar Kelimeler: *Matmata; kırsal vernaküler miras; troglodit; stratejik tasarım; entegre turizm; sürdürülebilir kalkınma*

1. INTRODUCTION

This paper investigates the sustainable design strategies implemented in the vernacular architecture of Matmata's mountains. Situated in southeastern Tunisia, this small town serves as a pristine token of the Berber architectural heritage and originality. It provides a unique opportunity to scrutinize and discuss enduring building strategies from the past, particularly evident in the subterranean troglodytic (underground) architecture.

The primary objective of this article is to accentuate Matmata's distinctive architectural features and underscore the cultural importance of its underground dwellings, which have experienced a significant decline due to the multiple regional socio-economic shifts. Additionally, the paper aims to illustrate the various strategies implemented to promote this heritage as a tourist attraction, including the establishment of hotels inspired by the local architectural legacy.

In our quest to identify the elements of sustainability in Matmata's troglodytic rural vernacular architecture, we will navigate through two key phases. The initial phase involves interpreting the fundamental theoretical and methodological principles of sustainable design. Following this, we present a geo-historical investigation of the area. Subsequently, an analytical exploration into the troglodytic architecture of Matmata comes to fruition.

The research Methodology

In this article, we will delve into four key areas of focus adopting both a chronological and thematic approach. The initial area will explore the geographical and historical aspects of Matmata's mountainous region. Simultaneously, the second axis will be dedicated to exploring concepts related to our study theme, encompassing vernacular architecture, troglodytes, and sustainable development.

The third axis will shift its focus to the local values embedded in Matmata's troglodytes, viewing them as an exceptional example of vernacular architecture. Within this section, we will introduce various values, including the troglodytes' unique know-how, the intrinsic value associated with their original vertical architecture, and finally, the significance of this monument as a collective cultural heritage. Moving forward, the fourth axis will concentrate on studying rural vernacular heritage as a means of fostering tourism development.

The research approach & Objectives

In our examination of the sustainable design strategies within Matmata's vernacular architecture, we have adopted an inclusive approach that blends thematic and descriptive elements, incorporating maps, photos, and diagrams. The initial thematic analysis aligns with the specified themes outlined in the methodology (research axes), aiming to furnish both a pertinent and evaluative understanding of our research theme. Concurrently, the descriptive study plays a pivotal role in our research endeavors, seeking not only to define the architecture of the vertical troglodytes but also to accentuate their distinctive characteristics.

The rationale behind the research

This article fits in the framework of sustainable regional development, exploring the concept of a "bottom-up development strategy," also referred to as "decentralized development." The former approach holds promise for addressing both local and regional development within Matmata, operating under the assumption that the region can advance by leveraging its own resources. Consequently, a profound understanding of the region and its potential is crucial for fostering local development.
The "Matmata El Kadima" region is known for its distinct and "unique" heritage potential, particularly in its vernacular architecture, which stands as a key asset for diversifying Tunisian tourism products. The

objective is also to investigate the growth of cultural tourism in the inland regions of Tunisia, offering a viable avenue for the sustainable development of disadvantaged areas.

The Problem statement

How does the rural vernacular architecture of Matmata represent an innovative orientation within Strategic Design? And can this unique architectural heritage exemplify effective sustainable building practices, contributing to job creation in rural communities through integrated tourism?

2. PRESENTATION OF THE STUDY AREA
2.1 .Geographical setting (see maps)

According to the Berber encyclopedia, the “Matmata Djebel” -or Matmâṭa if we follow the Arabic spelling of the word- rises to altitudes ranging from 500 and 650 m (715 m east of Zemertene), spanning approximately 50 kilometers in length and running roughly parallel to the Mediterranean. The town is around 50 km away from the Mediterranean. It also overlooks the small coastal plain of the Arâd and the broader plain of the Djeffara. That study area is in fact a part of a much larger morphological ensemble; the “Jebel” or “Ksours” mountains –with the term “Qṣûr”, plural of “Qṣar”, translating to "castles" or "fortified villages" in Arabic This mountainous region forms a semi-circular arc, stretching about 150 kilometers from Jebel Matmata in the north to the eastern limits of Tripolitania in the far south. Following a meridian orientation, Matmata Mountains give way to “Jebel Dammar” -in dialectal Arabic: Demmer, at the level of “Foum Tataouine”, and then further to “Jebel Abiod”, bending to the southeast. In Libya, the Ksours mountains extend into a long high ridge that notably includes “Jebel Nefoussa [1].

This region is widely renowned for its geological heritage and distinctive geomorphologic forms, setting it apart from the coastal plains of eastern Tunisia and the dunes of the Great Eastern Erg in western Tunisia. This mountainous area is home to a wealth of typical architectural features: “Hûsh” structures, religious buildings, both horizontal and vertical troglodytic dwellings intricately carved into the isothermal clay and gypsum layers known for their cooling in summer and warmth in winter. The mountain villages, with architectural and cultural traits reminiscent of the Berber origins of the southern Tunisia villages; coexist with “Gsours”, oil mills and citadels. All these buildings bear the indelible mark of human endeavor and collectively contribute to the development of a sustainable economy.

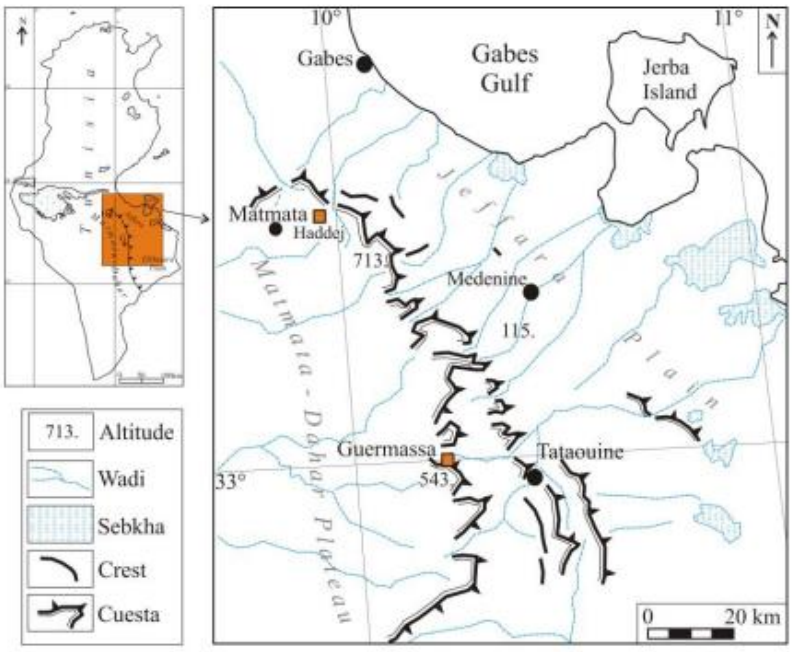

Figure 1. Location map of the study region [2]

2.2. Historical Background

The town of Matmata boasts a rich history considering the fact that it has been continuously inhabited from prehistoric times to the present day. Hence, archaeological research has uncovered evidence of the « Ramadiya »shell middens and various artifacts from the lithic culture dating back to the Neolithic period [1].

However, this presence is rather limited. In fact, the map of the prehistoric sites drawn up some twelve years ago [3] clearly demonstrates their scarcity in the Jebel region. Boukhchim states: "On the eastern slope of the mound bearing the great citadel of Matmata, we have located the remains of a prehistoric settlement in connection with a water source ("Ain El-Gattara")" [3]. These remnants come to further affirm the existence of a pastoral mountain population since prehistoric times.

During the Roman period, dating back the 2nd/3rd century AD, the Jebel became an integral part of the Roman Empire, situated within the limes tripolitanus. The forts at "Ksar Tarcine" and "Ksar Ghilane" marked the boundary of the Sahara far to the west [4]. The evidence of Roman settlement is substantiated by the presence of defensive ruins within the Jebel. Additionally the region encompasses various types of hydraulic installations, including "Jessours," dams, wells, and basins [5]. The occupation of Jebel Matmata by the prominent Berber tribes of "Zenâta", "Laouāta" and "Haouara" lasted from late antiquity to the middle Ages [6]. "Ibn Khaldûn" further affirms the very ancient Berber origin of the tribes that settled in this mountainous region [7]. Yet, regardless of the exact date of their arrival, historical sources confirm that Matmata was hosting the most significant tribes in the northern Dahar during the 11th and 12th centuries [8].

The modern and contemporary era seems to be marked by a proliferation of buildings, as indicated by the legend of "Ghazi" in "Douiret" (Louis 1975): "Toujane" is believed to have been founded four centuries ago, with its mosque dating back to 1002/1596. One of the courtyards of "Ksar Ouled Soltane" is even slightly older than that. Matmata, founded approximately two centuries earlier, is said to emerge following the initial settlement on the mountain. Above all, the last two centuries have witnessed a rapid surge in the number of "ksour" (Baklouti 2000), which is likely to be attributed to the standardization of lifestyles. This trend persisted through the Protectorate era, with the second courtyard of "Ksar Ouled Debab" dating back to 1881. Indeed, this Berber region has undergone far-reaching cultural changes, with the history of Jebel Matmata and its inhabitants evolving over time.The "Dahar", originally Berber-speaking, underwent Latinization and subsequent Christianization during Antiquity. Yet, with the Arab conquest that endured until the early 8th century, a new cultural influence appeared. It is also noteworthy to mention that the islamization and arabization of southeastern "Ifriqiya" introduced elements of the Arabic language and the Muslim religion in two waves: one in the 8th century and another in the 11th century, marked by the arrival of the nomads "Banû Hilal" and later "Banû Sulaym" from the Arabian Peninsula and Egypt [2].

3. A STUDY OF CONCEPTS

3.1 Vernacular architecture

"The study of the vernacular architecture development is an opportunity to learn significant lessons: It serves as a manifestation of the values embedded in the popular culture of each country, reflected in its construction practices. This architecture has evolved over centuries, deploying local means and techniques to address specific social, cultural and economic needs. Through its character, originality and inventive qualities, vernacular architecture plays a crucial role in shaping the environment, seamlessly blending into its surroundings [9]. The term vernacular, originating from the Latin "Vernaculus" and "relating to slaves born in the house" [10], denotes "everything that is particular to a country and its people" [11].

Vernacular architecture also referred to as local or regional architecture, gained prominence in the late twentieth century under the influence of English vernacular architecture.It describes the architectural style of a specific time, place or group of people. It also refers to "the influence of cultural traits, the impact of physical environments, the role of materials and techniques, the stages of construction, the details of design,

the importance of symbolic and decorative elements, the methods of typological categorization & the variety of uses and capacities" [11].

"Traditional or built vernacular heritage is the fundamental expression of a community's identity, reflecting its relationship with the territory and simultaneously representing the world's cultural diversity" [12]. Now that we have defined vernacular architecture and attempted to identify its boundaries within the field, we can outline its scope as follows:

- popular or primitive architecture
- rural or mountain architecture
- anonymous or architect-less architecture
- marginal architecture
- spontaneous architecture
- regionalism and critical regionalism ...

Vernacular architecture has consistently been associated with the notions of territory and identity; Above all, it emerges as the outcome of a design process that prioritizes the use of local resources and culture. Its diverse global manifestation encompasses numerous dwelling types, with troglodytic dwellings being particularly noteworthy. This style of architecture, whether rudimentary or sumptuous, can be discerned across diverse traditions featuring underground or carved dwellings.

3.2. The troglodytes

Troglodyte is a common noun originating from both ancient Greek “τρωγλοδύτης” (from “τρώγλη” = cave and “δύειν” = to enter, to plunge into) and Latin "Troglodyta". The adjective derived from this noun is troglodytic. According to “Le petit Robert”, this defined as "an inhabitant of a dwelling built underground, in rocks (...). By analogy, a person who lives or works underground" [13]. The troglodyte dwelling is an ancient phenomenon with a prehistoric tradition, wherein people dug dwellings in rocks and caves, underground or on the mountainside, to find shelter and hide from the danger of animals and adverse weather. In the book entitled " Dug houses, underground houses: discovering, restoring and building troglodyte dwellings ", authors distinguish between two architectural types of troglodyte dwellings around the world: Lateral troglodyte dwellings , characterized by caves dug horizontally into the mountain (Fig 2) and vertical troglodyte dwellings, characterized by caves dug vertically into the mountain (Fig 3).

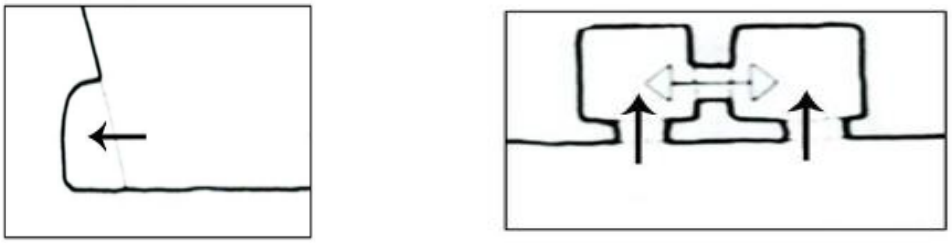

Figure 2. Schematic cross-section and plan of a horizontal dwelling [14]

Figure 3. Schematic cross-section and plan of a vertical dwelling [14]

Not only did these dwellings serve as temporary or permanent shelters, but they were also often religious places, featuring temples and monasteries built into the rocks. The troglodyte house is a dwelling designed within a natural environment, perfectly integrated with its surroundings. One of the significant advantages

of troglodyte constructions is undoubtedly their harmonious integration into the landscape. In Tunisia, the greatest concentration of troglodyte dwellings is situated in the south-east of the country. It "is located along the “Djebel”, the expansive mountainous arc that stretches from the southern Matmata region to “Tripoli”, delineating the “Sahara” Desert and jutting out onto the plain in both Libya and Tunisia" [15]. In southeastern Tunisia, troglodytic dwellings can be categorized into two main types: The Matmata region is characterized by vertically dug troglodytes (Figure 4), whereas the Tataouine as well as Remada regions are known for their horizontally dug troglodytes into the mountain (Figure 5)

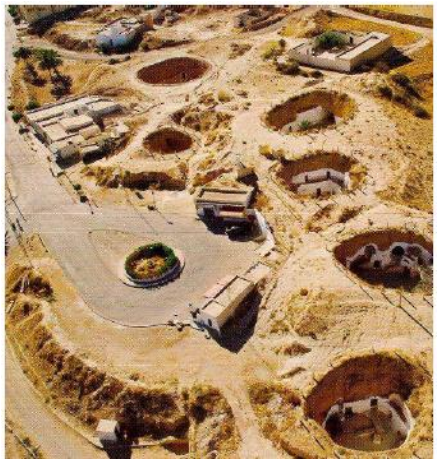

Figure 4. Vertical troglodytes

Figure 5. Horizontal troglodytes

In this article, we will focus on the study of the vertical troglodyte dwellings in the Matmata region.

3.3. Sustainable development:

This term is derived from the English concept of "sustainable development", coined in 1987 by the World Commission on Environment and Development, known as the “Brundtland Commission”. Then, it was further elaborated by the “UNCED” at the Rio de Janeiro Earth Summit in June 1992.
Besides, the concept of sustainable develoment was extended to tourism in 1995 at a meeting organized by the “UNWTO” in Lanzarote (Canary Islands), leading to the publication of the Charter for Sustainable Tourism. According to this charter, sustainable tourism is defined as the "tourism that takes full account of its current and future economic, social and environmental impacts by meeting the needs of visitors, professionals, the environment and host communities" [16]. Sustainable tourism development is essentially based on environmental, social and economic aspects.

- Environmental sustainability involves promoting tourism that preserves ecosystems and minimizes environmental damage.
- Social sustainability implies tourism activities that improve the local populations' standards of living without over-exploiting resources.
- Economic sustainability entails creating a tourism activity that ensures effective economic development for host communities over the medium and long term.
- Sustainable tourism must safeguard the cultural specificities of each region of the world. The cultural aspect remains one of the few elements that evaded globalization

.

Given the assertion that "without culture, there is no tourism" [17]. Cultural tourism is partly founded on the enhancement of local cultural identities. In fact, as stated by [18],"They don't describe social objects; they create them and help them stand out». Subsequently, cultures, identities and local heritage, serving as pillars of cultural tourism development, are described as "symbolic, open, political and dynamic. They go beyond the description and representation of societies" [18]. The chart below illustrates the different dimensions of a sustainable tourism development.

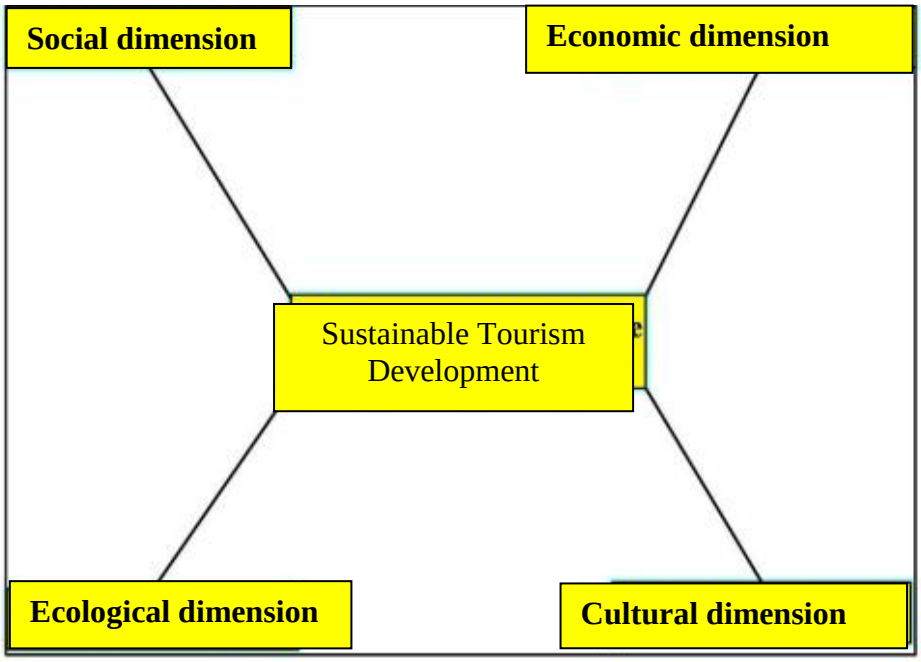

Figure 6. The dimensions of Sustainable Tourism Development [19]

The cultural dimension is thus centered on preserving regional identity, safeguarding human heritage and respecting local values" [19].In the following chapter, we will focus on the local values of Matmata troglodytes as an outstanding example of vernacular architecture.

4. THE LOCAL VALUES OF MATMATA TROGLODYTES AS AN OUTSTANDING EXAMPLE OF VERNACULAR ARCHITECTURE.

Located halfway between the surface and the underground, troglodytic dwellings seem to represent a bridge between architecture and nature, i.e., between man and nature. By burying themselves in the ground, they aim on one hand to preserve the landscape, and on the other to protect the individual. The extraordinary diversity of these forms bears witness to man's adaptability to any environment, which is why this underground architecture deserves to be part of the world's heritage. With the notion of heritage, troglodytic dwellings are not just a part of folklore, but can once again become a contemporary way of life. This is both a miracle and a lesson in how to live in harmony with nature, preserving it while enhancing its value. These features have helped us identify a number of shared values between the troglodyte and mankind.

4.1. Know-how value

Digging a troglodyte dwelling is meticulous process, guided by a set of well-defined conditions. Consequently, there are generally four steps to excavating a troglodyte dwelling.

- The first step involves selecting a site with a moderate slope (no more than 20 degree inclination). This is typically achievable as the natural typography of the area usually provides the required morphology. The chosen site is then subdivided into three levels (level A, B and C).
- The second step comprises the excavation of the central courtyard, known in Matmata as the "Mehress". The digging is hence carried out down a gradual stairway using a pickaxe, connecting the upper-level A to the lowest level C.
- The third step involves stopping the vertical digging upon reaching level C. At this point, a horizontal tunnel is excavated to connect the central patio to the outside area. The excavation connects the B level to the C level via a tunnel, known as the "Sguifa". Its length varies according to the distance linking the intermediate level to the lower level (B and C).
- The fourth step involves excavating the rooms opening onto the central patio once the exterior design has been completed. The morphology and structure of the site favors this stage. "From a depth of 5 meters, the clay layer becomes more solid, enabling secure rooms to be dug" [14]. The

number of rooms varies according to a set of criteria, including the number of family members, usage and so on. For safety reasons (risk of landslide), rooms should be no less than two meters deep and no more than four meters high.

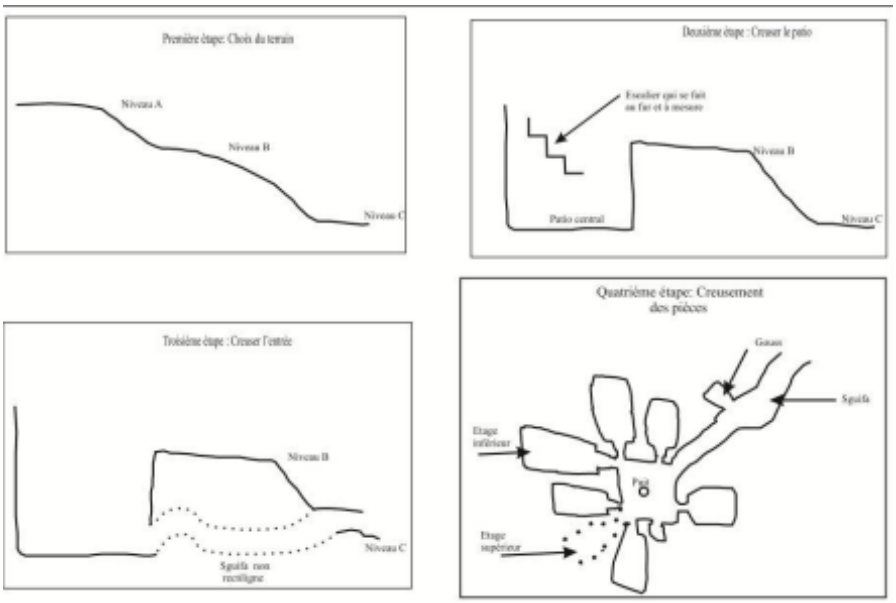

Figure 7. Steps of the vertical troglodyte dwelling excavation [20]

4.2. Architectural value: an original example of vernacular architecture

When seen from the sky, the village is characterized by a play of fullness and emptiness. The upper plane corresponds to the village space while the lower plane, on the other hand, represents the domestic space. Besides, the central courtyard structures the troglodyte architectural space. The underground caves surround this open-air space. On the ground floor, the caves serve as living quarters. Upstairs, they are used as an attic. A chimney cut into the ceiling opens directly onto the village space, allowing the caves to be ventilated.

The construction of a troglodyte house begins with the excavation of a circular courtyard measuring between 5 and 10 m in depth, depending on the presence of compact clayey sand. The entrance is built second. It may be an underground or open-air corridor, with or without a door. The final stage is the excavation of the rooms.

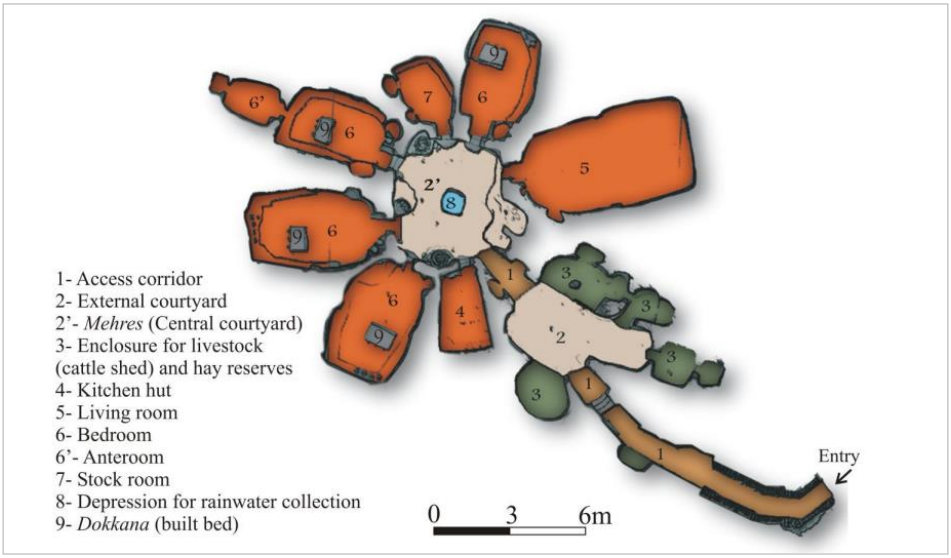

Figure 8. Example of a vertico-lateral dwelling at Jebel Matmata [21]

What's more, this vernacular space has been characterized by a unique aspect of thermal comfort. Being warm in winter and cool in summer is just one of the many privileges offered by these troglodytic dwellings to their occupants. According to Gideon S Golany, this factor is the main reason for digging troglodytic dwellings. Indeed, "the main motivation for establishing underground settlements was the inhabitants' desire to escape climatic stress" [22].

4.3 A collective heritage memory

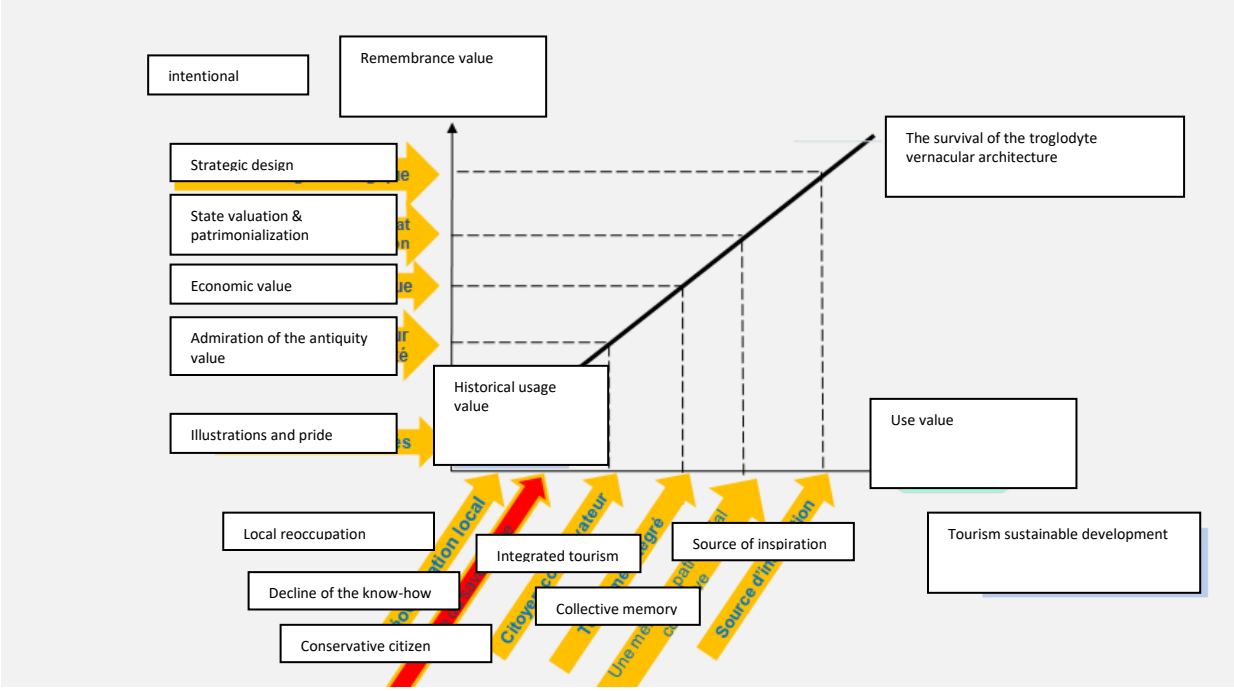

Figure 9. Survival in relation to the two parameters of remembrance and use

We will explain this evolution in detail. Initially, the local population's reoccupation of the troglodytes gave rise to a widespread sense of pride and joy, resulting in the creation of museum spaces for visitors. Hence, that rejuvenation of use can be considered a means of future remembrance. Nevertheless, it is also necessary to note that the “know-how” technique of digging into the sea rock "know-how" is under threat of disappearing. In admiration of its age-old value, local citizens have preserved the troglodyte as a masterpiece of original vernacular architecture art for ten centuries of occupation. The Berber citizen is aware of the historical, cultural and economic values of this vertical space. This is why the use of troglodytes has evolved from a domestic space to a heritage space for tourism. Then, being aware of the troglodyte's iconographic value, the State introduced measures not only to enhance it but also to encourage its innovative reuse. Following this analysis of values, and to perpetuate this cycle of survival, we propose a more in-depth exploration of a strategic design approach based on the same characteristics of remembrance, aiming to establish a practical school of know-how. This involves state institutions, civil society, universities, and private-sector companies as well. Accordingly, the State is advocating for integrated tourism to ensure the survival of troglodytic vernacular architecture, which holds significant value as a remembrance.

5. DEVELOPING TOURISM USING RURAL VERNACULAR HERITAGE

The town of Matmata , recognized for its heritage and habitat, is characterized by a set of "exceptional universal values». It serves as the bearer of the local multi-faceted values. For Berbers, it is unthinkable and excruciating to separate the material elements of heritage from its social and economic environment, as well as its residents who create, own and use it. Thanks to the international exchanges and incentives for innovation, local artisans have gradually broadened their horizons, which have created jobs for young people returning to their hometowns.

Today, heritage has emerged as a significant economic consideration in the discourse on local development, playing a pivotal role in both tourism and cultural industries. The increasing number of visitors to monuments and sites, the profound connection of local populations to these symbols of their identity, and the growing interest shown in them through multiple preservation and enhancement incentives all attest to the potential that heritage holds for local development. Integrated tourism seeks to develop sustainability, striking a harmonious balance between the economy, nature, landscape, and society. This form of tourism brings together intensive and extensive approaches, catering to both locals and vacationers throughout the year. Matmata, with its numerous troglodytic and heritage sites, offers a multitude of opportunities for integrated tourism and an adapted experience across various domains. In a country like Tunisia, endowed with few natural and mineral resources but a rich history, leveraging vernacular architectural heritage for tourism purposes is a key instrument for the development and promotion of territories. According to [23],"All development and planning at a given moment are expected to align with necessity and possibilities, addressing the economic needs of a group or community. These transformative endeavors often entail altering the existing state, whether in its natural wilderness or constructed form".

Integrated tourism is a genuine tool for development, fostering encounters and exchanges. The aim is to establish an integrated, equitable, and sustainable tourism structure. Tourists immerse themselves in another culture at the village's own pace, engaging with the daily life of the local population through participation in traditional activities. However, in Matmata, the existing system for safeguarding the outstanding natural and cultural heritage faces several limitations. This classification excludes a significant part of rural heritage from protection, thus alienating it from its deep cultural roots. Furthermore, the exclusion of heritage from the local development process risks standardizing sites and instigating detrimental rivalry among them in attracting tourists.

5.1. Strategic Design

This is a specific project activity with the goal of formulating and developing a strategy, which is not merely an outcome but rather a sequence of decisions known as "Strategic Action". How can a design strategy contribute to the enhancement of our troglodytic heritage through integrated tourism?

Integrated tourism is indeed a genuine tool for development, fostering encounters and exchanges. The goal is to establish a sustainable, egalitarian, and integrated tourism business model. Tourists gain insights into a new culture through the lens of troglodytic vernacular architecture, deepening their understanding of the host population's daily routines by participating in traditional local activities. The benefits for the village are manifold, including job creation, growth in local trade and crafts, combating rural desertification, and promoting Matmata's culture and region.

Integrated tourism allows for sustainable development, achieving a balance between the economy, nature, landscape, and society. Additionally, three strategies have been implemented to safeguard the troglodytic architectural heritage and enhance the living standards of local inhabitants in terms of protection, livability, and economic development of services and creative industries. However, many heritage sites relying solely on tourism face a serious economic crisis when tourism is affected, as demonstrated during the pandemic. Matmata has proactively developed new cultural industries, as evidenced by the International Matmata Festival and the "Costumes for Cinema" festival held in the ancient ksour, home of the Amazigh Berbers. The parade, featuring Amazigh women, injects vibrancy and reinforces economic stability during low tourist seasons. The study of tourism activity in the Matmata-Demmer chain has revealed a significant undervaluation of heritage. Consequently, the impact of tourism on local development is constrained. Various factors hinder the promotion of cultural tourism in the region under study, including legislative loopholes, land tenure problems, insufficient heritage restoration, discrepancies among stakeholders, and the failure of tourism development projects. As a result, the development of cultural tourism in the region requires legal and legislative reforms favoring decentralization. A strategic approach is essential to safeguard and protect the mountain heritage. Alongside the necessary measures to overcome the crisis in the tourism sector, there should be a specific focus on promoting "Integrated Rural Tourism (IRT) based on local social networks" in any future Tourist Development strategy in the Matmata-Demmer chain. This focus on heritage and sustainable development stems from the same belief in intergenerational solidarity.

Heritage signifies an inheritance passed on to the next generation, while sustainable development embodies progress that "meets the needs and aspirations of the present generation without compromising the ability of future generations to meet their own." The concept of heritage complements the notion of sustainable development by defining what must be considered as heritage. Conversely, sustainable development implies consideration of heritage. This connection is the third overlap between the two concepts, extending the notion of heritage to include natural heritage. Additionally, the idea of "common heritage of humanity" is particularly applied to natural heritage, contributing to the global solidarity concept.

In short, once in Matmata, one can notice two types of valuation: The first is the “Marhala” Hotel in Matmata El Kadima serving as an in-situ troglodyte. Being dug into the rock, this hotel displays a unique set of vernacular architectural characteristics. The second is Hotel “Diar El Barbar”, which is in the famous Berber village of Matmata. Being built 12 meters underground, the latter features a distinctive architecture in the style of a vertical troglodyte house adopting the vernacular architectural as a source of inspiration in its design.

Figure 10. Marhala Hotel in Matamata El Kadima

Figure 11. Diar El Barbar Hotel

5.2. Results

- Understanding that tourism can facilitate a thoughtful and sustainable development for our archaeological monument, striking an economic, environmental and social balance.
- Discovering that Matmata, with its numerous troglodyte and heritage sites, offers a multitude of opportunities for an integrated tourism that should consequently be widely promoted.
- Being aware of the need to preserve this monumental vernacular heritage and prevent it from disappearing.
- Advocating for the integration of Matmata’s rural vernacular heritage into the global cultural heritage.

To achieve these goals, the National Heritage Institute (INP) is called upon to intervene.

6. CONCLUSION

To conclude, Matmata stands an ideal destination for tourism thanks to its natural, cultural and heritage attributes. Therefore, the development of a balanced and adequate tourism approach can positively address its challenges. According to the latter, solidarity tourism remains the best option for the travelers given the benefits it provides and the significance it assigns to local heritage and cultures. In particular, it enable local people to integrate into tourism projects, fostering a stronger sense of belonging and revitalizing their esteem for their heritage and culture.

Throughout this work, we tried to approach Matmata as a case study providing insight into how successful a village with a heritage allure can be. Our focus was on the fundamental principles guiding the development of a brand image through "strategic design". In this context, the renewal of resources takes on a clear cultural dimension since the field of culture is broadly defined. Cultural resources encompass sites, landscapes, monuments, objects and documents associated with both past and present human activities. According to this article, the local regional as well as national dimensions are rooted in identity, where cultural resources are even connected to the colors and architectural model. These dimensions primarily serve to reveal the degree of the local populations' attachment to their identity. In the same vein, the new forms of governance guiding sustainable development are inherently connected to the history of the populations in question, their cultural practices and the space they occupied at a given time. Hence, such a definition brings together the two poles of nature and humankind. In general, the social system involves the economic subsystem whose role in the evolution of the eco-socio-system is often decisive.

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Born on October 8, 1974, in El Marsa, Soumaya Gharsallah Felhi is an accomplished historian with a rich academic background. In June 1995, she achieved her Literary Baccalaureate, paving the way for her pursuit of higher education. Soumaya earned her Master's degree in History from the Faculty of Letters and Humanities of Sfax in June 2000. Building on her passion for ancient history, she completed a Diploma of Advanced Studies in April 2004, focusing on the "Archaeological Map of the Cercinitis Ancient Sites" under the guidance of Prof. Chelbi.F. Her commitment to scholarly pursuits culminated in December 2016 when she obtained her Ph.D. in History from the Faculty of Tunis. Her doctoral thesis, titled "Punic Pointed Jars in the Western Mediterranean Basin: Typology and Chronology," was submitted on April 9 under the supervision of Prof. Fethi Chelbi and H. Ben Younes. Soumaya Gharsallah Felhi's academic journey reflects her dedication to the exploration and understanding of historical contexts.

Investigating the Role of a Mosque in a Residential Neighborhood of Rajshahi City



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Abstract: *Since the early days of Islamic practice, the mosque, as the principle religious institution, has played a central role in developing communities across the globe. With the spread of religion around the globe, in many regions, the role of the mosque has been reduced to only being a platform to pray daily. This change in practice suggests that there is a difference between Islamic values and human perception. Bangladesh, with its majority of people being Muslims, is also facing the same scenario. This research attempts to study the Muslims' perceptions and practices in the present time to get an idea of how they are visualizing the role of mosques in their daily lives. A residential neighborhood in Upashahar, Rajshahi, is studied as a case study the research is designed around conducting a survey of the residents belonging to different age groups, genders and academic qualifications. The research findings suggest that there is undoubtedly a deviation seen among the Muslims' practice from the traditional norms of Islamic doctrine. This research is a conscious attempt to create awareness among practicing Muslims. The limitation here is that the studied case cannot illustrate the picture for the broader urban context. This ultimately creates the scope for further research to be conducted on this topic to get a coherent picture.*

Keywords: *Religious institution; residential neighborhood; Islamic values; human perception; practice.*

Bir Caminin Toplumsal Rolü: Rajshahi Şehrinin Bir Mahallesindeki Müslümanların Algılarının İncelenmesi

Özet: *İslami uygulamaların ilk günlerinden bu yana cami, temel dini kurum olarak sosyal etkileşimin geliştirilmesinde merkezi bir rol oynamıştır. Dinin dünya çapında yayılmasıyla birlikte, birçok bölgede caminin rolü sadece günlük ibadetlerin yapıldığı bir platforma indirgenmiştir. Uygulamadaki bu değişim, İslami değerler ile insan algısı arasında bir fark olduğunu göstermektedir. Halkının çoğunluğu Müslüman olan Bangladeş de aynı senaryo ile karşı karşıyadır. Bu araştırma, Müslümanların camilerin sosyal alandaki rolünü nasıl algıladıklarına dair bir fikir edinmek amacıyla Müslümanların algı ve uygulamalarını incelemeyi amaçlamaktadır. Rajshahi, Upashahar'da bulunan bir mahalle örnek olay olarak incelenmiştir. Araştırma, farklı yaş gruplarına, cinsiyetlere ve akademik niteliklere sahip mahalle sakinlerine yönelik bir anket çalışması etrafında tasarlanmıştır. Araştırma bulguları, Müslümanların uygulamaları arasında İslami öğretinin geleneksel normlarından şüphesiz bir sapma olduğunu göstermektedir. Bu araştırma, uygulamacı Müslümanlar arasında farkındalık yaratmaya yönelik bilinçli bir girişimdir. Buradaki sınırlama, incelenen vakanın daha geniş kentsel bağlam için resmi gösterememesidir. Bu da sonuçta, tutarlı bir resim elde etmek için bu konuda daha fazla araştırma yapılmasını gerektirmektedir.*

Anahtar Kelimeler: *Dini kurum; sosyal etkileşim; konut mahallesi; İslami değerler; insan algısı; uygulama*

1. INTRODUCTION

The Muslim place of worship is referred to as a mosque, the House of Allah. The term mosque comes from an Arabic word ‘masjid’, meaning a place of prostration. In Islamic practice, Muslims are to go to the mosque five times a day to perform their prayers. It is important to take note of Dr. Spahic Omer's comment since it emphasizes the importance of mosque institutions in Muslim culture. Without a doubt, he claimed, the mosque has been and always will be the focal point of Muslim life [1]. The ritual of praying in a mosque organizes daily life and builds social connections between people from diverse socioeconomic backgrounds.

During the lifetime of the Prophet Muhammad (PBUH), all the activities of the Muslims i.e., religious, educational, social, economic, political, cultural etc. were mainly centered on the mosque. The mosque simultaneously served as a school, a parliament, a courthouse and a community center as well. The mosque was the center where the community learned their religion, the society discussed new laws, and judgments were passed. In addition, the mosque was an institution where neighbors were able to meet with one another, share their problems and hold their celebrations. The role of the mosque in Muslim societies from the lifetime of the Prophet Muhammad (PBUH) to the present time is further explained in the literature review section under the title of mosque-centered activities.

However, as Islam has spread over time, there have been deviations from ideal practices in the day-to-day lives of Muslims in many regions around the globe. Moreover, today is highly urbanized and technologically advanced age contributes to the same. Muslim individuals departing from the ideal practices of Islamic doctrine is a long-standing and vast topic to cover. The research focuses on the issue of how Muslim people's reliance on mosques as a hub for communal life has reduced and how this has led to mosques failing to serve as a platform for community. This research attempts to study the current practices of the Muslim community and determine whether they deviate from traditional Islamic norms and practices.

Speaking of Bangladesh, it ranks eighth among all countries by population [2] and according to the Population & Housing Census 2011, 91.04% of Bangladesh's population is Muslim [3]. Yet there has not been a lot of research conducted on the mentioned topic to generate awareness. The dire need to generate discussions around these issues has paved the way for this research.

The research is focused on a neighborhood area in Rajshahi City, Bangladesh. Rajshahi, a part of the Varendra region of North Bengal, is one of the oldest regions of Bangladesh. Many Hindu kings, Muslim sultans, British companies and Zamindars once ruled it. It shares a deep connection with Shah Makhdum, who was a Sufi Muslim figure and who brought Islam to the Varendra region. Moreover, Rajshahi division has the second-largest Muslim population and around 93.67% of its population is Muslim by religion. The chosen study area is Upashahar Residential Area situated in Rajshahi City. It is the first planned neighborhood in Rajshshi City. Then, upon deciding the study area, a survey is designed with a sample surrounding a mosque to gather primary data from the responses of the residents of the residential neighborhood. The justification behind the study area and the mosque selection will be discussed in the methodology section.

Firstly, the literature is studied to gain a deeper understanding of the practices, trends and patterns around the globe. Then, upon deciding the site, a questionnaire survey was designed. The data gathered is both quantitative and qualitative in nature. The data is analyzed in the form of descriptive statistics and thematic analysis to draw conclusions and have a fruitful discussion about the current practices of the Muslim community.
In order to reflect on the fading importance of the mosque as a hub for the community, this research was designed to investigate the contemporary practices of the Muslims in the study area. However, there is definitely this limitation of only collecting data from a sizeable portion of a neighborhood. This indicates that this research cannot illustrate the results for a broader population. Still, this research would highlight the need to conduct further research in this direction to reach a broader sample.

2. LITERATURE REVIEW

In Islam, believers, worship as a way of life, and the notion of the mosque as a community center, are inseparable. They originate from each other, needing one another for their proper functioning and continued existence [4]. The literature review was conducted to gain a better understanding of how mosques are fulfilling their original purpose and playing a variety of roles in the lives of believers through different timelines around the globe.

2.1. Mosque-Centered Activities

In many places of the world today, the mosque's role has been reduced to that of a venue for prayer exclusively. But this was not how mosques were used in the early days of Islam. Additionally, mosques' function as the focal point for the growth of Islamic da'wah cannot be isolated from the spread of Islam. Thus, the literature is researched here to comprehend the functions of a mosque for the Muslim community, ranging from the Prophet's (pbuh) Mosque to the Islamic Golden Ages to Modern customs.

Mosque of Prophet (PBUH)

Construction of the city's main mosque was the first and most pressing duty related to the Prophet Muhammad's (pbuh) objective to form a community when he moved from Makkah to Madinah. Everything else had to wait until the Prophet's Mosques were finished, including building homes for the migrants, the bulk of whom were underprivileged and essentially homeless. When finished, the Prophet's Mosque had a very straightforward shape. Despite its unassuming appearance, the mosque has been a genuine hub for local growth from its founding and has quickly developed into a multifaceted structure. The mosque was designed to serve a variety of religious, social, political, administrative, and cultural purposes in addition to prayer services at set times. It served as a stimulant and a benchmark for projects aimed at advancing civilization throughout the Muslim world.

In Medina, it was a simple layout, made out of date tree stumps and leaves. Hazrat Ibn Umar relates that in the time of Holy Prophet Muhammad, the pillars of his mosque were made of stumps from date trees and its roof was made with leaves of date trees [5].

The main functions performed by the Mosque revolved around being a center for individual and congregational worship practices, a learning center, the seat of the Prophet’s government, a welfare and charity center, a detention and rehabilitation center, a place for medical treatment and nursing, and a place for some leisure activities. The Prophet’s Mosque was the nerve-center of the wide spectrum of the community’s activities. It was also a center of gravity for the civilizational aspirations of the fast-emerging Muslim community (ummah) [4].

Mosques during Islamic Golden Ages

Two significant dynasties are engaged in terms of history. One is the Umayyad dynasty, whose monuments date from 680 to 745 and which ruled from 661 to 750. The only Islamic dynasty to have ever ruled the entirety of the Islamic-conquered world. The Abbasid dynasty is the second one, and while it nominally ruled until 1258, in practice its princes had little influence on culture after the second decade of the 10th century.

The mosque, also known as the masjid, is the only apparently new purpose that emerged during this time. The Prophet's home in Medina served as the primary location for the early Muslims' religious and other activities. The establishment of masjids outside of Arabia in each center that the new faith conquered is the fundamental phenomenon of the early decades that followed the invasion. These weren't just or even predominantly places of worship. Instead, they served as the religious community centers where all social, political, educational, and personal concerns were conducted. Common prayer and the khutbah ceremony were a couple of them. The first mosques were built primarily to serve as the restricted space in which the new community would make its own collective decisions. It is there that the treasury of the community was kept, and early accounts are full of anecdotes about the immense variety of events, from the dramatic to the scabrous, that took place in mosques. Since even in earliest times the Muslim community consisted

of several superimposed and interconnected social systems, mosques reflected this complexity, and, next to large mosques for the whole community, tribal mosques and mosques for various quarters of a town or city are also known [6].

Contemporary Practices

Islamic centers have been popular in recent years. The world over, people engage in this practice. These are public forums that welcome everyone and spread awareness about Islam. These centers' missions and vision statements inform us that they serve as community centers rather than just places for prayer. The Center is dedicated to upholding an Islamic identity, establishing and sustaining a strong Muslim community, and advancing an all-encompassing Islamic lifestyle based on the Holy Quran and the Prophet Muhammad's Sunnah.

2.2. Mosque Accessibility

Women were allowed to pray along with men during the times of Prophet Muhammad (pbuh). Even though, it was a rule for men to go to mosques to pray five times, he was lenient with women stating that their prayers are as good as the ones in mosques even if performed from the home. Women were active in public life and regularly attend the prayer at the mosque including Fajr and 'Isha, during the time of Prophet Muhammad (pbuh). Children and babies accompanied their mothers to the mosque. The Prophet (pbuh) explicitly stated that men should not prevent the female slaves of Allah from entering the mosque of Allah, even at night. At the same time, the Prophet (pbuh) did not make it a rule that women must pray in the mosque [1].

Given the Prophet's (pbuh) advice and example there should never be a mosque that tells women to leave when they want to enter and participate in prayers or other activities. It is a woman's right to choose whether she wishes to participate in mosque activities, and she must have open access to the mosque. In accordance to the argument above, Islam does not forbid women from entering mosques or praying along with men shoulder to shoulder. However, it has become the norm in placing rules on women as such [1].

In Arab world, we see that women participate in regular congregational prayers in a mosque. We never heard of any unexpected occurrences due to women's participation in congregational prayers of mosque. We can have a mesmerizing scenario on the 27th day of Ramadan in the Prophet's Mosque, Mosjidul Haram, and Mosjidul Aqsa. Especially, in Mosjidul Haraam and Prophet's Mosque, women participate in regular congregational prayers [7].

Western world also has achieved new heights in their practices. One such instance is The Women's Mosque of America. It was founded in 2015 by two South Asian American Muslim women – comedy writer M. Hasna Maznavi and attorney Sana Muttalib. It was conceived as a space to empower Muslim women to take on active roles in their individual community mosques and influence changes in a mosque culture that is often unwelcoming to women [8].

Yet in some parts of Muslim world, there is a different scenario. One such part is Indian subcontinent. "Most mosques in the Middle East, South East Asia, and Africa always have spaces for women," said Sania Mariam, the head of a collective called the Muslim Women's Study Circle. The Indian subcontinent is an anomaly, she said [9].

3. METHODOLOGY

In this section, the research design is detailed. In this research a survey was conducted in the study area to collect primary data. From the targeted population, a representative sample was gathered. A questionnaire was formulated to collect data. The data was then analyzed, both qualitative data and quantitative data.

3.1. Mosque Selection

The survey's design is concentrated on a particular mosque, as was already indicated in the introduction. The mosque was selected for a purpose. The Government of Bangladesh has undertaken a program to build 560 model mosques and Islamic cultural centers at the District and Upazila levels. The Model Mosque at Rajshahi Upazila level is opened at Upashahar Neighborhood (previously the mosque was known as Central Jame Mosque). A radius of 400 meters around the mosque, a five-minute walk, is the study area where the survey is conducted. This selection of a Model Mosque leaves scope for further systematic investigation and analysis of other model mosques of the country.

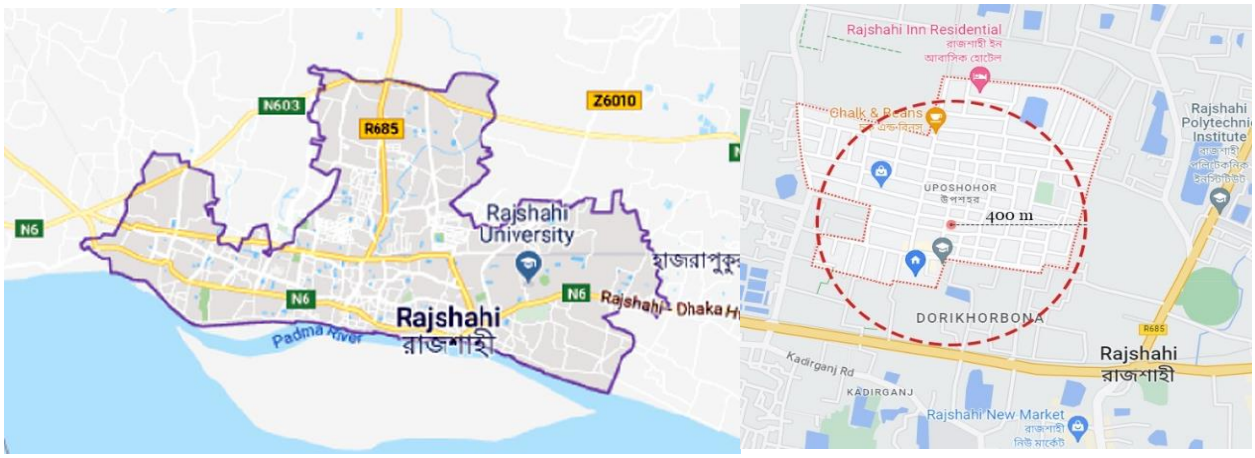


Figure 1. Study Area

3.2. Population

As already mentioned in the introduction, the research would be conducted in the Upashahar residential area, a neighborhood in Rajshahi city and the residents of the neighborhood are the target population group here. Rajshahi City is composed of 30 wards and the study area is situated under the 14th number ward. According to the Population & Housing Census 2011, the population of the 14th number ward was around 22.070 [3]. However, along with the study area, the 14th number ward covers other areas too. Hence, the assumed target population narrows down to around 10.000.

3.3. Sampling

From the information on population stated above, the sample size is determined. With a 95% confidence level and a 5% margin of error, the sample size should be 370. Due to constraints like time and finances, the sample size is narrowed down to the minimum. The sample size is 100 (with a 10% margin of error).

A sample of 100 residents was determined employing the stratified structured sampling method to ensure representation from different genders and age groups. The ratio of males and females is equal, 50 males and 50 females, so opinions from both groups can be highlighted. Along with the age, there were four major age groups: 0- 18 age group, 18- 30 age group, 30- 50 age group and 50+ age group and four education levels: primary, secondary, undergraduate and postgraduate; although participants from a variety of professions took part. Male and female respondents were evenly distributed throughout each age group.

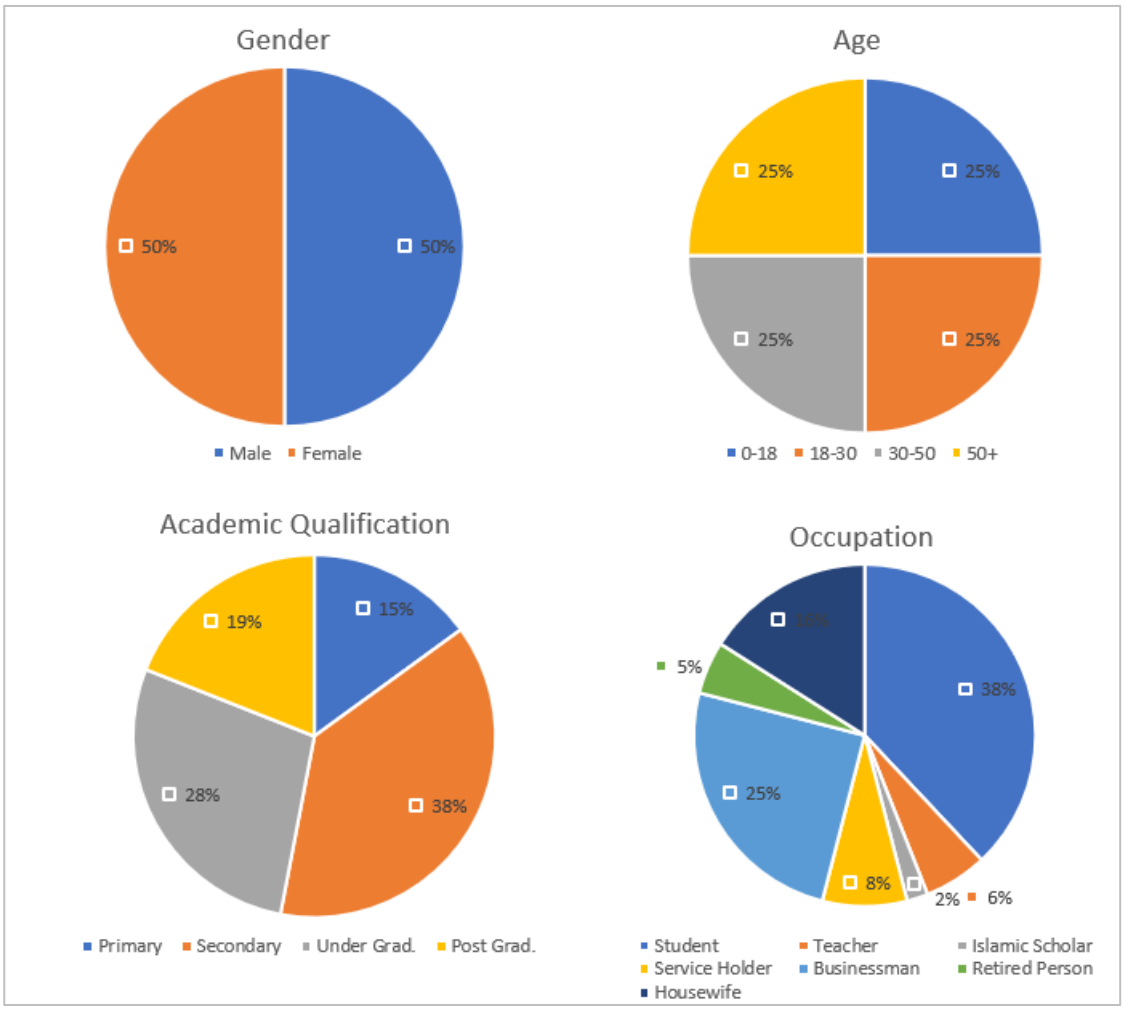


Figure 12. Sampling

3.4.Data Collection

- A questionnaire was first created to collect data, create a thorough picture of people's reliance on mosques and hence apprehend the role of mosques in a society. It covered subjects including how frequently individuals visited the mosque, how much time they spent there and what kinds of activities they engaged in aside from worshipping.
- A pilot test was conducted to ensure the clarity, validity and reliability of the questionnaire. An initial sample of about 30 individuals underwent the pilot test. Based on the findings of this test, certain open-ended questions were included in the survey in order to assess respondents' level of familiarity with Islamic doctrine and collect comments on potential improvements.
- Finally, the questionnaire was developed to capture information on the following dynamics.
  1. Mosque accessibility: The intention was to gather data about the daily participation of men and women and the probable causes leading to less participation. In addition, data was gathered to assess their opinion about mosques being accessible to everyone, especially women.
  2. Mosque-centered activities: The questions were designed to determine how many active hours residents generally spent in the mosque and what activities they engaged in. In addition, questions were asked to assess their depth of knowledge and gather some opinions.
  3. Islamic knowledge: This section was added after the pilot test. The inquiries assisted in determining the sources of the locals' Islamic knowledge.
- A combination of closed-ended and open-ended questions was included to collect quantitative and qualitative data. The closed-ended questions were designed to capture quantifiable information and

summarize frequencies, percentages, etc.; while open-ended ones were added to gather qualitative data and summarize patterns, themes, etc.

- The questionnaire was administered through face-to-face interviews, considering the convenience and preferences of participants.
- The privacy and confidentiality of the participants were ensured, as was their voluntary participation, by obtaining informed consent.

3.5. Data Analysis

- Quantitative analysis was conducted and descriptive statistics was utilized to summarize frequencies, percentages, etc. and examine patterns and trends related to mosque accessibility, mosque activities and Islamic knowledge.
- Thematic analysis was conducted to identify recurring themes and patterns in the qualitative data obtained from open-ended questions.

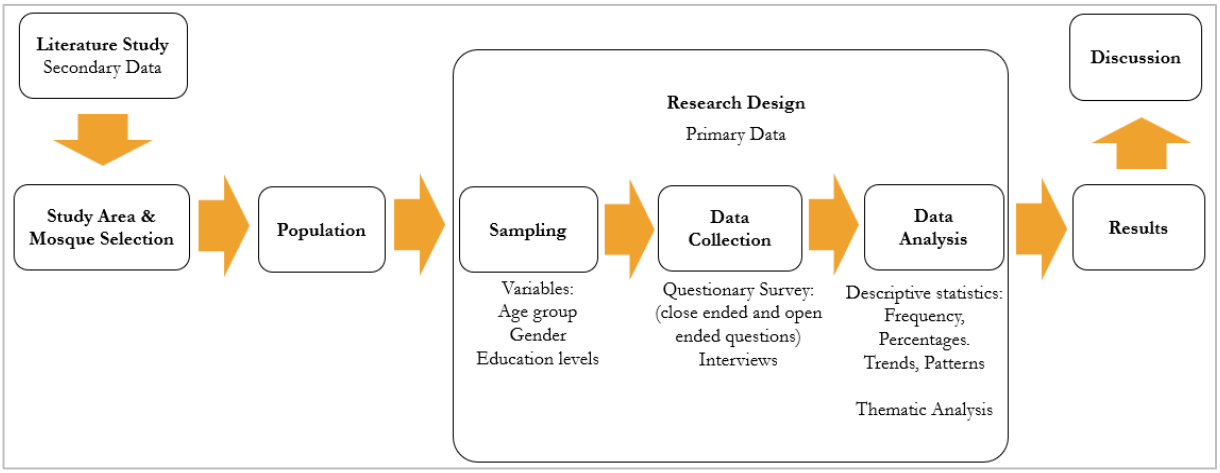


Figure 13. Research Methodology Flow-chart

4. RESULTS AND DISCUSSIONS

In this section, findings from the gathered data will be presented, focusing on different sections of the questionnaire, namely mosque accessibility, mosque activities and Islamic knowledge. Descriptive statistics is used to summarize the quantitative data i.e., frequency, percentages etc. to explore patterns and relationships. Thematic analysis is used to identify recurring themes and patterns to summarize the qualitative data. The results would be separately analyzed for different age groups, genders and educational levels to identify any patterns.

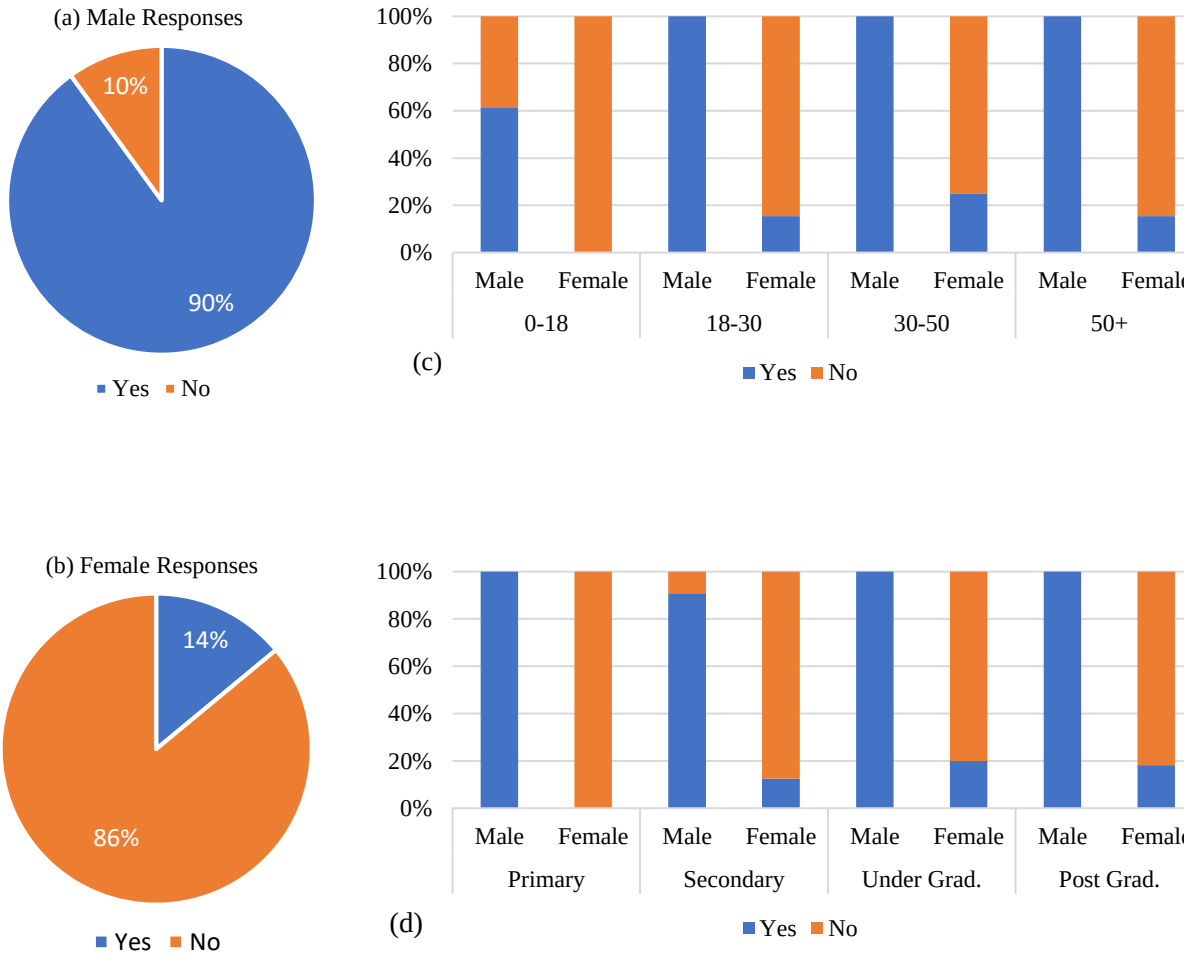
4.1. Mosque Accessibility

This section of the questionnaire was basically designed with closed-ended questions. The goal was to identify the group or section of society that is frequent (daily) mosque goers and who is not and the reasons why. It was also crucial to learn how welcoming mosques were for women in the study area and to solicit their thoughts on whether or not women should be allowed to enter the mosque. The gathered data was analyzed based on the set variables of age, gender and academic qualification to identify patterns (if there were any).

Mosque Goers

Overall, 52% of the respondents reported that they go to the mosque to say their prayers. Almost 90% of men go to the mosque to say daily prayers, while only 14% of women go to the mosque, that too on Fridays and occasionally. (Figures 4(a) and 4(b)).

Figure 14. The charts show percentages of mosque goers based on (a) male responses (b) female responses (c) age groups and (d) academic qualifications



It is found that among male respondents, about 61.5% of participants aged 0-18, 100% of participants aged 18-30, 100% of participants aged 30-50 and 100% of participants aged 50 above go to the mosque; while among female respondents, none from participants aged 0-18, 85% of participants aged 18-30, 75% of participants aged 30-50, 85% of participants aged 50 above go to the mosque. The data is again analyzed based on academic qualifications for both genders. It is found that among male respondents, about 100% of participants with primary education, 91% of participants with primary education, 100% of participants with under graduation, 100% of participants with post-graduation go to the mosque to say their prayers while in case of women respondents none with primary education, 12.5% of participants with primary education, 20% of participants with under graduation and 18% of participants with post-graduation.

In fine, it can be concluded that the majority of female respondents do not go to mosques to say their prayers within the study area. Regarding the percentages according to their age groupings and educational backgrounds, there was no discernible difference in patterns.

Reason Behind the Current Practice

It is already found that women do not go to mosque to say their prayers. The reasons were asked and the results are illustrated in the figure below. The results show that women belonging to different age groups and academic qualifications are not used to going to the Mosque for their daily prayers. From the literature, it is already established that women have access to mosques just as men do, according to Islamic doctrine. But the current practice in this neighborhood does not align with the Islamic lifestyle.

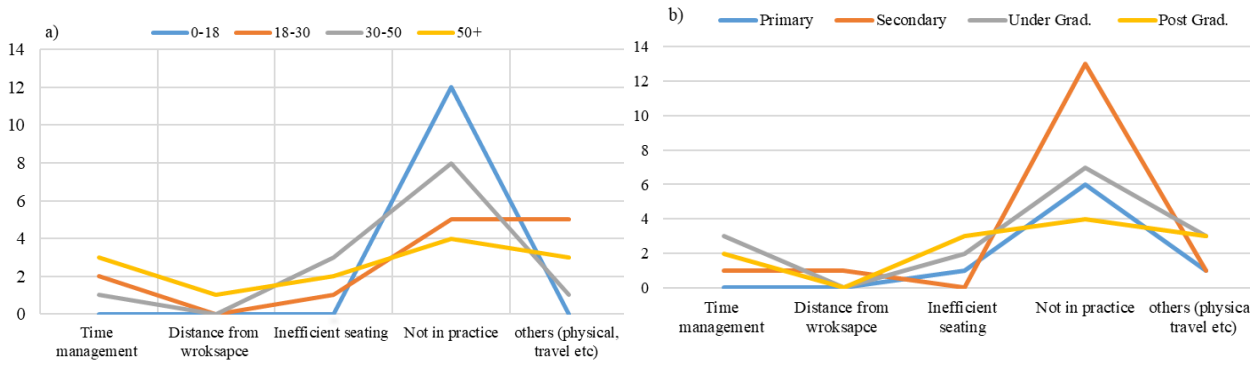
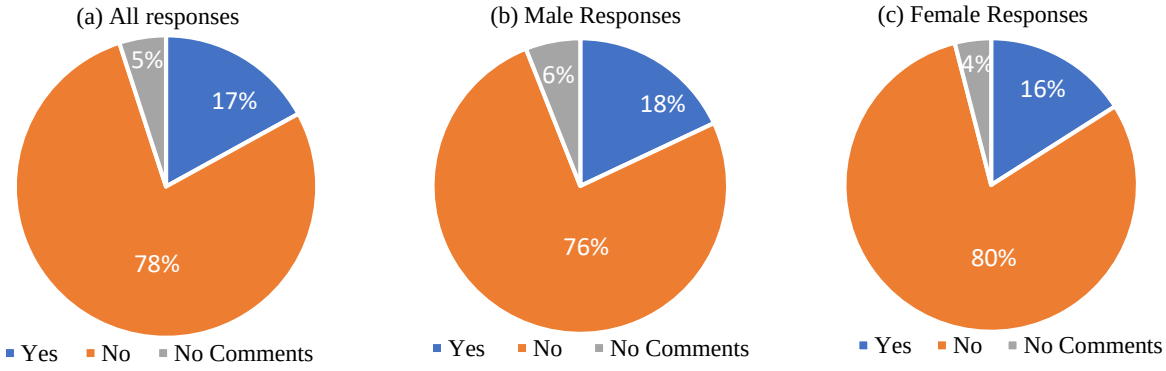


Figure 15. Analyzing the reasons for women not going to mosque based on (a) age groups and (b) academic qualifications

Woman-Friendliness of Mosques

Based on the fact that women do not visit mosques here, obtaining the sample's perspectives regarding the woman-friendliness of mosques was a crucial question.

Figure 16. The charts show opinions on mosques being women-friendly by (a) all responses (b) male responses (c) female responses



From the above figure, it is found that overall, 78% of the total respondents do not think that mosques here are women-friendly, whereas around 76% of male respondents and 80% of female respondents agree with the same.

Opinion on women going to Mosques

The discussions in the aforementioned sections have already made it necessary to determine the sample's position on whether or not women should visit the mosque every day.

The findings are very contradictory. The majority of the sample's male participants agreed that women should pray regularly, while the women's group did not express this opinion firmly. It is evident from the graphs that the trends, based on age groups and academic qualifications, are the same for both genders.

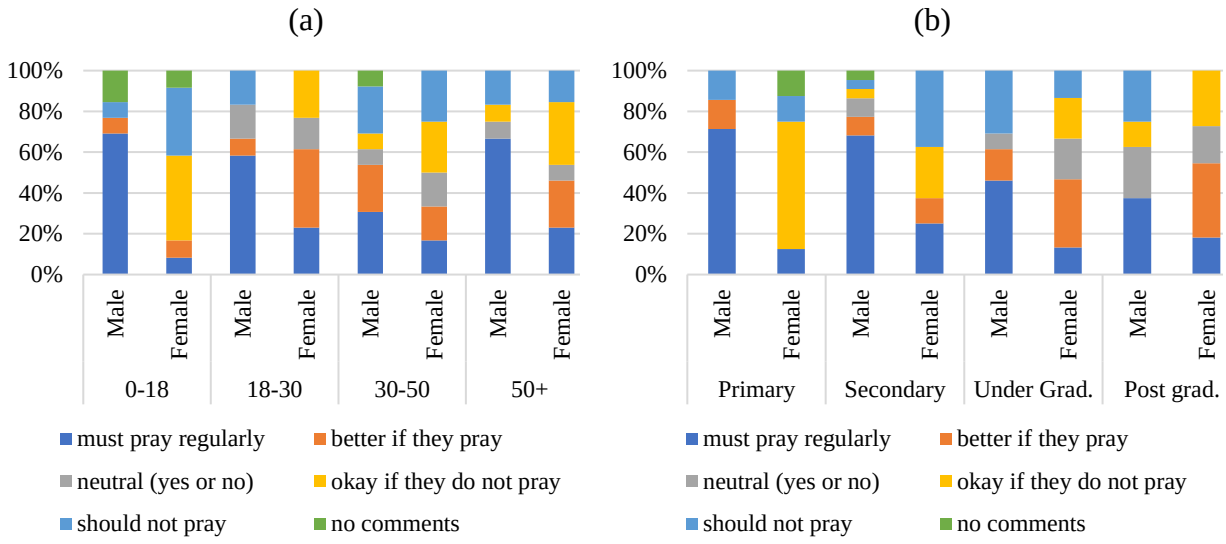


Figure 17. The charts show responses on the topic of women going to mosques by (a) age groups and (b) academic qualifications

From the discussions in this section of "Mosque Accessibility", in the study area it is found that:

- The majority of female respondents do not attend mosques for prayers, regardless of age or academic qualifications. This is due to differences in religious practices and cultural differences.
- Another fact, i.e., the unfriendliness of mosques toward women, points in the same direction.
- In the literature review, it is already pointed out that there is no restriction on women entering mosques. Still, the responses from women on the topic of entering mosques show the deviation from traditional norms.

4.2. Mosque-Centered Activities

Next section of the questionnaire, mosque centric activities, was designed with both close-ended and open-ended questions. The intention was to gather information about people's involvement in mosque-related activities and to determine whether or not individuals knew the activities that are ideally practiced in Islamic lifestyle. Additionally, opinions on whether or not mosques can effectively implement values and what steps mosques might take to safeguard societal values were solicited.

Participation in Mosque-Centred Activities

The gathered data shows that more than half of participants are not participating in mosque-centric activities. Further summarizing the data based on the variables, gender, age and academic qualification, would provide a clear picture.
The results, illustrated in Figure 8 below, show that neither gender's participation is satisfactory. However, women's participation is comparatively lower than men's, which is consistent with the fact that they do not visit mosques frequently.

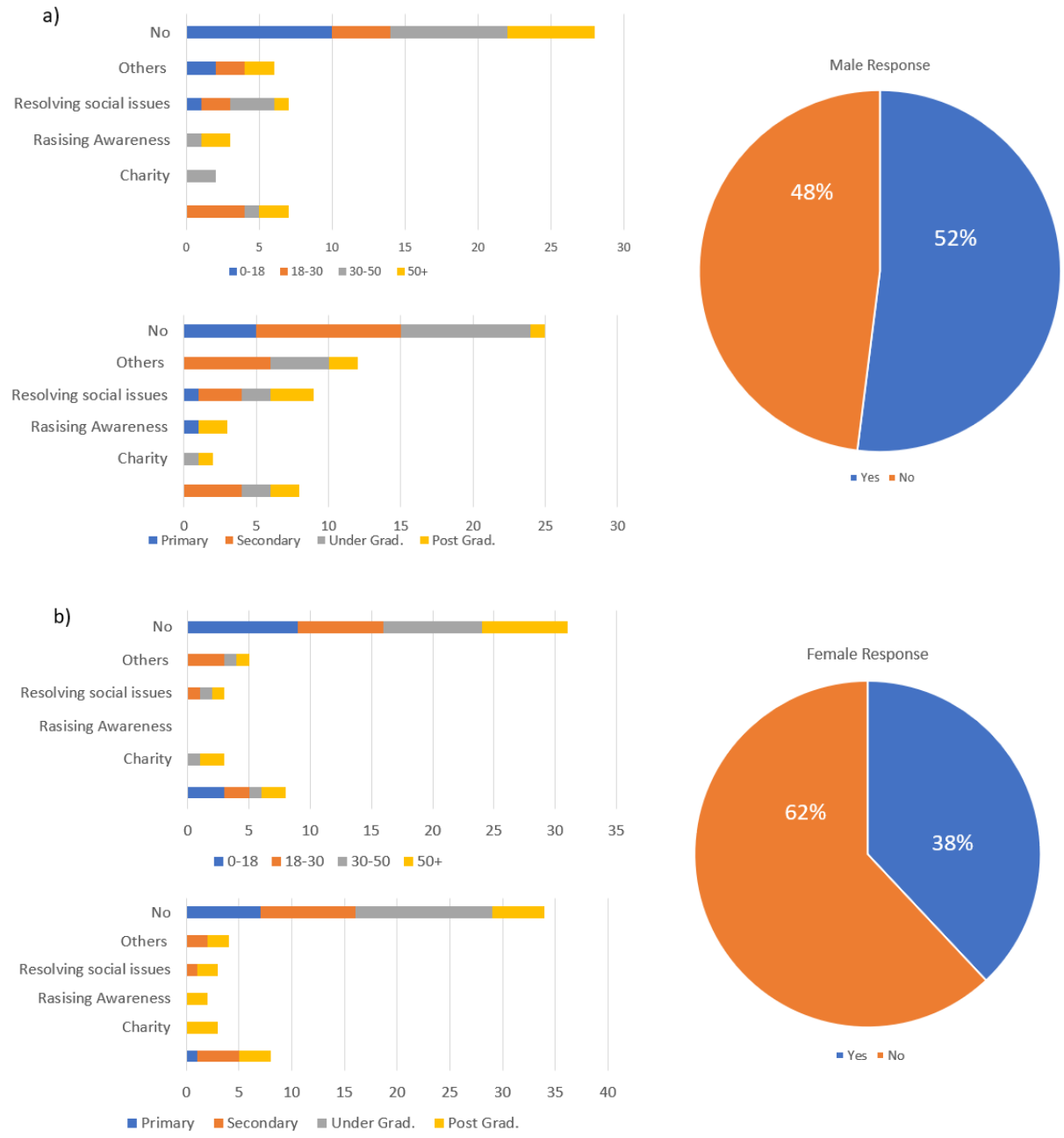


Figure 18. Participation in mosque-centered activities of a) male respondents and b) female respondents based on age groups and academic qualifications

Knowledge about Mosque-Centered Activities in Islam

A qualitative question was asked to understand mosque-centered activities in Islam, and a thematic analysis was conducted to identify meaningful patterns and themes. From the answers of the respondents, meaningful patterns were looked for and analyzed by repetitive data reading, coding, and theme creation.

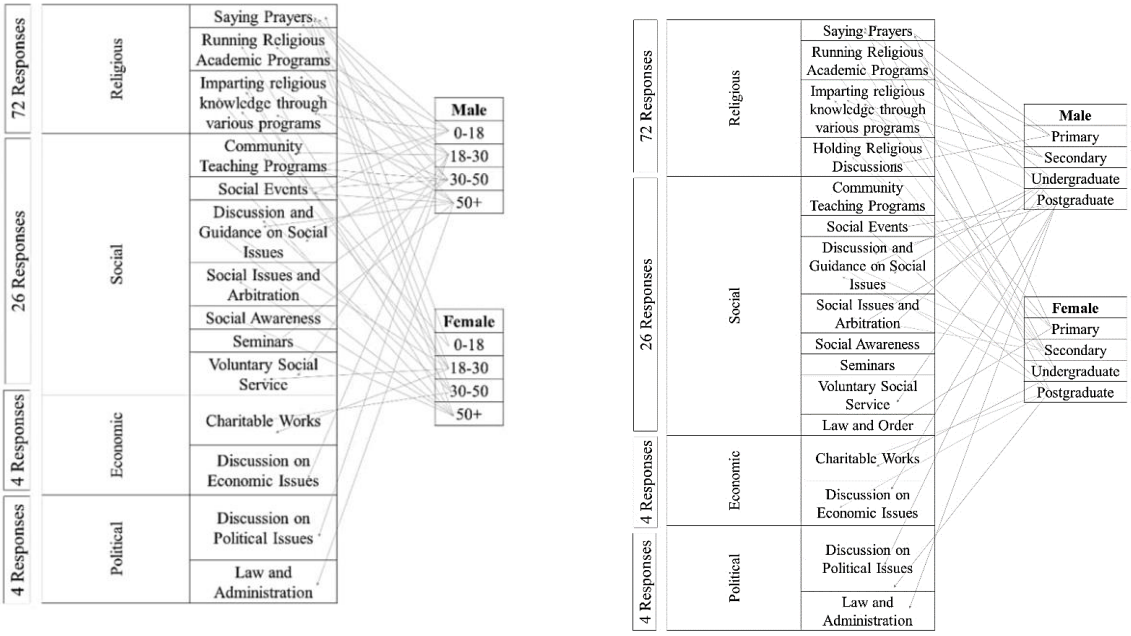


Figure 9. Thematic analysis of opinions on mosque-centered activities in Islam, based on age groups and academic qualifications

Both analytic diagrams show that the bulk of replies, which pertain to all variables—gender, age, and academic qualifications—were about religious activities while only a small number were concerning social features. It didn't change, even with higher educational degrees. The matrix makes it clear. This clearly hints towards the lack of knowledge among Muslims about the Islamic doctrine and traditional norms.

Mosque's Role in Implementing Social Values

This sub-section illustrates the opinion on whether mosques play an effective role in implying social values in our daily lives or not. About 61% of the sample responded "yes." The outcomes are presented based on a variety of factors, including gender, age group, and academic background.
From the below figure (Figure 10), it is obvious that not every response was a unanimous "yes." Almost 40% of the sample's respondents gave different answers. It is quite obvious from this that people do not hold the mosque in high regard as a social institution.

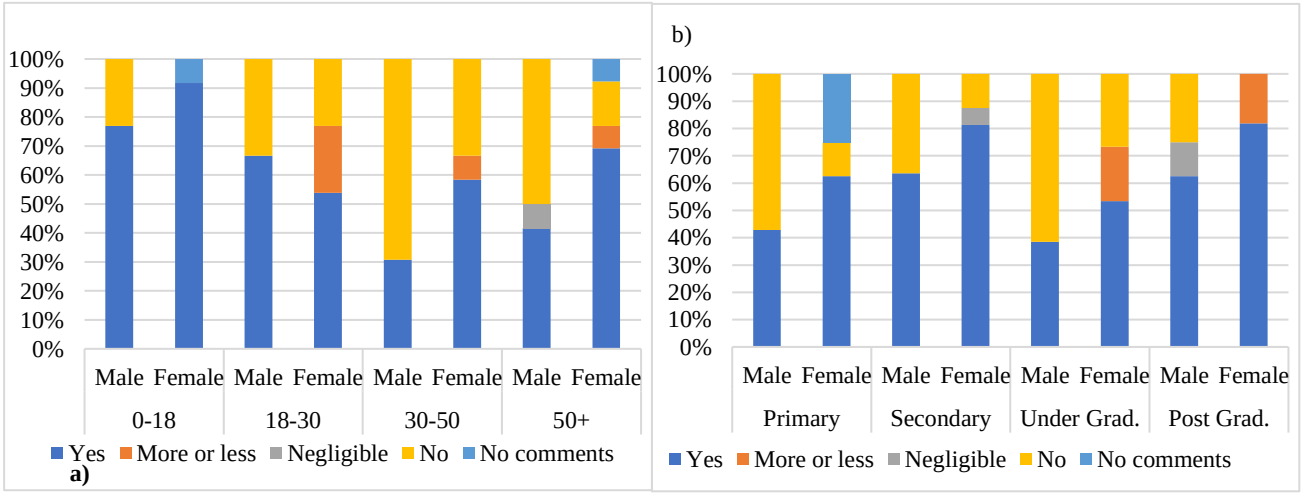


Figure 19. The charts show opinions on mosques playing a role in implementing social values based on genders, age groups and academic qualifications

From the discussions in this section of "Mosque-Centered Activities", in the study area, it is found that:

- There is a lack of awareness regarding the activities performed in a mosque aside from prayer.
- The rate of low activity is worrying.
- The data further suggests that the majority of the sample does not view the mosque as a hub for a variety of community activities.

4.3. Islamic Knowledge

This section of the questionnaire was included to provide a clearer picture of the sample's sources of Islamic knowledge. The majority of respondents, according to the findings in the previous sections, do not participate in mosque-related activities other than praying. Even the female members of society don't often visit mosques to offer prayers. However, the mosque is the venue where Muslims learn about Islamic philosophy with the assistance of scholars. Moreover, different discussion programs can be a source of this knowledge. Therefore, acquiring information on the sample's Islamic knowledge sources is crucial to analyzing the current trend.

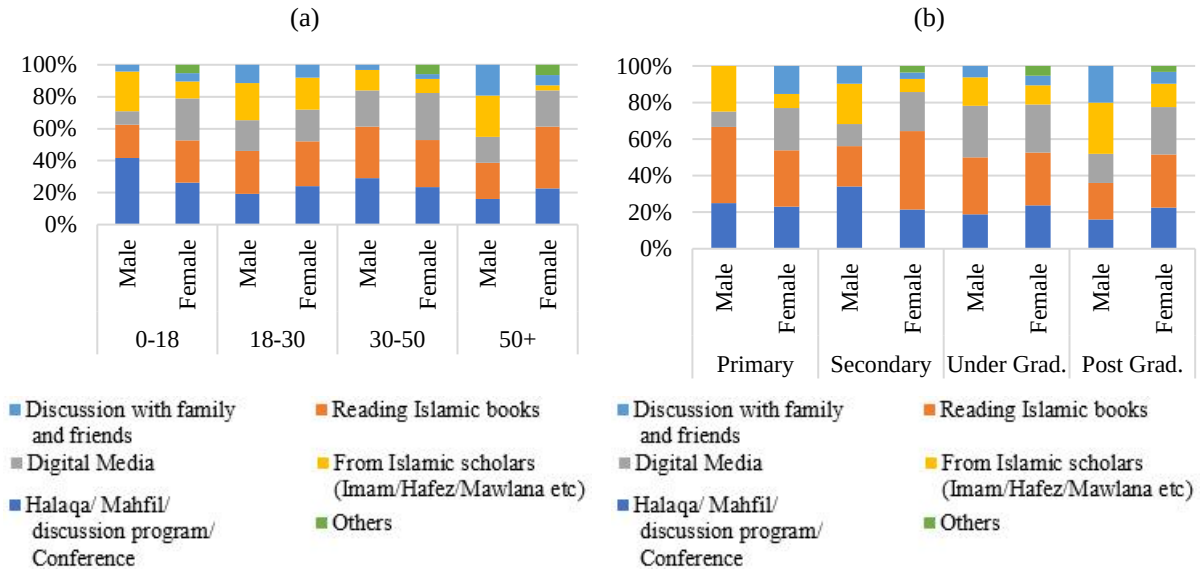


Figure 20. Responses of the respondents when asked about their source of Islamic knowledge a) age groups, b) academic qualifications

The charts show that all categories depend on conversations with family and friends, reading Islamic books and digital media. However, when it is about scholars and discussion programs, the involvement is not that great. Again, involvement is extremely low among the female respondents. This pattern found here also suggests that the sample does not rely on the mosque for their daily lives.

Overall, from the findings and discussions from all the above sections and subsections, a concern arises about the issue of mosques being inclusive in Rajshahi city. Moreover, a substantial portion of the respondents are not aware of the activities conducted by mosques in their neighborhood. This suggests that mosques are failing to play an active role in organizing various events and programs that cater to the interests and needs of the community. This awareness is vital in order to fostering community engagement and promoting social cohesion within the neighborhood.

SUGGESTIONS

An open-ended question was asked to gather suggestions from the respondents for actions the mosques could take to safeguard our social ideals. Their answers were reviewed and a thematic analysis was conducted. From the answers of the respondents, meaningful patterns were looked for and analyzed by repetitive data reading, coding and theme creation. The three broad categories were religious, social and

economic. Thematic analysis revealed religious, social, and economic aspects, with 50 responses focusing on religious activities, 25 on social aspects, and a few on economic aspects.

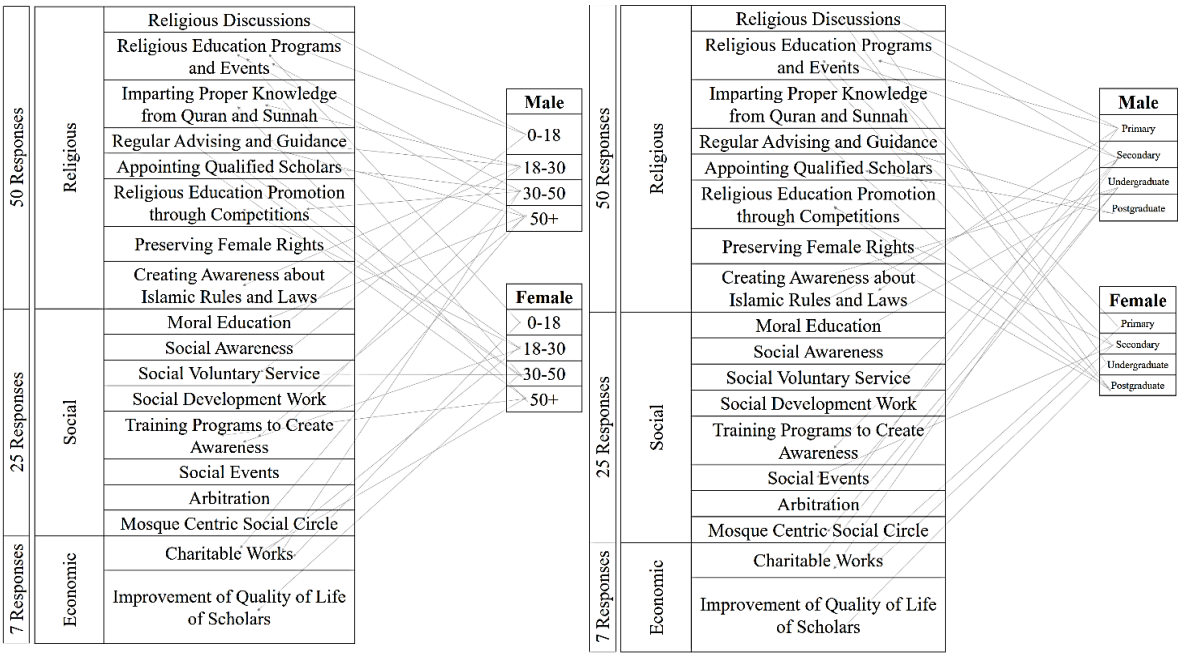


Figure 21. Thematic analysis of opinions about mosques taking actions to protect Islamic values

From the responses, one thing can be interpreted that there is a demand to raise the standard of Islamic education provided by the mosques. They placed a high value on qualified scholars who could disseminate accurate information about Islam based on the Quran and Sunnah. Also, suggestions such as conducting authentic discussions and promoting religious education programs and events and receiving regular advice were given to strengthen community learning and bonding. Another sincere suggestion was made to take steps to enhance the scholars' access to economic resources so they can actively play their roles.

5. CONCLUSION

Since the mosque's founding, it has played a multifaceted role in regions all across the world. This function has evolved across continents and situations spanning timelines, resulting in the curtailment of its operations and the relinquishment of its original purpose. This research was conducted to visualize the present practice trends in a Muslim community in a residential neighborhood of Rajshahi City, Bangladesh. The findings show a substantial discrepancy between the practices of the populace and what Islam teaches us to be. It might be concluded that there is a knowledge gap that has developed over time among the participants. Several recommendations made by them highlight their need for raising the standard of the Islamic teaching system and providing infrastructural support for the same. This research has a limitation in that the study's sample was confined to a residential neighborhood within a city, making it unable to represent the city's cohesive image. In addition, it makes room for more studies on the same subject using various sample sizes in order to present a coherent picture.

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The Role of the Indonesian Army (TNI AD) In Fulfilling Low Income Housing Need: A Case Study of the Magelang City Scavenger Community




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Abstract: *For a number of years, the housing construction effort of Gumuk Sepiring Scavenger Community in Magelang City, Indonesia, has been facing a significant stagnation. To tackle this issue, the local government of Angkatan Darat – TNI AD) to overcome the obstacles in the construction process by leveraging the Corporate Social Responsibility budget of Bank Jateng. This initiative raises a pertinent question: Can partnering with the Indonesian Army (TNI AD) lead to a more efficient implementation, particularly considering the constraints of Low Income Community budget?. The study employed a qualitative research method combined with persuasive writing This research discovered that the presence of the Indonesian Army expedited the process of constructing houses through various strategic measures, particularly when dealing with unforeseen circumstances and challenging landscapes (terrain landscape). Additionally, the Indonesian Army played a role in developing untapped skills among scavenger community members. As a result, the presence of the Indonesian Army (TNI AD) holds the potential to address the housing requirements of low-income communities. This underscores the significance of cooperation between the Indonesian National Army (TNI AD) and the government, which can effectively alleviate the backlog of housing projects in urban regions, especially when facing financial limitations.*
Keywords: *Indonesian Army (TNI AD), scavenger community, housing construction in difficult terrain, urban informal settlements, Magelang City Indonesia*

Düşük Gelirli Konut İhtiyacının Karşılanmasında Endonezya Ordusunun (TNI AD) Rolü: Magelang Şehri Çöpçü Topluluğu Üzerine Bir Vaka Çalışması

Özet: *Endonezya'nın Magelang Şehrindeki Gumuk Sepiring Çöpçü Topluluğunun konut inşa çalışmaları birkaç yıldır önemli bir durgunlukla karşı karşıyadır. Bu sorunun üstesinden gelmek için Magelang Belediyesi yerel yönetimi, Bank Jateng'in Kurumsal Sosyal Sorumluluk bütçesinden yararlanarak inşaat sürecindeki engelleri aşmak için Endonezya Ordusu (Tentara Nasional Indonesia Angkatan Darat - TNI AD) ile ortak bir çalışma başlatmıştır. Bu girişim önemli bir soruyu gündeme getirmektedir: Endonezya Ordusu (TNI AD) ile ortaklık kurmak, özellikle Düşük Gelirli Topluluk bütçesinin kısıtlamaları göz önüne alındığında, daha verimli bir uygulamaya yol açabilir mi? Bu araştırma, Endonezya Ordusu'nun varlığının, özellikle öngörülemeyen koşullar ve zorlu arazilerle (arazi manzarası) başa çıkarken çeşitli stratejik önlemler yoluyla konut inşa etme sürecini hızlandırdığını keşfetmiştir. Ayrıca Endonezya Ordusu, çöpçü topluluk üyeleri arasında kullanılmayan becerilerin geliştirilmesinde de rol oynamıştır. Sonuç olarak, Endonezya Ordusu'nun (TNI AD) varlığı, düşük gelirli toplulukların barınma ihtiyaçlarını karşılama potansiyeline sahiptir. Bu durum, Endonezya Ulusal Ordusu (TNI AD) ile hükümet arasındaki işbirliğinin önemini vurgulamaktadır; bu işbirliği, özellikle mali kısıtlamalarla karşı karşıya kalındığında, kentsel bölgelerdeki birikmiş konut projelerini etkili bir şekilde hafifletebilir.*
Anahtar Kelimeler: *Endonezya Ordusu (TNI AD), çöpçü topluluğu, zorlu arazilerde konut inşaatı, kentsel gayri resmi yerleşimler, Magelang Şehri Endonezya*

1. INTRODUCTION

1. 1. Background

Despite its relatively small size of 18.54 km2, Magelang City shares similarities with urban areas in other developing countries in terms of providing housing. The housing challenge is especially evident in developing nation cities, where a significant portion of the population resides in informal settlements within urban areas [1]. The escalating population growth underscores the significance of addressing housing concerns [2]. In the context of economic challenges, escalating property prices create substantial hurdles for individuals with moderate to low income in achieving homeownership. One of these conditions in Magelang City is in an area called Canguk. In 2018, the Magelang Municipal Government established a central market in the Canguk area. Construction is planned to be carried out in 2019 [3]. The development is intended to replace previously unfeasible market; narrow and lack of supporting facilities. The plan for the construction site of the central market utilized land of the Magelang Municipal Government which at that time was being occupied by residents to build residences, therefore allowing squatting occupants. Approximately 40 families are residing on the premise that most of them are semi-permanent houses. They have a variety of livelihoods, and the majority work in the informal sector. Due to the drive to build a central market by the government, the squatters should be willing to be evicted.

Finally, in early 2019, a total of 20 families bought a 2010 m^2 plot of land in Gumuk Sepiring Village and started constructing residential buildings. More than half of them make a living by scavenging garbage. As a consequence of their poor economic condition, the establishments were very humble in many ways. Likewise, the establishment arrangement process of building blocks in the plots they bought did not consider the principles of a healthy and safe residential environment. It was exacerbated by the inadequate supply of clean water and sanitation. This resulted in the emergence of new slum locations as they would full fill the indicators of the slum area [4] in Magelang City. To remove the slums area, upgrading is required [5] to fulfill the 11th goal of the Sustainable Development Goals. Therefore, in mid-2019 the Government of Magelang Municipality through the Housing and Settlement Area Agency sought a budget from the Ministry of Public Works and Housing as well as the Housing and Settlement Area Agency of Central Java Province Government. The ability of local government to support underprivileged populations is a critical issue, but if local government lacks sufficient power through decentralization, devolution, etc., it will be unable to provide adequate assistance to the urban poor However, from the two agencies, the budget could not be endowed because it did not pass verification [6]. Not until year 2021, finally financial assistance be obtained from Bank Jateng's Corporate Sosial Responcibility.

Technical problems resurfaced, namely the method of building houses. This occurs as the location of the land is in steep land contours and the difficulty of shunting the material would be experienced. Coping with terraced land involves complexities that demand specific methodologies and the expertise of seasoned professionals [7]. This problem has been the main consideration since the beginning. With regard to this problem, steps were taken by inviting the Indonesian Army (TNI AD), in this case Kodim (District Military Command) 0705 / Magelang unit, to carry out the development upon the consideration that in 2021 the Kodim 0705 / Magelang has assisted in the implementation of simple housing for the Low-Income Community ex-residents of the Magelang City Low-Cost Flats. Furthermore, the Indonesian Army (TNI AD) has a track record of constructing infrastructure such as roads within challenging terrain through the TMMD (Tentara Manunggal Membangun Desa) or United Soldiers Building Villages program [8].

1. 2. Problem Formulation

This study's primary aim is to assess whether collaborating with the Indonesia Army (TNI AD) yields enhanced efficiency in providing housing for the Low-Income Community, given the constraints of a limited budget. The research's formulation was also carried out to achieve the following objectives:

a. Provide evidence to The Government Auditor Team that selecting Kodim 0705 / Magelang personnel in the construction of simple houses for Low-Income Society is a good decision since it can provide maximum results than those that built by building contractors.

b. As an example for other municipal and regency governments in Central Java to make more use of the Indonesian Army in implementing simple housing construction for Low-Income Society. Out of 35 municipal and regency governments, only the Magelang Municipality has cooperated with the Indonesian Army in implementing housing construction for Low-Income Society, while the Indonesian Army as stated in Article 7 of Law of Republic of Indonesia No. 34 of 2004 helps to make it possible by cooperating with local governments in constructing community.

2. MATERIALS AND METHODS

The method used in this study is a qualitative research method with a case study. Data are presented in narrative and figures are obtained from interviews, personal documents, field notes, and literature. In the capacity of a Civil Servant, working within the Housing and Settlement Area Agency of Magelang Municipality, the author has been actively engaged in overseeing house construction in Gumuk Sepiring Village. This engagement has enabled the author to comprehensively document nearly all project-related implementations Furthermore, the data were analyzed descriptively and numerically. The study involved interviews with various stakeholders involved in facilitating the construction of housing in Gumuk Sepiring Village. This included discussions with members of Kodim 0705 who oversaw the project's execution, as well as conversations with Gumuk Sepiring residents. These interviews addressed aspects not covered in the author's direct observations, particularly concerning activities conducted beyond regular working hours. Additionally, consultations were carried out with experts in the field of construction to gather comparative data regarding similar housing projects, aiming to assess the final outcomes of the house construction endeavor.

Professional builders were asked questions regarding construction methods, budget, and time needed to build simple houses. For the process of calculating the proposed budget plan, use the Regulation of the Minister of Public Works and Public Housing of The Republic of Indonesia No. 1 of 2022 concerning the Regulation of the Minister of Public Works and Public Housing concerning Guidelines for Preparing Estimated Costs for Construction Work in the Field of Public Works and Public Housing. The professional building gave a calculation of the budget requirements for the construction of a simple house with a building area of 27 m^2. It was stated the amount of the budget is Rp. 3,642,341.36/m^2. For the calculation of temporary occupancy, a calculation of the temporary office / guard house / temporary warehouse is given. Because the residents of Gumuk Sepiring Village used existing materials for temporary housing, , then for the comparison only used the budget for the needs of builder which is Rp. 446,250.00 / m2. For material transportation used a wholesale calculation, which costs IDR 1,500,000.00/house – completed by 4 people for 5 days. Clearing the construction site requires Rp. 17,600.00/m^2 using the building analysis written in the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 28/PRT/M/2016 [9]. Working days required for material transportation, construction of temporary shelters, and land preparation are according to needs; if it is needed quickly, the number of workers is added. Because the work is in an open and wide area so that if the number of workers is added it does not interfere with the smoothness of the work. Meanwhile, for the construction of houses, In general, construction of a type 36 one-story house takes 2 months (table 4) [10]. In a collaborative effort towards erecting a modest 37.5 m2 residence, estimated a three-month timeframe for completion [11].

2. 1. The Condition of Gumuk Sepiring Residents

In Figure 1 can be seen the condition of the houses of the residents of Gumuk Sepiring Village which were not well organized so they look rundown. Village or kampong is a large part of urban areas in Indonesian big cities. It is understood as an urban burden on the urban modernization process. It shows a negative 'stereotype', meaning that it does not have the ability to drive changes in urban modernization. It shows a negative impact on the changing process of urban modernization. It represents chaos and slum condition as a residential environment in urban areas [12]. Most of the residents of Gumuk Sepiring Village work as scavengers, therefore the location of the village was originally known as Kampung Pemulung [13]. That scavengers and panhandlers are included in Social Welfare Problems. This is reinforced by the contents of the Regulation of the Indonesia Minister of Social Affairs No. 08 of 2012 that scavengers are included as

residents with Social Welfare Problems even though they do not live as homeless people. Therefore, it is the government's responsibility to assist in helping them find suitable accommodation [14].

Figure 1. Initial housing conditions in Gumuk Sepiring Village

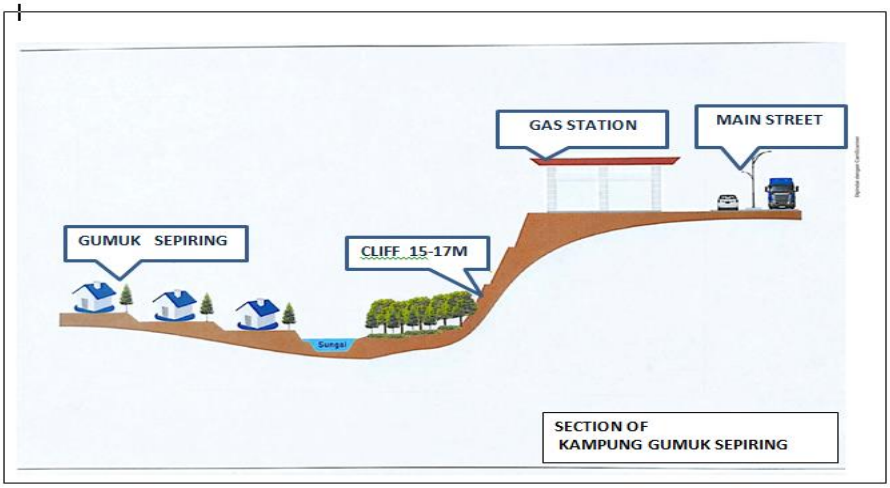

Figure 2. Location Contour of Gumuk Sepiring Village

At first, Kampung Gumuk Sepiring was a new remote settlement located on the banks of the Dadali River. There is no legal access to reach the area. Two accesses can be used, namely through the east and west of the village. Figure 2 shows a cut from the location of Gumuk Sepiring Village. From the east, when viewed from the main road, namely Jalan Soekarno Hatta, Gumuk Sepiring is behind a row of buildings facing the main road. Seen from the ground contour, one must pass a descending path of about 15-17 meters from the main road. This descending path passes through other people's property which is empty land full of plants so it is rather uncomfortable for walking and even tends to be dangerous as it is slippery and steep. As a consequence, they had to cross the Dedali River with a bamboo bridge. During rain, it would be partially damaged because it is washed away by the flow of water that passed through the river and they had to repair the bridge several times. Meanwhile, access from the West is via a route around an irrigation canal that stretches in the middle of rice fields for about 400 m. Because it is not an access for people to pass by, the way is full of shrubs and slippery when it rains.

The initial construction process for the scavengers' residence was very difficult. The material used was the demolition of their house from the old location which will be used for the wholesale market. They brought materials to the site collectively through infeasible access for those to walk by. However, by working together, some of these temporary shelters can be built. At the beginning of the settlement process, only 17 families occupied the place because some of them did not have the materials to build a dwelling. Those who could not afford would live in rented houses in other locations. For about a year, the scavengers had been living without electricity. For lighting, they used kerosene-fired lamps. For access to clean water, they went to the gas station which is the closest public building to their village. Sanitation was done around the

Dedali River. Electricity and clean water could be accessed by residents about a year after they live in the area. At first, the electricity was solar power assistance from NGOs. Electrical power could only be used for one unit of 7-watt lighting per residential unit. Initially, access to clean water and sanitation was obtained from hand pumps and simple toilet cubicles. Eventually, at the end of 2019, the government distributed water installation from the Regional Water Supply Company as one of the first steps for the Magelang Municipal Government in fulfilling the welfare of its citizens. The local government and related institutions should pay attention to the welfare of its citizens as well as regular health control because how they live in unhealthy environments and are vulnerable to infection by various diseases [15].

2. 2. Government Program

Unsymmetrical and contoured land makes it difficult for residents to divide it. There is an unwritten agreement among the residents that for swiftness, they were welcome to use the land according to their needs as long as the building is temporary. The reason behind this is that in the future other residents who need land for housing and are forced to use land that has already been used for houses, the house can be partly demolished. Due to limited knowledge regarding settlements, scattered buildings, and even access between dwellings, are almost unthinkable. There are 27 landowners with an area of 2010 m^2 in Gumuk Village. As per the Regional Regulation of the Magelang City Number 2 of 2020, the construction of a settlement requires the ratio between the plot of land and the public facility to be 60%:40%. Furthermore, the next step for the housing construction to be certified per owner is by referring to the regulations in the Magelang City Government that the minimum land area is 50 m^2. Based on these considerations, only 20 plots could be certified, while the owners are 27 people. This raises a new problem; persuading 7 people to resell their land plots to the land owner who previously offered to buy half of their land area. Finally, with the approach taken by the North Tidar Village Head at that time, the problem could be resolved properly.

As citizens with Social Welfare Problems, the government is obliged to help improve their lives (Law No. 11 of 2009). In terms of residences, the Housing and Settlement Area Agency Magelang Municipality was working on providing simple, liveable houses. As a result of the limited budget of the Magelang Municipal Government, the first attempt was made to use the budget of the Ministry of Public Works and Housing. With the submission of the proposal and presenting it directly to the Ministry of Public Works and Housing, problems can be delivered as a whole story. The proposal of development for the scavenger community is considered very strategic because it has never been proposed by other cities or regencies. This resulted in a prompt response. After some time, the verification team arrived at the location. Verification is carried out to ensure that the technical requirements have been fulfilled properly. It appeared that there was one technical requirement which according to the verification team could not full fill the requirements, namely the absence of road access to the location used for construction and occupancy purposes. Until the specified time limit, the access road could not be prepared. This led the assistance from the Ministry of Public Works and Housing could not be given.

The next step in providing housing is to apply for a budget to the Housing and Settlement Area Agency of Central Java Province Government. Because the financial assistance would be given to the scavenger community, this also became the strategic solution for the agency, so a technical team was immediately assigned to the location. Again, the decline in budget assistance encountered obstacles because the agency works there with the Social Service Agency of Central Java Province Government as a regional apparatus within the government that is engaged in the social sector and is tasked with serving the community to improve welfare [16]. It means that the Prospective Recipients of Social Welfare had to be included in the Integrated Social Welfare Data, while the majority of residents who owned land in Gumuk Sepiring Village were not included in the Integrated Social Welfare Data. Integrated Social Welfare Data is data used as a reference in providing social assistance to the community with certain conditions [17]. The next effort is to seek sources of funds from the Corpoate Social Responsibility (CSR). CSR is a company's commitment to act irrationally ethically, operate legally and contribute to improving the economy both improving the quality of life of employees, their families as well as the local community and society [18]. Then it was decided to request a funding proposal to be directed to the CSR department of Bank Jateng. This decision was chosen because it has assisted The Magelang Municipality Government in the implementation of the construction of Uninhabitable Houses in 2020. This was the right choice because the department has been

providing major assistance to the Surakarta city government for the Uninhabitable Houses construction program [19]. At the beginning of the conversation, the CSR team objected to the proposal because the Uninhabitable House construction program had often been carried out. However, when it was explained that the program was for a scavenger community residing in one area, and the implementation of the construction to be assisted by the Indonesian Army, they showed interest as it was never implemented before. The budget given reached Rp. 35,000,000.00 / housing unit with details of Rp. 30,000,000.00 for building materials and Rp. 5,000,000.00 for labor costs. The amount of this budget is equal to the budget provided by the Housing and Settlement Area Agency of Central Java Province Government for the construction of houses in 2021. The implementation of this house construction follows the Detail Engineering Design made by the Housing and Settlement Area Agency of Central Java Province Government, with a budget of Rp. 35,000,000.00 was only able to build a 36 m^2 type house without a cubicle (open plan) and cement plaster and no bathroom [20]. Table 1 shows a summary of the results of the budget search proposal submission process.

Table 1. Budget Search Process for the Construction of Gumuk Sepiring Village Houses

No	Program	Funding Source	Problems	Information
1	Simple Housing Development Assistance for Low-Income Communities	the Ministry of Public Works and Housing	There was no legal access to the housing site	Outcome : No financial assistance
2	Simple Housing Development Assistance for Low-Income Communities	Agency for Public Housing and Settlement - the Province of Central Java Government	Not all Prospective Recipients of Assistance were included in the Integrated Social Welfare List	Outcome : No financial assistance
3	Simple Housing Development Assistance for Low-Income Communities	CSR of Bank Jateng	-	Outcome : Financial Assistance given Rp. 35.000.000,00 / unit

2. 3. Development Process

Access to difficult locations and steep land conditions are the main challenges in the process of building houses for the residents of Gumuk Sepiring Village. Therefore, in the initial planning, it was decided that the construction would be carried out in partnership with the Indonesian Army. This is upon the consideration that in 2021, Kodim 0705 / Magelang has already provided housing for the Low Income Society community, former residents of Magelang City low-cost flats [20]. On May 19, 2022, construction began. The construction was carried out jointly between Kodim 0705 / Magelang, residents of Gumuk Sepiring Village, and 20 construction workers. Kodim 0705 / Magelang deployed a maximum of 50 people/day, which is a combination of three units, namely Kodim 0705 / Magelang, Armed Battalion 105 / Tarik, and Battalion 11/2 Kostrad with the command from Kodim 0705 / Magelang.

The first action was to think about the easiest way to transport materials. Finally, a decision was made to find the easiest access to transfer it manually [21]. For this reason, it was necessary to approach residents around Gumuk Sepiring Village to be allowed to use their land as a means of material and human circulation. It did not require many steps to be taken, because it is undeniable that residents still have great sympathy for the Indonesian Army [22]. It yielded two paths for access to materials. Moreover, one of the residents, namely Nomo Koeswoyo, a well-known Indonesian musician, allowed his front yard as a material storage that require special handling to avoid rain, such as cement and iron [23]. Material transportation was not completed at once but adjusted the site readiness to receive the house building, hence the material transportation consumed 130 days.

Figure 3. Material Transportation Process and Construction of Gumuk Sepiring Village Houses

The next step is to create temporary housing for residents. Materials for temporary housing used materials from existing houses, this certainly saved the budget. And it was agreed at the beginning that the house would be built on a semi-permanent system and it would be easy to be demolished. Locations for temporary housing use state land near community land. The required temporary housing was 14 units, according to the families of the Gumuk Sepiring Village. The process of preparing and building temporary housing took 65 days. Temporary housing was not made immediately. If the house is demolished to level the land, then temporary housing will be erected. The target for the construction of temporary housing was 4 - 5 days/house. In addition to temporary housing, a temporary building for a public kitchen was also prepared. The public kitchen was used to provide consumption for personnel working in housing construction as well as for all residents of Gumuk Sepiring Village. The budget for consumption prepared at the public kitchen was donated by Kodim 0705 / Magelang and the community around Gumuk Sepiring Village. All components of the residents of Gumuk Sepiring Village were involved in development, including the women who in this case were assigned to cook starting from determining the menu, the amount to be prepared, the cooking process to serving Involving the community in housing construction for the Low-income society community will bring positive changes in their lives [6]. In the step of construction of temporary housing, no professional builders were involved. The obstacle faced was the limited ability of the beneficiaries who still had to work and some were elderly so the manpower could not be optimized. Figure 3 shows members of the Kodim 0705/Magelang in the process of transferring building materials and constructing the simple houses.

Land planning was made to follow the contours of the existing land to make it terraces. The land was adjusted according to the previously-made site plan, namely a total of 20 plots with a size of 54 m^2/plot (6 m x 9 m). To determine the choice of site position, residents conducted it by deliberation. The main obstacle was that land preparation could only be done using simple masonry tools, namely hoes, shovels, and crowbars. Excavators could not be brought in because there was no access. To speed up the target, the land preparation process was also carried out in the evening by the residents after being explained in the afternoon. Despite utilizing basic equipment, meticulous calculations are employed to ensure the effective management of drainage flow, as well as the strategic placement and construction of retaining slopes. These measures are essential to safeguard the terraced structure of residential land from potential damage caused by the forceful runoff of heavy rainfall. The land preparation process finished in 65 days.

Once the land was ready to be built, then the implementation of residential construction began. As a result, the residential construction process was carried out in stages. This was taking into account the limited number of existing professional building personnel. There was a slight change in the plan. During construction, the bathroom, which was previously located in the main residential building, was moved outside the main building. This changed due to the consideration that the area of the main building would be slightly wider and to make it easier to clean the bathroom. Additionally, the floor of the house which was originally planned to be a cement mortar floor was altered to a ceramic tile floor after receiving assistance from the wife of the Commander of Regional Military Command, *Komando Daerah Militer* - Kodam IV / Diponegoro.

The results of the residential construction built by Kodim 0705 / Magelang were very satisfying compared to the same activities in 2021, which is the construction of simple houses for the Low-Income Community - ex-residents of the Magelang City Low-Cost Flats, which incurred an identical amount of Rp. 35,000,000.00. At that time, the Detail Engineering Design (DED) followed what had been constructed by the Housing and Settlement Areas Agency of Central Java Province Government, namely columns and beams which were the main structure of the house using a panel system of precast columns and beams (Fuad I, 2022) known as RUSPIN (*Rumah Unggul Sistem Panel* - Superior Panel System House) and Ruspin is a development of RISHA (*Rumah Instan Sederhana Sehat* - Simple Healthy Instant House) [24], Risha is a residential house that applies small precast system construction technology with a nut and bolt connection system [25]. The budget was fully absorbed for the precast material. Whereas, the DED of a simple house for residents of Gumuk Sepiring Village was made by Kodim 0705 / Magelang itself by maximizing local building materials in Magelang City so that the results of the houses built could be maximized. Magelang is a region situated in proximity to a volcano. Consequently, the construction of houses in this area predominantly employs sand and stones. Modern techniques combined with earthen architecture offer a logical solution to the issue of affordable housing [26]. In Figure 4 we can see a comparison of the progress of Ruspin's construction with simple houses built using conventional systems for Gumuk Sepiring Village.

Figure 4. Comparison two type of houses were built with a budget of Rp. 35.000.000,00

In addition to the 20 housing units, Gumuk Sepiring Village is also equipped with village lanes, a river safety barrier, and a prayer room, all of which were also built by Kodim 0705 / Magelang. The village lanes was made with terraces so motorbikes cannot be used on these lanes. The budget for making village lanes and barrier was derived from the Government of Magelang Mulicapal Government, while the prayer building was donated by Kodim 0705 and Non-Governmental Organizations. The time required for the construction of Gumuk Sepiring Village was 138 days (table 2). The Agriculture Agency of Magelang Municipal Government provided several fruit tree seedlings for the residents. They might use them either for their consumption or for sale. Residents are also constantly reminded to keep their houses and yards organized so that the village doesn't become slums. Utilization of open land to fulfill daily food needs is also emphasized.

To this day, the access residents of Gumuk Sepiring Village to enter and leave their settlement location still using the private land of surrounding residents or along irrigation canals. It is expected that in the middle of 2023, a new village lane will be built from the village to the east of Gumuk Sepiring Village. This budget will use the Magelang Municipal Government budget. The new village lane is planned to be as narrow as possible, only able to accommodate three-wheeled fire engines. This is in order to protect the rice fields whose existence surrounds Gumuk Sepiring Village, it is hoped that these rice fields can be saved from the construction of illegal houses so that sustainable settlement development can take place in the area around Gumuk Sepiring Village, because sustainable planning is a development that meets current needs without reducing the ability of future generations in the future in meeting the necessities of life can still be applied [27].

***Table 2**. The time required for construction process of Gumuk Sepiring Village Housing*

Agenda			Time (week)																		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	Material trasnportation																					
B	Demolition of houses & construction of temporary housing																					
C	Residential land preparation																					
D	Construction of public facilities (musholla, villages lane and drainage)																					
E	Housing development (names)																					
	1	Suradiman																				
	2	Joko Lakoni																				
	3	Sri Haryati																				
	4	Robikah																				
	5	Suroso																				
	6	Tatang																				
	7	Wakinem																				
	8	Tuyah																				
	9	Darno																				
	10	Siswanto																				
	11	Slamet Supoyo																				
	12	Kohar Setiadi																				
	13	Slamet Riyadi																				
	14	Sri Mudrikah																				
	15	Dwi Ningsih																				
	16	Pateni																				
	17	Dwi Winarno																				
	18	Sudarmajid																				
	19	Sri Mulyadi																				
	20	Mujiteng																				

When the construction of Gumuk Sepiring Village housing was completed (Figure 5), when members of the Kodim 0705 / Magelang said goodbye, it was a very touching moment. Residents of Gumuk Sepiring Village who have been helped and worked hand in hand to build their homes experienced happiness and sadness as they must have parted with the army [28]. The success of the program between the Magelang Municipal Government, the Indonesian Army (TNI AD), CSR of Bank Jateng, and Non-Governmental Organizations is deemed successful. It is shown by the amount of coverage from the mass media. The program implemented is almost close to the Pentahelix concept; combines the roles of academia, business entities, government, community, and media, which is very suitable for use when the government has limited resources, however, should complete the program [29]. The participation of many parties in solving settlement problem is highly expected. The phenomenon of participation has been an essential component of the globally accepted sustainable city concept since the 1970s [30]. Participation was emphasized with themes such as access to environmental information, cooperation, policymaking, active citizenship. The Indonesian Army (TNI AD) supporting the program is in line with the mandate of its institution in Law related to Military Operations Other than War, i.e. that each Regional Command Unit is given a task, one of which is to assist the regional government through Territorial Development, in this case, efforts to manage defense in the regions through an approach from Army's service [31]. Facilitating housing for Low-Income Communities necessitates active leadership, patience, participation, and the establishment of trust in the guiding process [6]. For the inhabitants of Gumuk Sepiring, leadership is embodied by the Indonesian Army in their housing provision efforts.

Figure 5. Site and Situation of Gumuk Sepiring Housing after the completion

3. RESULT

Based on the results of the discussion and data sources, an analysis was carried out in the table below to understand the comparison of the effort of the Indonesian Army - Kodim 0705 / Magelang in the process of building Gumuk Sepiring Village housing.The first is to compare the results of the construction of simple houses with the construction of simple houses in Tulung Village, Magelang City in 2021. The budget amount is equal, namely Rp. 35,000,000.00 which differs from the Detail Engineering Design (DED) provider. In 2021, the DED was designed by the Agency for Public Housing and Settlement – The Province of Central Java, and for DED the Gumuk Sepiring village house was designed by Kodim 0705 / Magelang (see Table 3)

Table 3. Comparison of Simple House Construction Results with a budget of Rp. 35,000,000.00

No	Details	Source of Detail Engineering Design	
		Agency for Public Housing and Settlement – The Province of Central Java, year 2021	**Kodim 0705 / Magelang, year 2022**
1	Builder	Member of Kodim 0705 / Magelang	Member of Kodim 0705 / Magelang
2	Building Material		
	Building fondation	Pedestal from river stone pair	River stone strip foundation
	Column and beam	Concrete pre cast	Concrete on site cast
	Wall	Light white brick	Light white brick
	Roof structure	Light steel frame	Light steel frame
	Roof covering	Galvalume roof	Galvalume roof
	Door and window	Wood and glasses	Wood and glas<ses
3	Material finishing		
	Ceiling	-	-
	Wall	-	Cement plaster
	Floor	-	Ceramic tile
4	Built rooms	**Only core room, open plan 6x6 m^2 (approximately 70% completed)**	**Living room, 1 bed room, kitchen, toilet and terrace 6x6 m^2 (100 & finished)**

The second comparison process (table 4) is to compare the results of simple housing construction by Kodim 0705 / Magelang with the results of interviews conducted with professional construction workers who calculated based on building analysis along with several existing written data sources.

Table 4. Comparison of time and budget for the construction of simple houses in Gumuk Sepiring Village

No	Process	Equipment		Time		Budget	
		Building Analysis	**Indonesian Army**	**Building Analysis**	**Indonesian Army**	**Building Analysis**	**Indonesian Army (TNI AD)**
1	Construction of temporary housing (200 m2)	Hoes, saws, hammers, ladders	Hoes, saws, hammers, ladders	60 days	60 days	200 m^2 x Rp. 446.250,00 = Rp. 89.250.000,00	-
2	Material transportation	Human power, wheelbarrows, sacks	Human power, wheelbarrows, sacks	120 days	120 days	(Rp. 1.500.000,00 x 20) = Rp. 30.000.000,00	-
3	Land Preparation	Hoes, shovels, crowbars.	Hoes, shovels, crowbars.	65 days	65 days	(6x9 m^2 x 20) x Rp. 17.600,00 = Rp. 19.008.000,00	-
4	Construction of 1 simple residential unit (36 m2) with 4 workers	Hoes, trowels, ladders, saws, brushes, buckets	Hoes, trowels, ladders, saws, brushes, buckets	60 days	40 days	36 m^2 x Rp. 3.642.341,36 = Rp. 131.124.288,96	Rp. 35.000.000,00

The construction day requirement for the construction of temporary housing, material transportation, and land preparation corresponds to the requirement for the construction process in Gumuk Sepiring Village.

4. DISCUSSION

From the process of implementing housing development, after being analyzed it can be concluded that: Implementation of fulfilling Low Income Housing need using the Indonesian Army (TNI AD), in this case, Kodim 0705 / Magelang is more efisien as it is faster and cheaper.: Empirical evidence indicating that construction activities undertaken by contracted parties incurred higher costs compared to those executed by the Indonesian Army [8]. In this context, the contractors referenced analyses provided by the Ministry of Public Works and Housing (Ministry of PUPR). Opting for construction activities involving the Indonesian Army could potentially lead to a budget reduction of up to 30% when contrasted with projects managed by external contractors [32].

The effectiveness of tasks performed in Gumuk Sepiring can be observed through the following aspects:

A. Attainment of construction quality:
   In the year 2022, domiciles constructed according DED specifications developed by Kodim 0705 exhibited full completion of 100%, rendering them ready for habitation. Conversely, dwellings constructed in 2021 using DED from the Agency for Public Housing and Settlement – The Province of Central Java necessitated additional work to attain 100% completion. These supplementary tasks encompassed the installation of room-dividing walls, toilet construction, application of plaster to walls, and laying of floor tiles. This disparity in completion can be attributed to the strategic approach employed by Kodim 0705/Magelang, which maximized locally available resources to align the material budget with project requirements.
B. The budgetary requirement for temporary housing construction.
   No budget is needed in the process of constructing temporary housing.
C. Budgetary needs for materials used in shunting.
   No budget is necessary for material shunting procedures.
D. The required number of days to build 1 unit of a simple house.
   Kodim 0705 / Magelang is capable of completing the construction in 40 days.
E. Resolving construction on terraced contour land.
   Kodim 0705 / Magelang is capable of addressing the construction challenges on terraced contour residential land without requiring a budget for its execution.

The five mentioned achievements can be reached due to the presence of the following factor:

Table 5. Factors of the Indonesian Army's capability and the achieved efficiency levels.

NO	FACTORS		EFFICIENCI GAINS
1	Labour		
	a	Despite lacking formal construction expertise, Indonesian Army (TNI AD) members exhibit effective work performance. As a national defense institution, TNI is required to prepare human resources characterized by commitment, positive attributes, creativity, competitiveness, communicativeness, credibility, and a preparedness for action when confronted with tasks [33].	B,C,D,E
	b	The Indonesian Army (TNI AD) has the capability to efficiently allocate personnel for tasks that require significant manpower, utilizing	C,E

		the command line system. This can be done through coordination with the Main Command when needed.	
	c	Members of the Indonesian Army (TNI AD) are ready to work more than 8 hours/day.	C,D,E
	d	Members of the Indonesian Army (TNI AD) are willing to work on holidays as well. TNI soldiers have extended working hours and must remain alert and responsive whenever the need arises [34].	C,E
	e	Weather conditions do not hinder work activities	C,E
2	Working Method		
	a	The Indonesian Army (TNI AD) efficiently utilizes its members in the process of transporting construction materials, eliminating the need for additional costly equipment.	C,E
	b	The Indonesian Army (TNI AD) can identify alternative routes for transporting building materials to expedite the construction process.	C
	c	The Indonesia Army (TNI AD) has the ability to use building materials effectively and efficiently leading to an increase in the target of building objects.	A.B
	d	The Indonesian Army (TNI AD) can effectively and efficiently manage its personnel to accelerate development implementation.	A,B,D
3	Other factors		
	a	Indonesian society is culturally very close to the TNI, which maintains a high level of trust in them. This closeness is particularly advantageous when involving the community in completing certain tasks. The TNI employs strategies to gain public sympathy [35], thus fostering unity between the TNI and the community. As stated in official guidelines, the TNI is required to engage in social communication activities with various community components to build positive emotional connections and gain public affection [8].	B,C,E
	b	The Indonesian Army (TNI AD) can establish relationships with other parties in order to obtain more assistance. The collaborative synergy between the military and stakeholders in thinking and acting together is more effective and efficient in achieving common goals compared to doing things independently [36]. A branch of the federal government is essential to fostering volunteering, which is at the core of nonprofit organizations [37]. They give freely of their time and abilities. Additionally, it shows that the military encourages its members to work for nonprofits.	A

During the conference, two questions were posed. Ms. Ph. D. Candidate Erna Nuralia Zharani posed the first query, inquiring as to how the locals felt about the Army's involvement in the construction process. How the locals felt about the Army's involvement in housing construction was not yet discussed at the presentation. In response to this question, it was answered that The TNI's participation in this program was warmly welcomed by the locals. And after the Army ended its construction and hosted a ceremony to say farewell, many locals wept. Meanwhile, Assistant Professor Ayad Khalid Al Maimani questioned whether the research also carried out comparisons with the implementation of construction by the Army in other countries. According to the author, comparison was made by searching from several journals and getting the result that the military in USA also do the same thing in helping the community, although not in the form of physical construction of buildings.

5. CONCLUSIONS

The process of constructing 20 units of simple houses for the Scavenger Community residing in Gumuk Sepiring Village is a complex undertaking that involves several stages. It begins with seeking funds for the housing project and continues through the actual construction process. This complexity arises from various technical challenges, including the remote and difficult-to-access location, lack of legal pathways, and the terraced nature of the land. Choosing to collaborate with the Indonesian Army (TNI AD) in the program to construct simple houses for the residents of Gumuk Sepiring village is appropriate due to TNI AD's ability to efficiently carry out housing development. This can be observed through the number of workdays required for construction, as well as the final outcomes that surpass the targeted housing quality. Moreover, the project also encompasses the construction of public facilities and social amenities. The Indonesian Army (TNI AD) has effectively utilized its personnel, equipment, and resources. It has successfully empowered the residents of Kampung Gumuk Sepiring and the surrounding area to contribute to the development process. The construction activity of simple houses for the Low-Income Community, involving more than ten units situated in a single location known as Kampung Gumuk Sepiring, represents a pioneering effort undertaken by the Indonesian Army (TNI AD) through the *Karya Bakti* program. The outcome of this endeavour demonstrates the effective execution by the TNI AD. This achievement will be reported to the National Housing and Settlement Working Group, with the aspiration that it could serve as a model for adoption by other municipal or district governments across Indonesia.

Can the Indonesian Army (TNI AD) effectively assist municipal or district governments in resolving housing issues in squatter areas? This question serves as a recommendation for further research.

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