ETHIOPIAN INSTITUTE OF ARCHITECTURE, BUILDING CONSTRUCTION AND CITY DEVELOPMENT

Urban Nightscape: An assessment of Artificial lighting on place recognition and perceived safety, the case of Addis Ababa main city center.

by

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A Thesis submitted to graduate studies of Addis Ababa University presented in partial fulfillment of the requirement for the degree of Master of Science in Urban design and development.

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Approval and Signature

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This is certifying that the thesis prepared by Elias Endale, entitled ***"Urban Nightscape: An assessment of artificial lighting on place recognition and perceived safety, the case of Addis Ababa main city center"*** & submitted to graduate studies of Addis Ababa University in partial fulfillment of the requirement for the degree of Master of Science in Urban Design and Development Compiles with the regulation of the University and meets the accepted standards for originality and quality.

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Declaration

I, the undersigned, declare that this thesis prepared for the partial fulfillment of the requirements for the degree of Master of Science in urban design and development entitled **"Urban Nightscape: An assessment of artificial lighting on place recognition and perceived safety, the case of Addis Ababa main city center"** is my original work and has not been presented for a degree in any other university and that all sources of material used for the thesis have been duly acknowledged.

Elias Endale Simegne

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Confirmation

This thesis can be submitted for examination with my approval as a university advisor.

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Wossen Woldekidan, PhD

May, 2024

Abstract

The study explores the impact of artificial lighting on perceived safety, environmental perception, and place identification in urban environments during night. It focuses on four selected areas in main city center of Addis Ababa: Piassa, Arat Kilo, La Gare, and Merkato. The study reveals a direct correlation between lighting and city image, with pedestrian safety directly related to visibility and maintenance of lighting posts. The research also highlights the lack of attention given to lighting on urban design elements like landmarks, monuments, historic buildings, and public spaces compared to street lighting. The study uses international codes of practice in lighting masterplans and interviews, analyzing data in charts and graphs. The result of this study shows that from the selected 8 areas, Yekatit 12 Memorial (35.38%), Arat kilo patriots monument (46.68%), Addis Ababa city administration building (87.67%), Churchill Road (73.13%), Ethio-Cuba friendship park(41.93%), Lion of Judah near Beherawi theater (37.7%), Lion of Judah in La Gare (56.14%) and Meskel square (92%) recognized in comparison from the daytime recognition test this shows an average of 58.89% of recognizability of this areas due to lack of artificial lighting and the reassurance of the place on pedestrians directly impacted by visibility of the surrounding environment. Finally, its recommended that to better recognize and identify and to improve the perceived safety of pedestrians urban lighting should integrated with urban design elements and responsible stakeholder should be involved in both design and maintenance.

Key words: Nightscape, Landmarks, Artificial lighting, Safety and Reassurance, Recognition

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List of Acronyms and Abbreviations

AACRA	Addis Ababa City Road Authority
BSI	British Standards Institute
CBD	Central Business District
CIE	Commission International de Leclairye
CIBSE	Chartered Institute of Building Service Engineering
CS	Collector Street
EIABC	The Ethiopian Institute of Architecture, Building Construction and City Development
IESNA	Illuminating Engineering Society of North America
LED	Light Emitting Diode
LRT	Light-Rail Transit
PAS	Principal Arterial Street
SAS	Sub-Arterial Street
VIP	Very Important Person

CHAPTER ONE

Introduction

This study focuses on the nightscape and nighttime environment in Addis Ababa, a city with a less studied aspect of urban phenomena. It aims to understand the nocturnal presence and its potential to enhance economic activity, aesthetics, safety, and security. The study also aims to understand lighting design activities, functions, and safety concerns in the city, thereby enhancing urban quality of life during the night.

1.1 Background of the study

Cities are full of complex activities and surprises with human interaction, different lifestyles, and cultural and economic activities, this dynamic character doesn't fade even in the late hours of the city to address this urban nightscape is introduced. Urban nightscape is defined as a night environment in urban that is lit up by artificial illumination from different sources, such as buildings, streets, billboards advertisements, and vehicular. Urban night corresponds to the urban entertainment economy, which is one of the defining elements in the nighttime activity, simply it's an integral part of cities that provide a great rigor to the thriving commercial activities.

This nightscape can be a great asset to create an attractive and meaningful environment at night, to make cities glimmer and give places distinctive character Nightscape plays a great role.

Apart from increasing urban aesthetics and improving nighttime economic activity, nightscape can serve as a conduit for ensuring the safety and security of residents.

After sunset, night create two particular emotions in many peoples, first as a place of celebration in different entertainment and leisure second, as a place of terror and full of threatening danger, these two describe and characterize the nighttime environment, active and lit street, window displays, colorful active frontages invite peoples, whereas empty streets, dark corners and blind walls repel city dwellers ("Urban Nightscape and The Cities," 2021.)

Studies of the nightscape began in the early 1990s when most researchers concentrated primarily on artificial light illumination (Zhou et al., 2006). By using visual perception determining the compatibility and attractiveness of lighting design on the urban landscape can be achieved (Pourfathollah & Mahdavinejad, 2020). The application of new lighting technology in the different gardens during the night, can enhance the expressiveness and enrich the people's experience and perception (Oh, Park, & Kim, 2009).

Many cultural and traditional customs should be considered in the design of lighting in the nightscape, such as cultural background, historical narratives, heritage preservations, respect for the identity of places, and many other considerations to mingle the social and physical fabric with the proposed nightscape. The misconception of the “nightscape” with “lighting” can significantly affect the construction of nightscapes in Chinese cities (Hongxiang, 2014).

In city centers, where individual buildings call for attention through bright light, harsh contrast, and colorful façade lighting, Zurich's master plan for lighting has focused on an overall image of a city with nocturnal presence in favor of authentic culture, instead of individualizing lighting design on buildings and built structures rather focuses on overall skyline and visual illumination that evokes the cultural identity of a place (Schielke, 2017).

There is a misunderstanding of the nightscape as a means of brightness of cities at night in city centers and landmarks. This misconception led to the loss of identity in places of competition depending on bright cityscapes rather than careful configurations, which led to light pollution in residential areas and traffic (Hongxiang, 2014).

The abundance of lighting at night became the expectation of many European and American cities, this resulted in a shift in lighting infrastructure and lighting and lighting design in recent years and the light became a background rarely unnoticed. Once a scarce phenomenon, its abundance and unavoidably ubiquitous made a critical shift in recent discourses that focus on the dark sky in lighting design (Taylor, 2019).

As the above studies show understanding the nightscape and its variables has a great role in enhancing economic activity as well as the aesthetic of a city at night, Nocturnal presence becomes a phenomenon that attracts tourist admiration, ignites consumers' desire to purchase, and increases the length of stay on residents during the night.

In studying urban nightscape different methods and techniques has been used from eye tracking technique on the participant during night time that focuses on perception, new lighting technology integration on gardens, observations, and considering overall skyline configuration into the lighting design to create unobtrusive night image, this study focuses on urban design elements and its synchronization with lighting design.

1.2 Problem Statement

Artificial lighting in Addis Ababa has been linked to two issues: first, a lack of visibility around landmarks, historic monuments, streets, and architectural structures that is associated with a lack of identity in meaning and identification; and second, a perception of pedestrian safety that is directly associated with a place's sense of security and susceptibility to crime. Even if there has been significant progress in some areas of light, Addis Ababa's main city center is still dangerous and inhospitable because to some sections' lack of inclusion and hierarchy. These two problems do contribute to unrecognizability of main city center of Addis Ababa urban design elements that affect the image of the city at night beside it lacks create unsafe environment.

The repercussion of leaving these problems without research, understanding and mitigation may result in chaotic/ visually which is directly resulted on glare and light pollution and its lack of consideration into isolated unsafe streets and neighborhoods.

1.3 Research Objective

General Objective

- To assess how artificial lighting in main city center of Addis Ababa impact recognition of a place and perceived safety of pedestrian.

Specific Objectives

1. To evaluate and contrast how artificial illumination affects daylight and nighttime place recognition.
2. To assess the influence of artificial illumination on the perception of safety in the main city center of Addis Ababa.

3. To assess how well the main Addis Ababa city center's urban design components are visible with artificial lighting.

1.4 Research Questions

1. How does artificial lighting affect the recognition of a place in the main city center of Addis Ababa?
2. How does urban lighting in the streets affects the perceived safety of the pedestrian in the main city center of Addis Ababa?
3. How does artificial lighting relate with identification of urban design elements in the main city center of Addis Ababa?

1.5 Significance of the study

This study highlights the importance of artificial lighting in Addis Ababa's streets and public spaces during night. It highlights the need for the government to experiment with new technologies and theories to improve night environment safety and economy it aims to create a more attractive city image at night. Professional designers and manufacturers of lighting fixtures should consider both manufacturing and architectural designs for nightscape and energy efficiency alternatives. Additionally, academia can test the relevance of artificial lighting and explore nighttime socio-economic and cultural endeavors.

1.6 Scope of the study

The study explores the impact of artificial lighting on pedestrians' safety perceptions in urban environments, highlighting negative perceptions. It examines built structures like streets (Churchill Road) historic buildings (Addis Ababa city administration building), landmarks and monuments (Yekatit 12 Memorial, Arat Kilo patriot’s memorial, Ethio-Cuba friendship park, Lion of Judah both located in La Gare and near beherawi theater), and public spaces (Meskel square) in the city center and four districts Piassa, Arat kilo, Merkato and La Gare focusing on nighttime environments created by urban light. It only also focuses on night time whereas daytime recognition test conducted to compare the impact of lighting illumination on place identification.

1.7 Limitation of the study

This study excludes nighttime activities like economic, cultural and social connections their impact on nighttime environment and eliminate vehicles light as a light source during data collection.

1.8 Organization of the study

The study report is divided into chapters: introduction, literature review, material & method, result, discussion & conclusion, and recommendation. First Chapter introduction provides an overview of the paper, including its background, objectives, research questions, significance, scope, and limitations. Second chapter literature review discusses the relevance of artificial lighting in urban environments for safety and place identification. Third chapter the research methodology is discussed, including sampling techniques, data collection methods, and accident indicating indexes. Fourth chapter the results are presented through summaries of field and professional participants, highlighting the role of artificial lighting in participant perception and place recognition and discusses the findings from the third chapter, and the study's changes and correlations with another research are ultimately covered. The fifth chapter discusses the research's conclusion and recommendations depending on the study's findings.

CHAPTER TWO

Literature Review

This literature review focuses on three topics: the meaning and definition of nightscape, why include it in urban design is important, and how urban lighting improves the aesthetic, social, and economic features of urban locations. Also, how is the sense of a location connected to the visual layout of space.

2.1 Theoretical Review

Background of light at night

There is a contrast in cities between daytime and night, with a constellation of light and shadow giving the city at night a distinct feature (Dunn, 2016) Also safety and security of a place during nighttime are very important for economic, social, and cultural vitality in urban areas (Petty, 2007).

Many hundred years ago cities, towns, and villages would have appeared nearly as dark as they can get glint of light might appear through doorways and windows in the early evening, but there was no street light and sort of (Brox, 2010), Now our nights flooded by light from inside and outside resulted from technological advancement.

Light with its function, aesthetic, and abundance changes lifestyle by providing extra working hours and making the night more habitable and make night no longer void and dangerous (Brox, 2010), It's essential to have a glimpse of knowledge and understanding of the evolution of light at night from ancient time to the present.

For millions of years fire blazed from pine torches, In the ice age humans in the Pleistocene period used stone lamps which are believed to be thousands of years old (Brox, 2010), as Brox noted as ages come by different materials have been used and lamps become improved by using shells, pottery or slippers and show development in its design (2010).

Romans were the first to develop bee wax candles, which have fragrant, clear, and steady flame and burn evenly, this expensive and rare bee wax was also used by the Roman catholic church for a long and by wealthy peoples, while the rest of the people were using fat-based lamps which are rendered from different animals. Different parts of the world use the

resource at hand to make light at night, In the West Indies, Caribbean, Japan, and South Sea fireflies were a source of light captured and kept in cages, some parts of the South Sea use candle nuts while Vancouver Island use dried salmon to make torches and others uses different oily animals to set a light (Brox, 2010).

Tallow candles were developed through time in different parts of the world by using animal fat, street lighting was nonexistent all over the world, cities, towns, and villages were dark and lifeless (Brox, 2010), and Renaissance Florence and Rome had no street light as Jerome Carcopino Wrote.

As Brox wrote, in Brilliant: The Evolution of Artificial Light Europe in the Middle Ages the end of the day was announced by bells and a curfew was set that announced to all city dwellers to stay put in their homes and finish their work (2010), this show that the absence of street light was an alarm for the ruling authority and a managing tool to control and manage its peoples.

In many fortified European cities, not only the gates were closed but the authorities collected all the keys from every resident to control the movement at night, Movement was allowed only with permission in the city like Paris in 1380, in addition to this every household were required to contribute men for the watch, these watchers have the authority to arrest and imprison those who broke the restriction (Brox, 2010), these watchers were using torches, portable lanterns, and stone lamps.

Overtime as cities grew, economic activity flourished within and abroad, this resulted in extended working hours into the night in 16th-century households were required by the authorities in large European and American cities to hang a lamp on their windows for a few hours after the sunset, this were believed to be the birth of public lighting (Brox, 2010). As nightscape grew so did different economic and social activities, which became common around 1700, man activity started to require and become light-dependent, in Many European and American cities authorities started to erect streetlights that replaced residents which is maintained by the city, paid from collected tax from the peoples.

There were some arguments in a few cities that streetlights can increase criminal activities, city like Birmingham and Cologne did not want to use new lighting because they believed

“as the fear of darkness disappears, depravity and illegality would increase” while other cities like to light their streets as much as possible believing dark neighborhood would be uncomfortable and full of criminals (Brox, 2010), sometimes with a dark countryside beyond, night in the city appear to be vast public interior with beautiful light in straight lane as theatrical illumination.

In cities like Paris, simple lanterns on the street have been replaced by oil lanterns which increase the brightness and the look (Brox, 2010), Night has Been uniform in all places it began to differ from place to place, city to city, and countryside to the city.

Through time the rhythm of the day starts to influence the city’s night, with the privileged and wealthy taking advantage, through this process cities start to develop their rhythm. Urban and urbane possess different human imagination as the illumination hour increases with its liveliness and glamour.

At the turn of the 19th century tallow and whale oil were replaced by cleaner, brighter mineral fuels in Europe and England. In the mid-19th century, gas-lit cities started to appear, Cities appeared to be avenues of light with an endless spark from light sources this emerging phenomenon express its civic order and its utilitarian nature.

Many light sources such as signs, shops and windows, restaurants, and the theater become vital for the city night to thrive, these illuminated play an important role in the vitality of the street in addition to improving economic activities, brighter places, and street create a safe environment to peoples this led some activities and events to be performed at night (Brox, 2010). Light at night not only extends the working hours but it exposes different human nature qualities and mysteries, this activity and occurrence create what is called “nightlife”.

After the development of electricity scientist called Sir Humphry Davy made a platinum filament to glow at the Royal Institute in 1802, This development later helped to develop an incandescent light bulb during the time of Tesla and Edison (Brox, 2010). During science expositions after its development improvements have been made that include direct and alternating current and improving the durability, efficiency, and cost-effectiveness of different lamps, which add a great value in brightening the streets in cities and residential use.

Lighting technologies were one of the most influential and transformative technologies in the 19th to 20th century, this technological development played a crucial role in nighttime behaviors, activities, image of a city by carving the space out of darkness and shaping urban and rural nightscapes not only providing illumination at night, this nighttime lighting can be perceived as a socio-cultural force affecting multitude ideas and practices that include safety, mobility od dazzling and operational society and civic and artistic expression (Taylor, 2019).

The two reasons that historians on nighttime illumination mainly focus on the 17th century onwards are first, the lighting technological domain unchanged and unimproved, and second the emergence of public lighting in the mid-1600s, for lighting technology to develop and related nighttime urban behavior societal change in Europe. Gaslight which was demonstrated in 1807, in London and later adopted in other parts of Europe and American cities, was perceived as modern progress that reduced fear of night and increased staying out later for economic and societal reasons (Taylor, 2019), electric lighting follows gaslight in the 19th century, becomes profound technological advancement.

Current estimates 3-6% increase in artificial nighttime lighting as cities expand globally, during the day and night urban spaces possess different characteristics that cause natural light and artificial light illumination (Vassilva & Kollhoff, 2006), due to this circumstance the image of urban night lack in meaning and identity.

Light at night in cities is vital for orientation, this lighting makes it possible to distinguish urban elements to differentiate one another (Santen, 2006), which is an additional value of light that serves to offer.

As lighting technology advances its primary purpose also evolves and adapts to its flexibility, once a rare commodity now its abundance in occurrence brings an additional attribute that improves the socio-cultural as well as economic tendency, especially in cities.

Character of a city at Night

During the night city functions and activities become less cause of the nocturnal presence and new character and ambiance settled in (Dunn, 2016), as night advance The urban offer diminishes the city shrinks and the city huddles around its historic centers (Gwiazdzinski,

2016), this phenomenon and exchange of character and meaning has its own perception of the city dwellers.

The arrival of the gas lamp and its development into electric light in industrialized cities in the 19th century changed and improved the perception and attitude toward night (Dunn, 2016), artificial light illumination dominated and controlled the night environment since then the public consciousness changed and darkness loses its power so nightlife become popular in many cities.

As objective night lighting in the city should create a pleasant environment, this sufficient light on the street has a positive impact on the feeling of safety. The atmosphere and ambiance that this light creates are difficult to encapsulate and set by rules because every scenario is different and unique in character.

In addition to involving safety, cost, maintenance, and energy consumption there are three factors to be considered in lighting design and illumination, the architectural, aesthetic, and emotional value that this light brings (Santen, 2006), Evaluating these 3 factors may render how artificial light illumination relevance in the society.

For centuries architecture and urban environment were planned to the day condition, Due to the availability and efficiency of lighting technology, artificial light integration has been developed recently urban lighting masterplan has started to develop that organize and define the criteria for urban lighting (Diana, 2016)

For many decades artificial lighting was only associated with the need for safety and security to Royal aristocratic society leisure (Neumann, 2002), but after the gas light lamp “lighting democratization” the public started to experience the prospect but this lighting streets were an impact on the economy and light pollution and authorities take measures by restricting into a certain time of the night, but further, this saving energy measures in addition to other factors led lighting technology to develop.

Lighting historical centers and heritage entail the rise of two questions, because many historical buildings and historic edifice precedes electricity invention it’s difficult to integrate, subjective interpretation and alteration is required and second many city centers and heritage buildings are important to the image of the city and culture of the society, thus

rules and regulations exists to be regulated and assessed, the relationship between monuments and its context is essential in the ancient city conservation, so lighting should include this premise (Diana, 2016).

Modern society is characterized by disruption of societal understanding of time, marked by individualization, change in working hours, and transcend the barrier of time, so this nighttime city requires attention and consideration as daytime, the economy of the day that takes an interest in the night contributing to the activeness of the night which is the final phase of "artificialization" of the city (Gwiazdzinski, 2016).

The new field of research in the past few decades has been developed around the nighttime environment of "night studies" (Straw, 2013), this field is multidisciplinary by nature it brings together town planners, historians, philosophers, architects, specialists in culture, communication and political scientists (Armenguad, Armenguad, & Cianchetta, 2009), (Cabantous, 2020).

Nighttime Economy

The first national conference on the nighttime economy was held in Manchester England in 1994, this conference brought many participants from researchers, nighttime entrepreneurs, artists, police representatives, and city authorities to think about the way the night should be regulated, measured, and designed (Gwiazdzinski, 2016), the "New York" nightlife association in 2004 study prove that billions of dollars in revenue have been generated by the night-time economy with employment around 100,000 peoples, many cities in Australia and other parts of Europe explore this economic dimensions.

The gradual technical innovation from candle to LED light creates a desire to control and influence the night, and the function of artificial light causes gradual changes in perception from safety to embellishment, This nocturnal identity has been created by illumination of buildings by "lighting designers" "artists" sculpting and decorating by using light (Gwiazdzinski, 2016), this light usage and display scale into different urban scales that express places character and act as an invitation to local and international tourists.

As Luc discussed cities like Lille, France launched a "character of the night" which reconciles the activities, city attractiveness, and resting residences and in many parts of

Europe urban night tourism has been improved by artistic discoveries and cultural life at night, such as “Night of the Arts” in Helsinki, “Night of the museum” in Munich, “White Nights” in St Petersburg, Paris, Rome, Brussels, Montreal and Naples and the “European nights of science” in Berlin and elsewhere was few examples, nighttime calendar become fuller and this attracts many crowds to enjoy and experience (2015).

The nighttime economy plays a crucial role by reshaping how tourists, visitors, and the local population especially university students experience the city (Grazian, 2009), Wan Min noted that Chinese planners summarized the content of urban nightscape, it contains illuminating technology, that includes lighting fixtures and knowledge and artistic effect which show how the form, color and texture and how this illumination rebuild and represent the building/object and human perception/meaning about it and finally, it has a character of urban landscape on its own (2002), elements of nightscape lighting are roads(that includes traffic roads and business streets) spatial nodes, buildings, green spaces, water features (river banks, bridges, and water sages), outdoor advertisements boards and other facilities (Hao, Lin, & Sun, 2004).

Marion Roberts, a professor at the University of Westminster made a great contribution to this topic by describing the expansion of the nighttime economy in British towns and cities in 10 years, Many English town centers have been transformed from being relatively deserted at night into being filled with a concentration of young drunken people out on street until early hours of the morning (Roberts & Eldridge, 2009), Cao Xinxiag, a Chinese professor in Heran University did a study on how the nightscape lighting affects mental preference by visual effect and he argues that human tends to be attracted by the light in the dark environment, so proper nightscape with diversified color and function can attract peoples during the night (2008), this can improve the aesthetics of the place and increase the length of night consumption by people.

Most cities in Europe, America and Asia have already noticed that good night scape accelerate the development of nighttime economy and socio-cultural activity of the peoples.

Nightscape in create the image of city

Lynch explained how mental image is created between people by the physical environment, as he pointed out legibility/imageability of people's behaviors and the physical should be the target in urban configuration. In his theory urban space can be understood as a "mental map" and physical composition of the path, edges, districts, nodes, and landmarks (1960), This clarity of composition connects people's behavior and the physical environment (Hongxiang, 2014), this increases the degree of how peoples understand their environment, pattern and structure and their relation to each other towards places and to relate place to place.

The nightscape of the city needs to have legible character (Hongxiang, 2014), even though the participants spent at night spent less time, there are different factors such as safety and security, night-time economy, and beautification of the city, the illumination of the city and lighting design must consider its urban elements and its imageability to resemble into daytime experience and presence.

The lighting of a city not only reflects its physical nature but also impacts its nighttime use and image. A city nightscape dominated by functional lighting, such as safe vehicle and pedestrian movement, outdoor activities, and property security, lacks visual qualities that attract and delight human visitors. There is a distinction between functional illumination and visual expression in city nightscapes.

In addition to Lynch's theory, other factors determine the image of the city such as geographical location, history, landscape, and human activities (Quan, 2013), in the history of Addis Ababa which is very vibrant and colorful with its adaptive capability, the city image plays a vital role in the perception of city dwellers and international viewers, proper lighting will easily show the spatial structure, enhance movement and visibility and safety of the peoples, the visibility of place and character increases the length of stay and promote the nighttime economy.

Safety and security at Urban Night

In urban areas street is an important element and its intersection is vital for shaping and for the identity of the city the city's safety is defined by the presence of humans at night and

nightlife plus the visual vocabulary of the nightscape element (Rezakhani, 2018), this increases the perception of urban space.

The space that offers a place for refuge and offenders and limits access for the potential victims to scape is considered to be unsafe and unreliable (Fisher & Nasar, 1992), visibility of others and visibility by others are the factors that are related to lighting and vision (Luymes & Tamminga, 1995), a question raises how much can I see and how much am I seen (Greene & Greene, 2003).

Visibility of others, the ability to see and observe one's surroundings, the ability to recognize and appreciate strangers to survey direction and areas and positions. Peoples develop a sense of safety if they have a good overview of the environment (Greene & Greene, 2003), An increase in illumination improve the speed of visual processing, improves discriminating details, increases the isolation of suspicious activities and objects (Boyce & Gutkowski, 1995)roper road lighting enhance the visibility of others and by others this increase the feeling of reassurance on peoples than darkened places, so road and street lighting has a potential to influence people to walk and cycle (Fotios, 2014).

The “cones” of light must overlap, as researchers demonstrate this is vital as the amount of light, average luminance, and uniform distribution of light exist (Santen, 2006), results from several studies show that proper lighting enhances reassurance on a pedestrian (Blobaum & Hunecke, 2005), (Matsui, 2007), (Vrij & Winkel, 1991), (Atkins, Husain, & Storey, 1991) and (Nair, Mcnair, & Ditton, 1997), an evident that brighter environment believe to be safe and secure for the peoples to walk and engage in physical activities.

The notion of “the 24-hour open city” or “the leisure city” not only play a vital role in the revitalization of industrialization cities but also in the growing activation of night in the everyday life of peoples in Western society (Nofre & Martins, 2017), the emergence of young hedonists who use the nighttime hours has cause for the new socialization to happen, new time meaning and perception and new spatialization of social relationship (Straw, 2013).

Late-night shopping and 24-hour industrial production were the results of the “mercantile society” in the nocturnal city (Bouman, 1987), urban activities and their spatial extension

mingled with each other and multiplied by urban lighting, in the 19th century the illumination of street transforms by an increase in the pedestrian, the amount of stay become long after dark, the stimuli that one experience has improve enormously (Gleber, 1999).

The night image laid over the modern city sky as a veil can be perceived as a counterpose to be electrified light as a blanket (Straw, 2013), which brings safety and comfort to urban life. Night is seen as both form and matter rather than territory not just time, the urban night is a world with its own population and activities an inverted substitute for the daytime city (Dewdney, 2004), the nocturnalization of cities has been identified by clustering and unravelling of nighttime activating of different practices (Straw, 2013), artistic forms and activities evolve through time so does the type of exhibiting and performance time that focus on night.

Through time the Night time environment has to develop beyond its functional need, with technological advancement and economic activity to an atmosphere and a different experience with its own urban fabric and collective experience.

Civic Architecture Space and their role

Urban public space has been the basis reflecting cultural values and social relations, this urban open space groups into three, domestic, neighborhood, and civic (Woolley, 2003), as Hongxiang noted for Nanjing city by performing and adopting Helen Woolley's urban Open space he manages to reclassify and categorized as domestic urban open spaces consists of housing frontage, private gardens and community garden, neighborhood urban open space consists of parks, playground, playing fields and sport grounds and schoolyards and civic urban open space which consists of pedestrian streets, roads, civic squares, historic districts, waterfronts, greenspaces and recreational zones (2014), this research focus on civic urban open space in the selected location in the city of Addis Ababa, which also focuses on urban physical elements of the city.

City architecture and civic public spaces are some of the elements that structure and define cities. These are the places where different civic culture flourishes, where people can interact and mingle and exchange ideas and beliefs, they are crucial places where collective consciousness and beliefs of the city are experienced and produced this civic architecture

and public space includes streets, squares, public parks, historic buildings, schools, city halls, hospitals, public structures like bridges, tunnels, pavilions, and others. Civic architecture conveys the way people live, interact, work, and adapt to their nature and shows local culture and economic life. These public spaces and civic architecture act as a catalyst to improve relation between peoples and society, peoples to places, and improves social cohesion and cultural renewal between societies (Civic architecture, 2019).

Environmental Perception Theories

The environment which is physical also perceived as temporal and can be seen as the organization of time, first as the large-scale cognitive structure of time how time is valued, linear or cyclic, future or past, and second as themes and rhythm of human activity (Rapoport, 1977), both peoples and their artifact should be included in the perceived environment.

Rapoport's 1977 study highlights that the interaction between an individual and their environment is influenced by their perception and interpretation of its relevance, which includes past stored information and present stimuli, influencing their current state of mind and characteristics (Warr & Knapper, 1968).

There are two manners in which humans extract information from an environment, first direct information from sensory experience of that environment and processed image/ perception of the environment about personal and cultural experience (Hongxiang, 2014).

The legibility of a city is related to the clarity of distinctiveness of a place and its identifiability from a whole, which helps the participant/ city dweller to better orient one’s location in space and time, this ordered environment, which is legible can do more than easily and quick movement but also serve as a frame of reference and a tool an organizer of activities, believes and behaviors (Lynch, The image of the city, 1960).

Environmental image is a two-way process between the observer and their environment, where the environment suggests distinctions and relationships between places, and the observer gives meaning to experiences. A legible environment with shared background and intention can create a common mental picture.

There is a strong surge developing in urban areas into adopting the characteristics of the day into the night, to enhance the image of the nighttime atmosphere, to preserve and enhance the visibility/legibility of a city by use of artificial light by considering illumination of water, identification of building, parks public spaces with its quality and identifiability (Santen, 2006), this shows that the collective understanding of peoples and different authorities has been developing in to exploit the potential of night.

This environmental image is analyzed into 3 components, its identity (its distinctive character and nature), structure (its structure to the observer and other objects and its frame of existence), and meaning, that the observer endows physical and emotional attachment, imageability the quality of physical that create an image and glimpse on any participant, this related to legibility and visibility (Lynch, The image of the city, 1960).

Kevin Lynch classified urban physical form into five elements, path (channel that the participant moves and circulates such as streets, pedestrians, and railroads) where spaces and places are observed and experienced with their relation and orientation, edge (boundaries between phases that break the continuity in physical form), district (a segment of a city with distinctive character from both inside and outside such as financial district, residential district), nodes (a strategic spot in the city which serve as a focus in the concentration of activity or path, serves as symbols in terms of physical form and social construct) and landmarks (a point of external reference, such as building, monuments, signs, natural features with their physical form and social meaning) (Lynch, The image of the city, 1960), the imageability of an environment is affected by social meaning, its function, history and even its name in addition to its place structure and its identity.

Any urban physical form categorized in the above 5 elements in one way or another, but careful and considerate juxtaposition of this element into urban design has a positive impact on the legibility of a city, The researcher argues that the artificial illumination/ lighting design should consider this notion to enable nighttime environment align even not better than day time experience and perception.

After industrialization light exists during both day and night, In the evening light is based on artificial lighting and its effects (Santen, 2006), this accent of light and its effect create a perceivable space and environment during the night, physical elements during the day such

as lamp post and street furniture may have a different expression, paving material, different facades, and other visual elements influence the light at night. The continuity and depth of urban space and characteristics can be disturbed by lighting conditions (Vassilva & Kollhoff, 2006), urban lighting systems can affect the perception and imageability of a place in direct and indirect ways, the night image of urban space can be enhanced or dilapidated by lighting design.

Cities at night are unique, with the play of light and shadows which is more distinct and spectacle when compared to daytime (Dunn, 2016), with different economic and socio-cultural activities at night this constellation of light and shadow becomes an identifiable character of many modern urban spaces.

Lynch's 1960 work highlights the importance of orientation in urban settings, which becomes more dramatic at night due to the design of landmarks, paths, edges, nodes, and districts. Artificial illumination and lighting design help to recognize these elements' existence and visibility, ensuring they are readable and experienceable in the daytime.

By definition night contrast day, which is related to darkness and fear (Dunn, 2016), but night happens with its exciting and dramatic existence by providing different experience and longevity to function (Neumann, 2002), rather than considering darkness as something negative peoples try to adapt and conquest with illumination to explore its potentials as well as to frame an alternative place of being. The nature of a place or an object should not be in contrast with each other during the day and night. As Dunn noted the primacy of architecture is perhaps not its body in light but the itinerant, fleeting shawl of darkness to create unwavering image and character, place identity and structure should consider each factor.

Imageability and readability of a place at night are directly related to the easily recognizable layout and structure of a city In European cities it is quite achievable to create unity and harmony at night by artificial illumination. Public lighting is no longer exclusively functional but also cosmetical and pleasurable (Santen, 2006), the illumination of elements of urban design like buildings, landmarks, boulevards, and natural features increases the identity of a place.

Light at night perceived to be in addition to “lengthening the day” and “turning the night into day” was popular in the late 19th century (Schivelbusch, 1988), a safety shield from the darkness and supernatural endeavors, This emerging experience and notions brought an aesthetic appeal of some sort with the technological advancement of lighting and related knowledge of light, the night starts to be considered and integrated into to urban design fabric. With its abundance and ever-existing nature artificial light becomes powerful to shape and recede the experience of the people. The lights in cities at night are incidental having many sources from traffic, different shops, restaurants, advertisement signs, residents, offices personal uses, and many others.

As Lynch argues in his famous book The Image of the City, the importance of visual design and visual structure in urban planning on the formulation of mental structure on the participant (1960), the structure that causes the cognitive map to appear is not limited to navigational domain but found on an abstract environment as well; this has implication such as reliability to the structure to learn every movement and navigation if its rich and vise verse when the visual environment is bad, he designed environment suitability to be adapted and learned and the system of adaptation by the participant (Chown, 1999), this environmental perception does not only constitute visual structure and design but rather multi-sensory experience.

The city is a conglomerate of human interaction and physical environment (Hongxiang, 2014), This interaction varies throughout the day, season, and distance, the perception of this environment and its interaction also change, which should be considered to be consistent and uniform. As Lynch's studies show from 3 cities Boston, Los Angeles, and Jersey City, the validity of the 5 building blocks of the city path, landmark, edge, node, and district, and their significance has been proven that enhancing the structuring of urban environment which vital for orientation, easy navigation and enjoyable experience (1960).

The recognition of these urban elements is critical to various illumination and lighting techniques for identifiability and readability (Hongxiang, 2014), to maintain its daytime hierarchy and interaction with people. To increase the imageability/readability of an environment the structure of an environment should reconsider visual clarity and identification of its components to create a holistic image (Lynch, The image of the city,

1960), The differentiation of these parts and continuity of the image must coexistence in both day and night. night.

The development of Lynch design attribute that contain the 5 urban design elements is an indicative on how humans are dependent on visual impact of his surrounding and imposed meaning by interpretation and perception and self-identification of the place (Hongxiang, 2014).

The development of Lynch's design attribute that contains the 5 urban design elements is indicative of how humans are dependent on the visual impact of their surroundings and imposed meaning by interpretation perception and self-identification of the place (Hongxiang, 2014).

Environmental perception theories reveal similar and generic design criteria towards the quality of the visual environment (Hongxiang, 2014), This overlapping of theories and scientific assumptions has a vital role in developing how structured and distinctive visual environments influence environmental perception on people. Again, this environmental perception is also directly related to lighting design at night in urban areas. As many studies show that humans perceive the environment as a general experience, the illumination of urban elements should not only focus on individual parts but also their composition, hierarchy, and clarity in this segment. segment.

Lighting Design and Urban Design

Many cities started to develop a night light master plan, which is a framework of lighting of walkways, buildings, and public spaces and to differentiate zones with a vision of congruous and harmonious manner in both day-to-day activity and festivals and national events.

Lighting masterplan is a discipline that focuses on urban lighting. This plan has many purposes to define and categorize functional and aesthetic criteria, increase quality and efficiency, and secure the safety and security of people (Ozkiper, 2020), this strategy and plan should also consider, energy cost, low maintenance cost, comfort of the citizens, aesthetics and attractiveness, to add value to architectural features and edifice, promote spectacular site to attract tourists and creating beautiful nocturnal atmosphere.

As Ozkiper noted that lighting master plan design should analyze different topics first, geographical features, traffic lanes, residential areas, green and leisure areas, waterscapes, and tourist destinations, describing existing lighting problems, lighting levels, fixtures, and color temperatures second, the city segment should be divided into zones depending on lighting requirement, purpose and required specification, for example, historic district/heritage areas, modern city/ central business districts so lighting system and techniques in this specific zone should be different and should be compatible with each other with lighting standard, hierarchy of zones and with their distinctive element (2020).

The form and function of public space and architecture at night is determined by artificial light, this illumination dictates and guides many pedestrians and cars along the roads and paths and also influences their speed. The light serves as a wayfinding tool at night, which reinforces the identity of the places.

There are international urban light codes and practices, with the potential framework that improves in economic and socio-cultural life of peoples in different parts of the world. The researchers try to review some of these known practice with their strategies and objectives.

International Urban Lighting Codes of Practice

Four lighting authorities are covered in this study, CIE (Commission International de Leclairye), the IESNA (Illuminating Engineering Society of North America), BSI (British Standards Institute), and CIBSE (Chartered Institute of Building Service Engineering). This research tries to see their guidelines and focuses on urban lighting.

IESNA, established design standards and codes of practice for both interior and exterior lighting systems, the objective of this lighting guideline is to “assist all who take or influence decisions that affect the safety, security and pleasantness of urban and rural districts” (Illuminating Engineering Society of North America, IES lighting guide: The outdoor environment, 1975)IESNA guidelines have 5 components,

1. Aesthetics and its impact on visual perception, the aesthetic/beauty and visual comfort of a lit environment are a tribute to good lighting, enhance the imageability of the urban area at night. Visual hierarchy, compositions and scale play an important role in the

structuring of the night scape (Illuminating Engineering Society of North America, IES lighting guide: The outdoor environment, 1975).

2. Environmental issue of urban lighting, “lighting pollution” and “light trespass” has been the two problems that are related to lighting, the amount of light emitted in the environment should be minimized to reduce the visual dis comfort and its impact on environment (Illuminating Engineering Society of North America, IES lighting guide: The outdoor environment, 1975).
3. Technological aspect of well-lit environment, the character and temperature of the light should be considered to alter the visual appearance as well as the perception of peoples (Illuminating Engineering Society of North America, Lighting for exterior environment, 1999).
4. Lighting for different urban element, urban elements with their distinctive and unique nature require different lighting texture, color and composition. This guideline distinguished the lighting design practice for architectural and landscape elements, it’s also separating spaces in to town, city center, urban residential district and rural districts depending on exterior lighting illumination requirement. The guideline also addresses on urban lighting elements such as, buildings, bridges and viaducts, individual features and leisure and entertainment areas, it also proposes an ideal situation for floodlight lighting technique on architectural and landscapes (Illuminating Engineering Society of North America, Lighting for exterior environment, 1999).
5. Economic issues that arise from urban lighting, the lighting system should be examined in terms of its practicality and maintainability including its cost (Illuminating Engineering Society of North America, Lighting for exterior environment, 1999).

British Standards Institute, is a national standards body of the UK that develops standards and standardization for society and business They draft lighting codes for outdoors that can be utilized by designers to light the environment (Hongxiang, 2014), This publication had 9 parts where the 9th part is of relevance in urban lighting.

Besides the prevention of crime and improving safety in vehicular and pedestrian movement, light can “bring a sense of order to a space where it is lacking and enhance those buildings of significant architectural merit” (British standards institute, 1992). To achieve balancing

and visual hierarchies' urban elements illumination is required. The lighting master plan should address this factor,

1. Architectural scene and urban landscape should promote by lighting design and equipment.
2. Provides safety and security for pedestrians
3. Urban light should be commensurate with character and volume of vehicular traffic
4. Advertisement illumination should be controlled
5. Control and integration of other installation in to the master plan
6. Control of the road and direction signs in relation to other illuminated materials
7. Control and blend lighting sources with their compatibility
8. Control temporary and special illumination such as in festivals and urban celebrations
9. Protection of residential zones from light pollution
10. Protection of installation from accidents
11. Maintenance of the installation

CIBSE AND ILE, their main focus as a guide to the good urban environment, the main objective of this guideline is to derive a coordinated nightscape by reconciling various lighting codes of practice (Chartered Institute of Building Services Engineers & Institution of Lighting Engineers, 1995)CIBSE and ILE noted that the benefits of good lit environment include ambiance to create desired atmosphere and mood, emphasize unique areas character, safety created by sufficient light, security reducing night time crime, orientation illumination of urban elements to aid recognition of place, promotion of an environment to boost tourism and increase pride and spectacle (1995).

This guideline also addressed the lighting requirement of these spaces, urban fridges an area which is located between a built-up city and the countryside where artificial light brought a significant effect, towns smaller in scale than cities and lower human activities, and cities where human concentration and human activities are high.

Lighting masterplan projects selected examples

Reviews of this example would illustrate how urban lighting and urban design relate to achieving a better-lit environment and show how codes of practice have been implemented according to the desired outcome. The criteria for the selection of this project are based on

site context, variety of execution techniques, and available information towards their evaluation.

Lyon – Heritage preservation

Lyon is a French city, situated fringed by Alpes to its East and massif center to its West, divided by river Saone Rhone River. It served as a cultural and architectural hub bridging both the Mediterranean and Europe. In 1998 UNESCO World Heritage Award Lyon for its architectural richness and ancient town configuration and its uniqueness (Hongxiang, 2014). Lyon was the first European city to implement a lighting masterplan, since 1989 the city of Lyon targeted to enhance its original heritage and create a pleasant and functional public lighting theme. This Lyon illumination is not only restricted to the authority but to various interested bodies Figure 1.

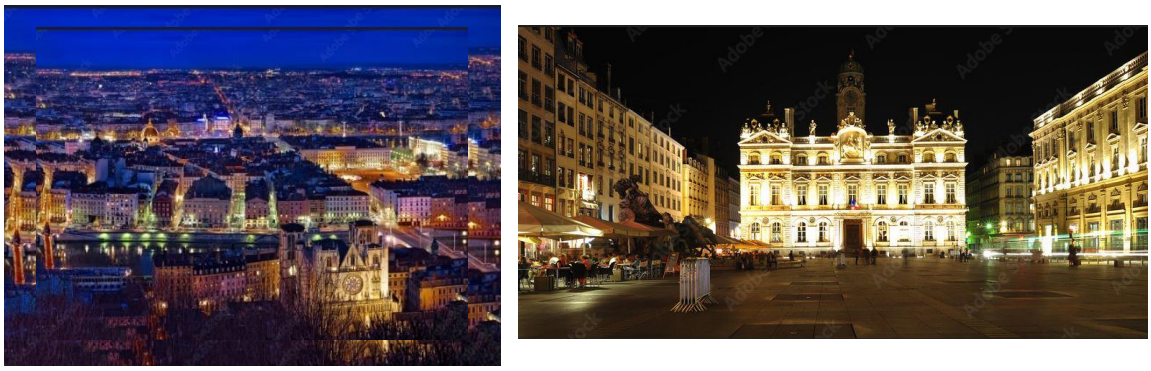


Figure 1.Lyon night with artificial light illumination, integrated with urban design

Lighting design objectives and principles

The main objectives of Lyon lighting master plan were while maintaining safety and security and functionality development of sets of guidelines that highlight the historical character of the city.

Lyon Lighting Strategies

1. Spatial division and clarity, different zones were identified with their individual character and lighting requirement, this zone includes public spaces and parks, architectural monuments and landmarks. Since the bridge played an important role, building in either side of the river has been maintained for special illumination.

2. Urban elements and their forms, the masterplan consider urban elements to clearly express their character and identity with distinctive lighting system, this urban element includes historical monuments, parks and landscaping, bridges and building along the river Saone. The code of practice states the illuminance level for each urban elements to highlighting the architectural character of the individual element.
3. Individual designing development of historic image the lighting plan identified different areas for the specific lighting schemes and the overall holistic image in the illumination.
4. Relation of lighting and time, the masterplan aim the lighting scheme to change through time to provide dynamic environment and to led the city evolve with time.
5. Quality of lighting fixtures, utilization of advanced technology, the masterplan committed to use up to date technologies and to allow the space/ the environment to further experiments on urban lighting ideas and technological advancements of the lighting fixtures should minimize sky glow and light pollution and follow up the performance of low efficiency fixtures.
6. Annual seminars and public education of lighting the city of Lyon committed itself for the development and excellence in urban lighting, annual light festivals and seminars to engage the public in to the common understanding of lighting design.

Hong Kong Victoria harbor lighting - Tourism

The Victoria harbor, popular spot with locals and 18 million tourists, to illuminate the spot Victoria harbor lighting plan has been commission by the Hong Kong tourism to display light and laser-based show on the prominent building Figure 2.

Figure 2. Victoria Harbor during the night that shows the skyline of Hong Kong

Lighting design and objectives and principles

Previously the lighting of building was random and focuses on individualizing this resulted chaotic skyline and cause light pollution, therefore the masterplan related each element to another and minimize individual lighting of building that reduce light pollution.

Hong Kong Lighting Strategies

1. Selected viewpoints and illuminated landmarks, the choice of illuminated structure was focus on their visibility from chosen viewpoint and angle, landmark building was chosen for their architectural integrity such as Hong Kong Shanghai bank central Barracks, Sardinic House and Hong Kong convention and exhibition center. The selected architectural landmarks have their own characteristics and identity and the plan then analyzed the way that each building complemented on the whole visual balance on the skyline there were well spaced in relation to each other between these prominent landmarks, so the unlit space between this illuminated structure create contrast and enhance the overall composition and skyline together with the water body the skyline reflection in the waterbody further enhance the aesthetics of lighting display.
2. Automated lighting control system, automated lighting control system used for façade lighting for creation of dynamic skyline, this increases the vibrancy and highlight sensorial stimulation
3. Vertical extension and light shows, integrating lasers in to the overall plans, installed in to selected buildings to enhance the experience this laser and stella ray projection allow active integration with the audience.

Alingsas, Sweden lighting masterplan – Lighting and functionality

Alingsas, a 35,000-person European town with historical wooden architecture, has been awarded for its best-kept historical center. The lighting masterplan aims to boost tourism and create a visually pleasing and functionally illuminated townscape Figure 3.

Figure 3. The street of Alingsas Sweden which has clear definition and character

Lighting design objective and principles

The main objective of lighting master plan was to enhance the diminished spirit of this unique image of the town, in addition the masterplan highlights on points of visual interest as one move through the town.

Alingsas Lighting Strategies

1. Sensitivity to architectural program and desired atmosphere with an objective to re-establish the visual link between the main town and the mill and to revive the romantic atmospheric that the mill possessed.
2. Functionality and complementing the landscape, in order to utilize the footpath or cycling route, lighting level should be sufficient to recognize both the environment and other peoples. functional lighting integrates well with nature to highlight the greenery and avenue at night.
3. Complementing the architectural elements, the light masterplan enhances the architectural character by introducing façade light for contrast, to complement with the character of the building, while highlight its unique architectural features and character sodium lamps were used.

Using lighting technology, the use of colored lighting allows the nightscape to be visually interesting with variety and balance the use of advanced lighting technology enables the lighting to complement with architectural intent.

Coventry, lighting masterplan – City Planning

Coventry was a main trading center for cloth in the 14th century, many of its famous building and city wall was destroyed in the Second World War, post-war restoration of damaged city fabric and architectural edifice was monotonous and concrete was mainly used (Hongxiang, 2014). In the year 1970 to 1980, the decline of the British motor industry had a huge impact on its economy to revitalize the degenerating urban fabric and to integrate with new development architects, light designers, and associates were invited Figure 4.

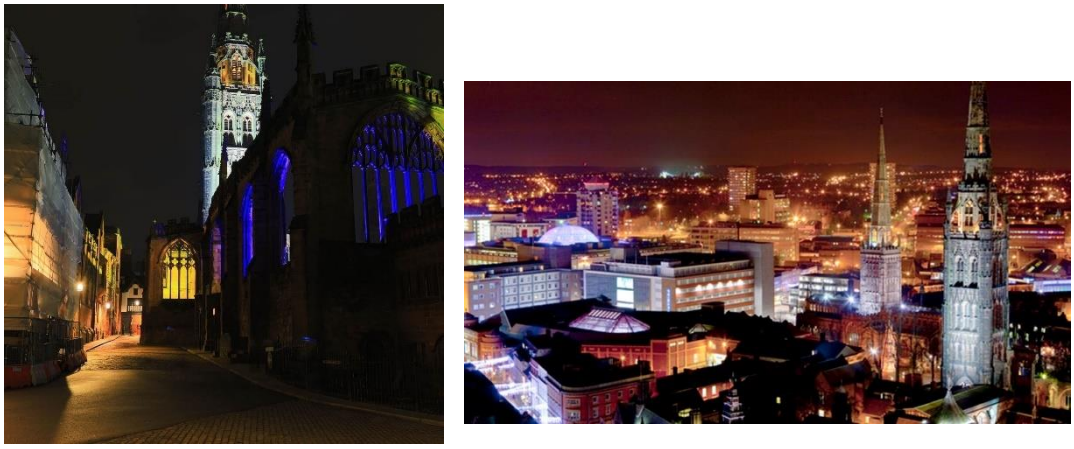


Figure 4. The street of Coventry with unique character and urban design element.

Lighting design objectives and principles

Coventry lighting masterplan recommends on the guidelines that highlight projects in architecture, structure and spaces that are culturally significant to Coventry city. The lighting guideline formulating to fulfil functional requirement of lit space while protecting the richness of Coventry urban-scape and the light design also composed of different districts with their distinctness.

Coventry Lighting Strategies

1. Zonal clarity, the cathedral district was vital for cultural and historical image of Coventry city, so the primary consideration of this master plan was to visually connect St Michael church, Christ church and Holy Trinity church. Another zone was Spon street with its traditional architecture, warm lighting was used to keep its atmosphere.
2. Preserving architectural character, in order to preserve the architectural character and highlight the materials and architectural forms warm color were used to illuminate and integrate lighting fixtures to minimize visual obstruction during the day. The visual

connection of the 3 spires of Coventry extends the image of the cathedrals vertically. Coventry council house an architectural landmark, the masterplan highlights its architectural features with warm light, the visual hierarchy with lighting illuminate gives the landmark a noticeable and distinctive image at night.

3. Visual interest and sequencing, visual rhythm was created by using connected pocket space and use of warm lighting. Different lighting technique illumination were used to create visual variety and highlight on the sensory experience lighting fixtures were kept low to minimize direct eye contact and creating visual discomfort.
4. Quality lighting environment and luminaries utilized urban centers are a composed of nodes, landmarks, pathways and their identification highlighting these elements were helpful in the ease of orientation and to easily and freely moves, the masterplan guideline conceptualized around this ease of identification of elements and highlighting the landmarks such as church and Coventry city council.

Zurich- Enhance Local Identity

Zurich, the largest city in Switzerland, a global center for banking and finance, which lies at the northern end of the lake Zurich.

Lighting design objectives and principles

The master plan lighting of Zurich focused on the overall image of the city with sensitive white light, that uses mainly urban studies and customized projections. Urban designers respect the dialog of buildings during the night, the well-adjusted light level in public, corporate, and sacred elements create a human scale that is deeply linked to the cultural identity of the place (Schielke, 2017).

Modest illumination is neither an expression of regional tradition nor for tourism, but instead its acculturation of a unique style, In Zurich, lighting masterplan building achieves sensitive quality light than using floodlighting technique, which causes light pollution.

The designers created a plan “plan Lumiene Zurich” after travelling and get experienced from Lyon and may involve parties were involved in this 10-year plan which is launched in 2004. This plan includes, definition of respective zones and essentials visual guidelines with a main focus on illuminated space than staging luminaries instead of prescribing were light in the plan focus on the interplay of with darkness Figure 5.

Figure 5. Zurich at night time, careful lighting system that enhance the local identity.

In order to do this, lit areas were located, and prominent structures like as bridges, city halls, churches, and buildings were chosen to improve the cohesiveness and character of the city. By lowering excessive light outputs, this strategy helps prevent light pollution and glare for walkers. The bridge and specific buildings are the focus of the lighting, which minimizes the visual noise produced by the reflection of water. The light emphasizes the spatial impression and creates a dynamic reflection on the bridge's sides and underside, while the surrounding area around the river is kept dark to accentuate the contrast.

Due to white light used for all buildings, the inner city is united in a neutral color. In buildings such as the Zurich opera house sophisticated façade projection technique is used.

2.2 Contextual Review

Addis Ababa was established at what was thought to be the epicenter of the Empire. The growth of Amharic speakers was centered on the southern border, and Menilek conquered these regions in the nineteenth and twentieth centuries. Addis Ababa links the dynamic interplay between Ethiopia's climate regions, the daga and the wayna daga, which are fundamentally based on altitude. This means that Addis Ababa links a local logistical trade between two regions, each of which grows differently in terms of crops. The climate could then separate them, allowing the Cypriots to better manage their resources. This approach to agriculture has been instrumental in reducing the poverty and promoting sustainable development in Ethiopia. The country's agricultural sector has been a key driver of economic growth and development in the country (Garretso, 1974).

The period from 1855 to 1911 as a key period in modern Ethiopia, adopting the term Modernization as a category of analysis. This is based on a truly real process, although it is distinguishable from others such as development or industrialization. The Ethiopian case is, in material terms or infrastructure, barely tangible. However, from the perspective of a cultural penetration and, above all, the construction of the State, it takes full force. The independence achieved from the Battle of Adwa and the stabilization process that followed is the clear frame of reference (Jove I Domínguez, Jonathan, n.d).

In 1887, Minellik II and Empress Taitu created the city of Addis Ababa. Beginning with the city's founding, the history of road construction in that city also begins. In 1902, Minellik II built the nation's first two highways, which ran from his palace to the English Embassy and from Addis Ababa to Addis Alem. The emperor brought in the first roller in 1904, and several people pulled on it in order for it to work. Additionally, Emperor Minellik is credited with being the first to bring automobile technology to Addis Ababa in 1907 (global african history, 2010). when he imported two vehicles. Modern road building in the nation is closely associated with the reign of Emperor Haile Sellase. Many contractors were assembled to build roads under Haile Sellase I's administration Addis Ababa, Ethiopia's last imperial capital, was established in 1886 as a mineral springs resort for the royal family and nobility.

Emperor Menilk II made it the capital in 1892, and by 1896, nobility began building permanent homes. The city attracted foreigners, artisans, and merchants, and its future was established in 1907 (world investment news, 2013).

After the Battle of Adwa, Menilek attempted to control foreign minorities in Ethiopia, similar to how he did with certain Ethiopian population groups. The independence of these minorities depended on their work and spokesmen's qualities. Menilek had a running battle with British, French, and Italian citizens over their attempts to extend protection over Greeks, Armenians, Indians, or Arabs. The success of Menilek in controlling these minorities reflects the respect Ethiopians had for foreigners. However, in 1905, 1907, or 1909, all minorities experienced population fluxes due to unemployment and railroad contract stoppages (Garretso, 1974).

During the Menilik era in the late 19th century, Ethiopia was first exposed to electricity. Around 1898, Atse Menilik received the first generator to light the palace Figure 6. In addition to using generators, Atse Menilik built the first hydroelectric plant on the Akaki River in 1912 to offer electricity to newly founded Addis Ababa's tiny companies. As a result, the palace's power supply—which had previously only been available to tiny factories—was expanded to include public areas and important thoroughfares close by, Coneil, an Italian business, took over the production and distribution of electricity during this brief occupation. The business increased the power supply to the larger towns and put generators in various locations. Following the Italian expulsion from Ethiopia in 1941, the creation of the Enemy Property Administration organization assumed control of the production and dispersal of power to the general populace, among other functions. An entity that had been granted ownership of enemy property changed its name to Shewa Electric Power in 1948. Even with its small capacity, this was nevertheless able to boost the electricity supply in Shewa and the other administrative regions. Its name was changed to "Ethiopian Electric Light and Power" in 1955 due to its new purpose. The government-appointed Board of Directors assumed oversight and control of the organization shortly after its founding. The Ethiopian Electric Light and Power was renamed the "Ethiopian Electric Light and Power Authority" eight months after it was founded. In addition to producing,

transmitting, distributing, and selling electricity to Ethiopians, the authority was also involved in any other lawful business incidentals or appropriate that was determined to advance the authority's interests or increase the value of its properties (Tadesse, 2024)

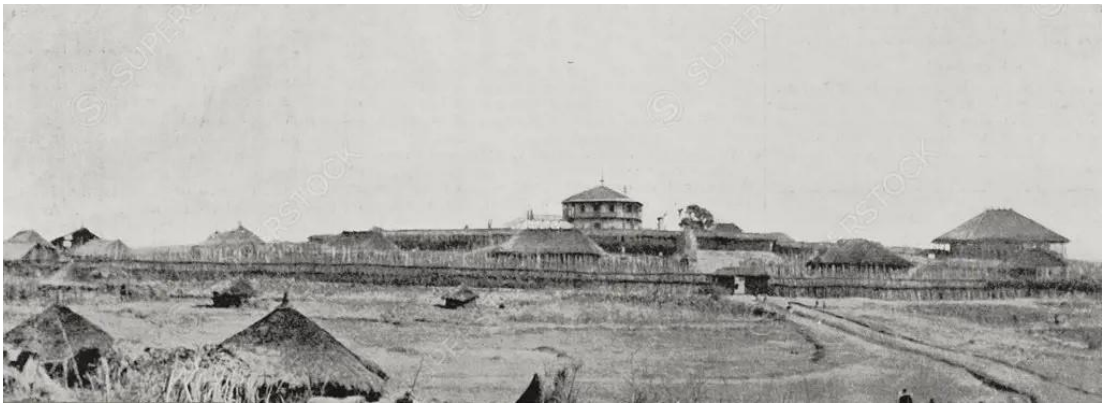


Figure 6. The imperial palace of Menilik II, view of the Ghebbi

The Ethiopian emperor's declining health led Britain to seek colonial membership. Menelik, dissatisfied with France, agreed to establish a railway company, with the Ethiopian government as the shareholder. The company would pay the emperor 2.3 million francs with a 5% interest, and construction work would begin a year later. The emperor would provide the firm with property from the capital city to the border, and French business control over the subsurface. The Ethiopian government would retain control over the subsurface (Kozicki, 2015)

Addis Ababa experienced a significant economic boom in 1926 and 1927, with the middle class increasing the number of buildings and importing European furniture. Urbanization and modernization increased during the Italian occupation, with subsequent masterplans designed by French and British consultants focusing on monuments, civic structures, satellite cities, and the inner-city. The Italo-Ethiopian masterplan focused on urban structure and accommodation services, later adapted by the 2003 masterplan. Italian architects collaborated on a new master plan for Addis Ababa, aiming to create a beautified colonial capital city. The plan focused on the city's general architectural plan, with two preparations approved: Le Corbusier's plan and Guidi and Valle's. Corbusier's plan featured a grand boulevard, while Guildi and Valle's plan focused on fascist ideology and monumental structures. The plan connected Arada/Giyorgis with a railway station. (Wikipidia, 2024)

In 1942, Addis Ababa established a mayor and council, establishing the "Road and Building Works" department for city roads construction and maintenance. This department remained until the Haile Sellase regime was replaced by the Derge regime, with no significant organizational change observed. (Wikipidia, 2024)

The shift from a centralized command economy to a free market economy in 1987 was one of the biggest developments in the economic field.As a public enterprise established for an indefinite period by regulation No. 18/1997, conferred with the power Authority, the Ethiopia Electric light and Power Authority was renamed the Ethiopian Electric Power Corporation (EEPCO) in 1997 to accommodate the new environmental changes. In line with the government's policies and priorities for social and economic development, the corporation's purpose is to produce, transmit, distribute, and sell electric energy. It also intends to carry out any other relevant activities that will help it fulfill its mission (Belayneh Tadesse, 2018)

The Addis Ababa City Roads Authority (AACRA) was established by the Addis Ababa city government in 1998, the role of this authority is to plan and maintain the city road network including the street lightings (AACRA, n.d).

According to AACRA legislative framework AACRA has the power to require that private developers must construct the roads and all related facilities including street lighting, in accordance with AACRA requirement and under its supervision. This authority develops street lighting manuals with three objectives, to provide AACRA with design standards which are in line current best international practices, to provide maintenance framework which will ensure that the best performance of the existing and future street lighting installation is sustained for the lifetime of the equipment and to provide guidelines for the cost-effective upgrading of the existing street lighting installation.

Ethiopian Electric Power Corporation (EEPCO), has the power to supply electricity in every part of Ethiopia, street lighting must comply with the safety and metering regulation of the EEPCO as per advised in 2002 the tariff of the street lighting was 0.3970 birr per kilowatt hour (AACRA, n.d). Before the formation of AACRA the responsibility of street lighting installation, construction and maintenance of street lighting fixtures was lie for EEPCO after its establishment many existing street lights that have become the responsibility of AACRA

are mounted on poles which also carry open wire power distribution system and therefore remain the property of EEPCO.

All electrical equipment, including street lighting, is subjected to the effects of the environment in which it is installed. The major climatic and environmental factors that can affect street lightings includes, fog, rainfall and insects, atmospheric pollution, wind, temperature and radiation. The lighting manual classify the roads in illumination levels, category V lighting, lighting which is applicable to roads on which the visual requirement of motorists is dominant, e.g. main roads and category P lighting, lighting which is applicable to roads and outdoor public areas where the visual requirement of pedestrians is dominant e.g. minor roads, car parks, pathways, etc. (AACRA, n.d) Table 1 shows the street hierarchy with illumination level where, Overall uniformity of road luminance (U_o) and Longitudinal uniform of the road surface luminance (U_1).

Table 1. Summary of Illumination of the street depending on street hierarchy

Road category	Minimum Illuminance initial(lux)	Minimum Illuminance maintained(lux)	Minimum overall-Illuminance uniformity (U_0)	Minimum longitudinal Illuminance uniformity (U_1)
PAS (20 -45m)	20	15	0.33	0.5
SAS (20 – 40m)	7.5	5	0.33	0.5
CS (15 – 25m)	-	-	0.3	1.75
LR (<10m)	-	-	0.3	0.85

International best practice currently recognizes two types of poles specifically for roads or streets in addition to electricity distribution poles those are, rigid poles, poles that not design to break away or yield when struck by a vehicle. They can be used in location where there

is no risk of vehicles colliding with them, most of Addis Ababa's lighting posts are rigid and fragile lighting post, designed to break away, yield or otherwise absorb the impact of an impacting vehicle to extent that the resultant deceleration forces on the vehicle and its occupants are reduced to within specified acceptable limits (AACRA, n.d). Figure 7 shows the lighting post that the AACRA used in different part of Addis Ababa.

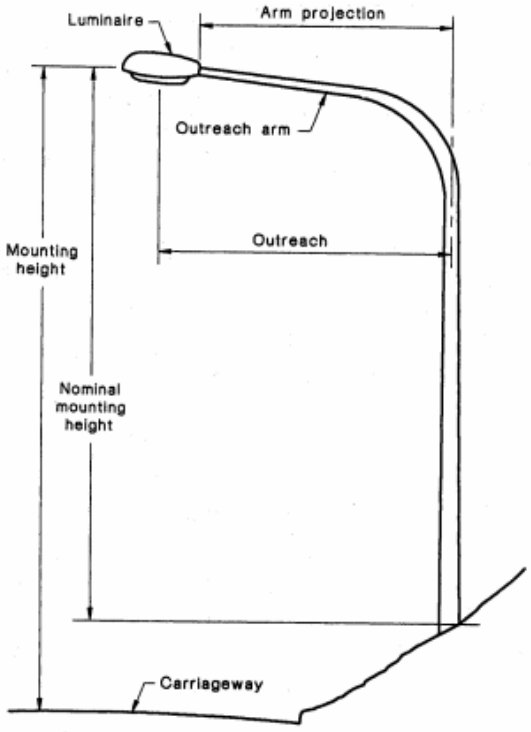


Figure 7. Common lighting post used by AACRA

The newly finished Central Business District presents Addis Ababa as a cutting-edge, internationally competitive metropolis that complies with international norms. Addis Abeba's political and economic aspirations are projected through the visual inter-referencing of its built environment with other global cities, including Shanghai and Dubai, as well as its iconic structures. (Reqiq insights, 2023)

Addis Ababa's modern skyline is largely due to the expansion of financial institutions, who have built towering skyscrapers. However, real change requires a holistic approach. Financial institutions should embrace sustainable and socially responsible investments, promote access and inclusion, and support community initiatives. This will ensure their

impressive facade matches a modern and responsible business approach. (Reqiq insights, 2023).

Addis Ababa's vibrant night lights, a blend of traditional streetlights and modern LEDs, are a sight to behold. However, the city's rapid development and expansion, coupled with the city's growing population and increased energy demand, contribute to the growing issue of light pollution. The Addis Ababa Museum, a landmark showcasing the city's cultural and historical heritage, and the Ethiopian National Museum, which houses significant artifacts and archaeological finds, are among the most notable examples of the city's growing light pollution. This issue affects both humans and wildlife Addis Ababa's evolution requires balancing modernization with preserving its unique identity and social fabric. With careful planning and development, the city can flourish like a flower, becoming a true African gem. (Night Earth, n.d).

The AACRA street lighting manual mainly focuses on the technical aspect of street lighting system and its framework (utility lighting) mainly, but it lacks integration with architectural edifices and urban design elements such as, paths, edges, district, landmark and nodes according to Kevin Lynch this are the recognizable elements of any given city.

CHAPTER THREE

Materials and Methods

This chapter mainly explains how the study was conducted, the applied methods and techniques in data collection, and the reasons as to why they were used according to the research aims and main objectives of the study.

3.1 Description of the study area

Addis Abeba, Ethiopia's capital, is located between 8° 50′N-9° 5′N and 38° 38′E-38° 52′E, at an elevation of 2015 to 3150 m a.s.l. It is located at the base of an isolated mountain known as Entoto, which was the city's origin. Its proximity to the equator means that the temperature is rather stable from month to Figure 8. Except for the northern flank, which is constrained by topography, the city has expanded in every direction. It presently houses 30% of the country's urban population, but its population is steadily expanding. Addis Abeba has a total population of 2,738,248 as of the 2007 census, and the current forecasts predict that figure will continue to climb, reaching 12 million by 2024 (UN HABITAT, 2006).

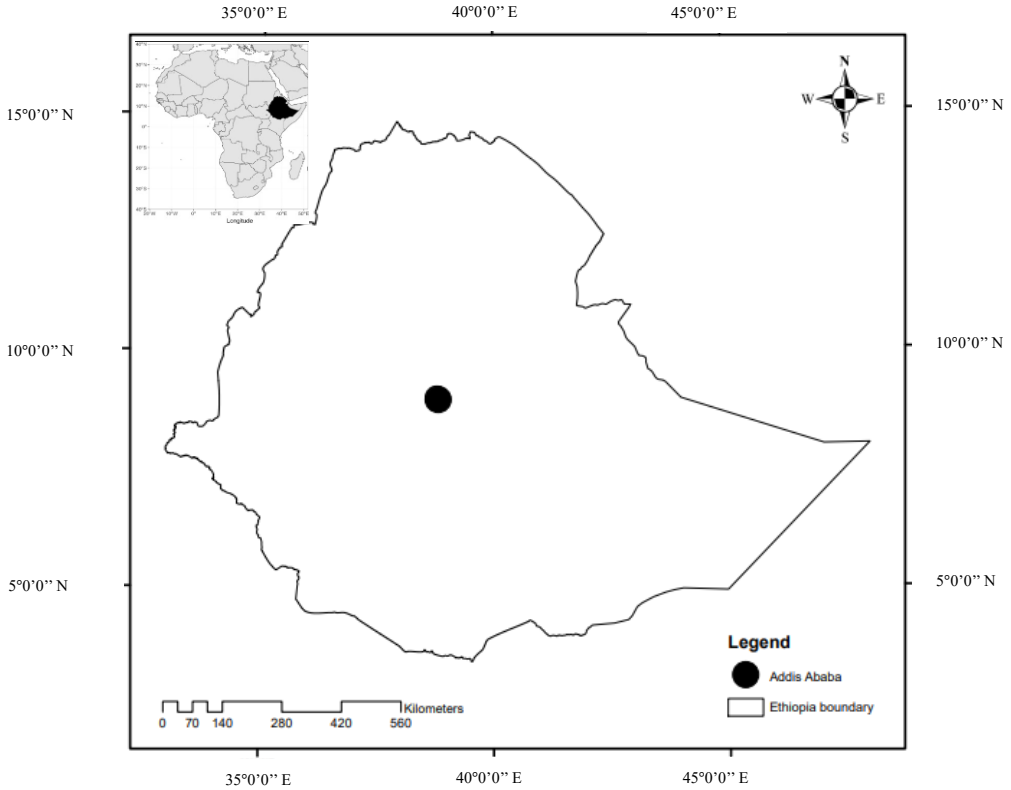


Figure 8. Location map of Ethiopia and Addis Ababa.

Lynch's study picked city centers in order to obtain a diverse sample, with Boston chosen for its character, New Jersey chosen for its lack of shape, and Los Angeles chosen for its scale and gridiron (1960). In this study, the city center of Addis Abeba was chosen because it is historical, has a particular character, identity, and form, and has a well-defined territory to investigate and analyze Figure 9.

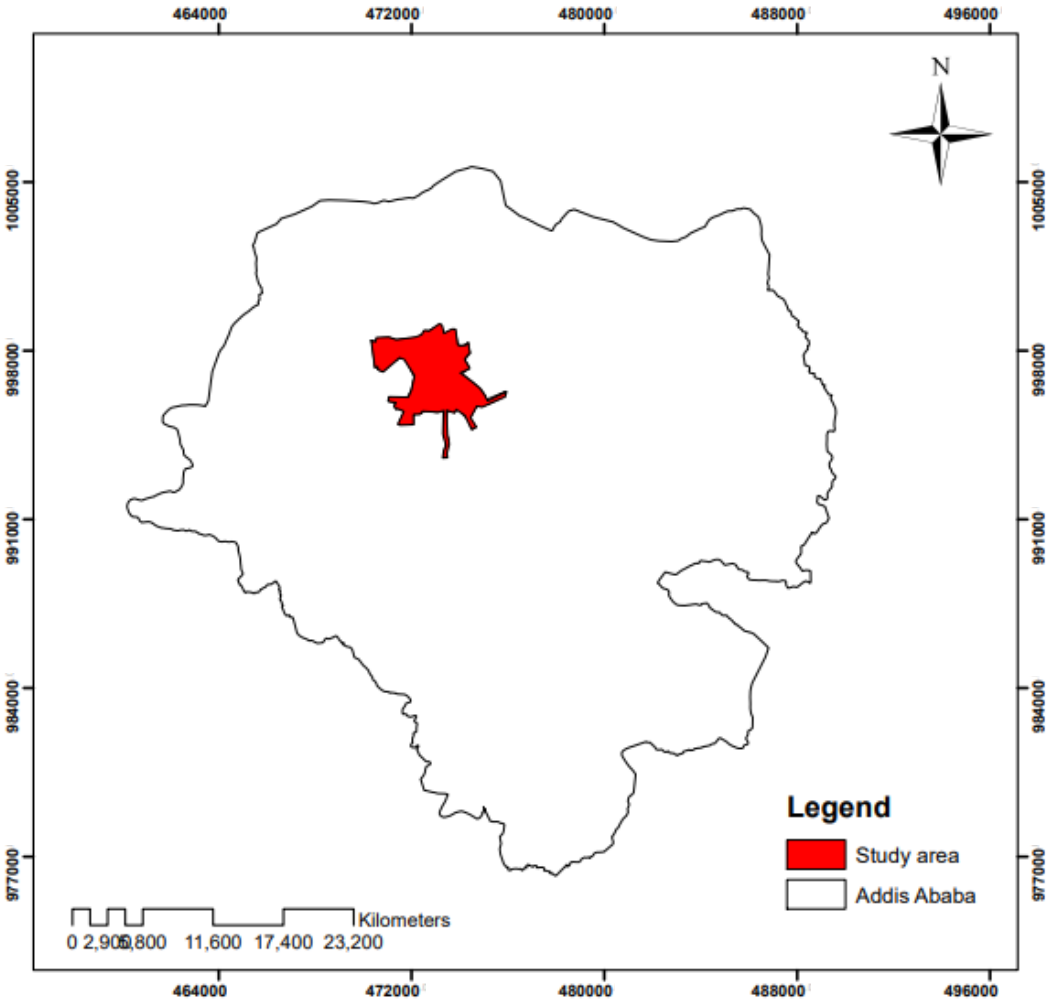


Figure 9. Location map of the study area (main city center of Addis Ababa)

Figure 10 depicts the chosen landmarks, historic buildings, and streets in the research region for the photographic interview. Both daylight and nighttime photographs were shot from the same location to better compare and contrast the location. Eight areas were selected for this study, Yekatit 12 memorial monument, Arat Kilo patriot's monument, Addis Ababa City

Administration building, Churchil road, Ethio-Cuba friendship park, Lion of Judah near Beherawi theater, Lion of Judah in La Gare and Meskel square.

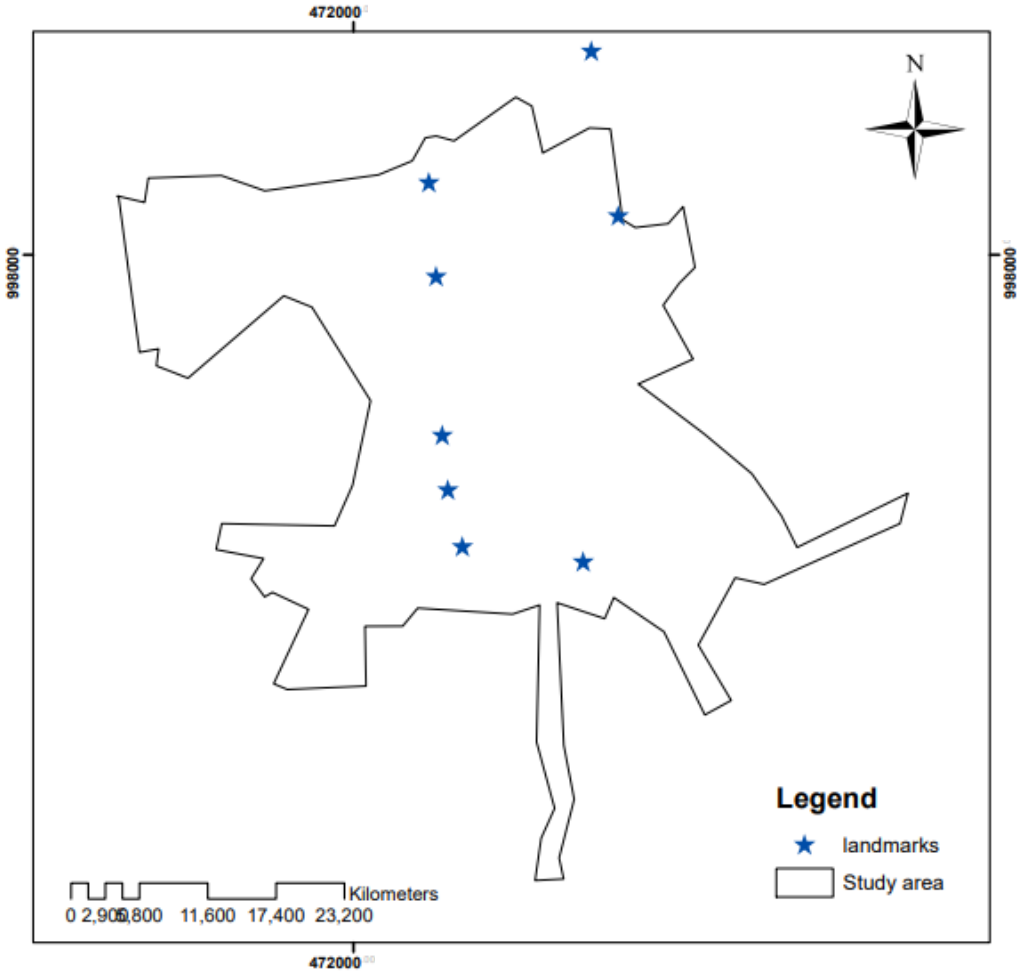


Figure 10. Location map of selected landmarks for photographic interview

3.2 Research Design

Research design refers to the overall strategy used to conduct research which defines a concise and logical plan addressing established research question through the data collection, interpretation, analysis and discussion of this data. This research design defines the study qualitative research that is mainly concerned with establishing an answer to how and why events and phenomena interrelated.

This study employed an observation and conduct verbal and photographic interview and primary data utilized for this analysis, interviews from participants helps to full contextual analysis of the night tie events and artificial lighting implication on night environment.

Data was collected from 4 selected files in the main city center of Addis Ababa. This study therefore used descriptive study to provide a picture and situations persons and events and their interrelation in this study the role of artificial lighting and its impacts, since it places emphasis on a contextual analysis of participation and condition. The time and financial constraint factors were also considered in selecting this research design. This study it in to consideration in depth analysis of people's perception of safety and security and place identification in relation to artificial lighting that affect the visibility of surrounding.

3.3 Data Source

Primary data type used for this research which is based on the three specific objectives as described in chapter1, section 1.4, for comparison and contrast between daytime and nighttime place recognition to observe the impact of artificial lighting places photographs were used ,to observe the impact of perceived safety of pedestrians verbal interview were utilized and finally to observe the effects of artificial lighting on urban design elements direct observation takes place with the help of photographs in the selected 4 areas, that includes streets, open spaces, landmarks, monuments and historic buildings.

3.4 Method of Data Collection

This study uses qualitative data gathering methods, including observation and open-ended interviews, to describe meaning, narrative, and observation of events and persons, focusing on specific objectives as described in chapter one Table 2.

The interview involved two questionnaires administered to volunteer field participants and professionals in government offices. The questionnaires aimed to understand nightscape meaning, urban lighting relevance, perception of distinctiveness at night, safety at night, and lighting design drawbacks. The volunteers also discussed the location's similarity during the day and night, highlighting potential discrepancies due to artificial illumination.

Photographic interviews and image recognition tests were conducted on both on-site and professional participants to gather visual information on the location's identity during the day and night.

Observation: To better observe and experience the nighttime urban environment, test walks were used on the action area. Nighttime photographs were taken in various parts of the selected site in Addis Abeba's main center, which consists of different urban elements with distinct character and cultural significance on the city center's safety and imageability. Secondary data was gathered from international and local street lighting standards, urban lighting planning guidelines, and past nightscape research and studies.

Table 2. Summary of data collection

Participant	Method	Occasion	Type
City dweller	Interview	🌙	Field interview
	Photographic interview	🌙	Field interview
Professional	Interview	☼	Office interview
	Photographic interview	☼	Office interview
Nighttime photographs	Observation	🚶	Content analysis

The selected sites were photographed at night using a Canon Rebelt T7 24.1-megapixel camera with an 18-55 lens Figure 11.

Figure 11. Data collection tool digital camera24.1 megapixel

3.5 Method of Data Analysis

This research presents an analytical framework that integrates theoretical, foundational, and conceptual aspects of nightscape, focusing on its definition, background, relevance, and

relationship with variables, addressing its concept, visual assessment, and urban environment quality.

Discourse analysis: a qualitative and interpretive way of examining texts and descriptions, discourse analysis was used to analyze the verbal interviews of both on-field and professional participants.

Comparative analysis: a process of comparing sets of items and contents with their similarities and differences; this analysis was used on the photographic interview/image recognition test from daytime and nighttime photographs, and t-test statistical tests were used to test the statistical significance of the difference.

Comparative and content analysis: these two analysis approaches were utilized in the observation, with a set of local and international urban lighting standards and a comparative analysis on daytime and nighttime environment in both test walks and photograph review.

Discourse and comparative analysis: these two analysis methodologies were used on a document assessment of AACRA street lighting guides with international standards and past studies on urban lighting.

Analysis procedure

The study involved volunteer participants and government employees completing questionnaires to understand nightscape meaning, urban lighting significance, perception, safety, and lighting design problems. Volunteers discussed artificial lighting causing differences in nightscapes, while professionals discussed their involvement and Addis Ababa's city image contribution. To review and analyze the data obtained from each participant independently, an excel document was produced, and pie charts and bar graphs were used to clearly represent the results.

A photographic interview was conducted by placing color-printed 8-day time photographs in a left column of an A3 paper. The left column was copied into a second paper, and the 8-night time photograph corresponded to the randomly ordered left element. Participants were asked to identify the first A3 paper element, match daytime urban items with the nighttime matching picture, and discuss difficulties in identifying their nightly existence. An Excel

sheet was created to evaluate participant responses and demonstrate the statistical significance of daytime and nighttime identification differences using t-test statistical tests. Observation: Following a repeated test walk in the research area and content analysis of the photographs collected, descriptive and narrative analyses were utilized.

CHAPTER FOUR

Results and Discussions

4.1 Results

Interview on field participant

The on-field participant discussed the role of urban lighting in enhancing pedestrian safety, economic activity, beautification, and identification. Results showed that 83% of responses related to safety and security, 9% to enhance economic activity, 6% to beautification, and 2% to improve place identification Figure 12.

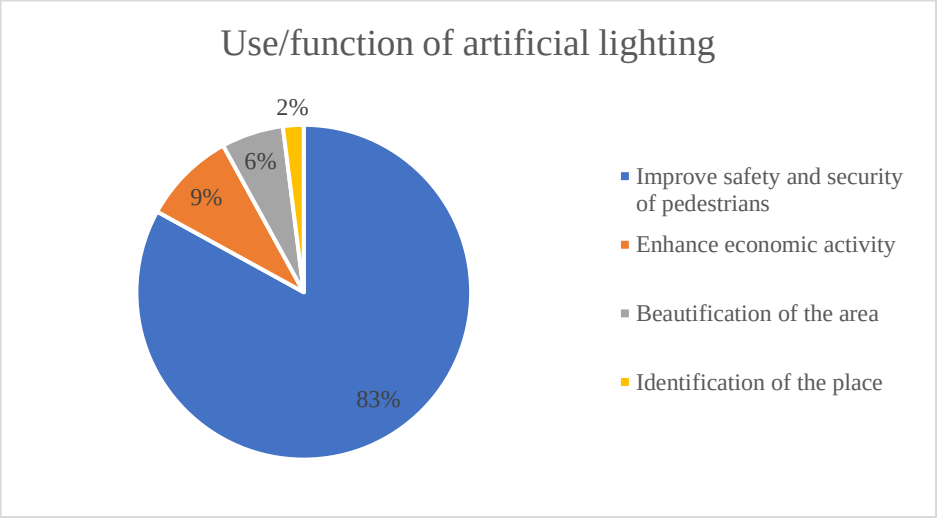


Figure 12. Summary of artificial lighting function

Table 3 shows the summary of the feedbacks from the pedestrians on artificial lighting impact on place identification on each selected 4 areas, with La Gare being the highest 100% and Merkato 13.3% above neutral.

Table 3. Summary of artificial lighting impact on place identification

	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
Piassa		3	4	7	1
La Gare				4	11
Arat Kilo			5	7	5
Merkato	6	5	2	2	

Figure 13 shows the summary of pedestrian feedback on the contribution of artificial lighting on perceived safety of study areas, this shows Merkato has 86.6% below average and La Gare with 73% above the average, which shows the La Gare Street has more visibility.

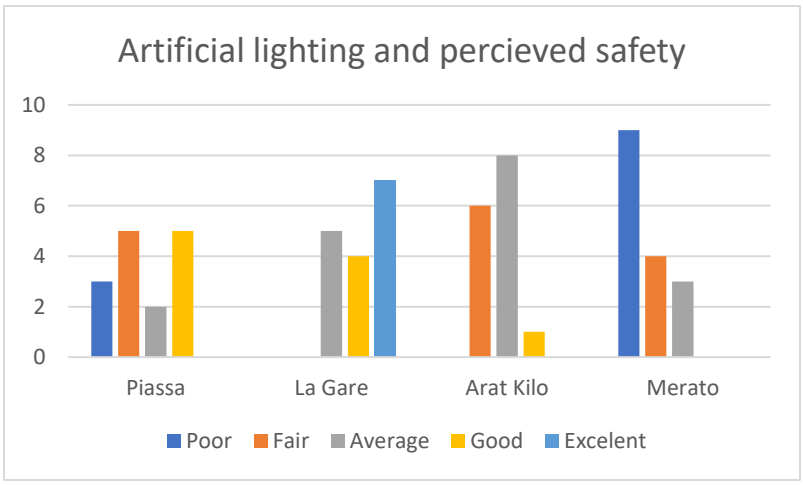


Figure 13. Summary of the evaluation of artificial lighting.

Using a Likert scale with five categories—extremely hazardous (0–20), unsafe (21–40), average (41–60), safe (61–80), and very safe (>80)—the participants in the field were asked to rank the respective location out of 100. The results are summarized in the relevant region in Figure 14.

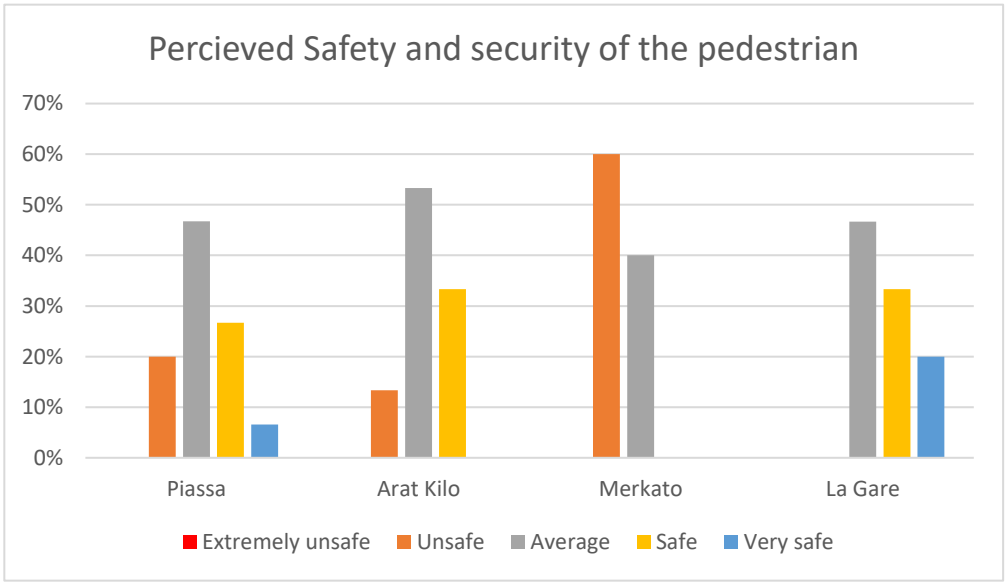


Figure 14. Summary of perceived safety of the selected area by artificial lighting.

Participants were asked to identify places from four selected sites, with places with a memory of more than 10% being considered for method 3 observation. A summary of these places is shown in Figure 15.

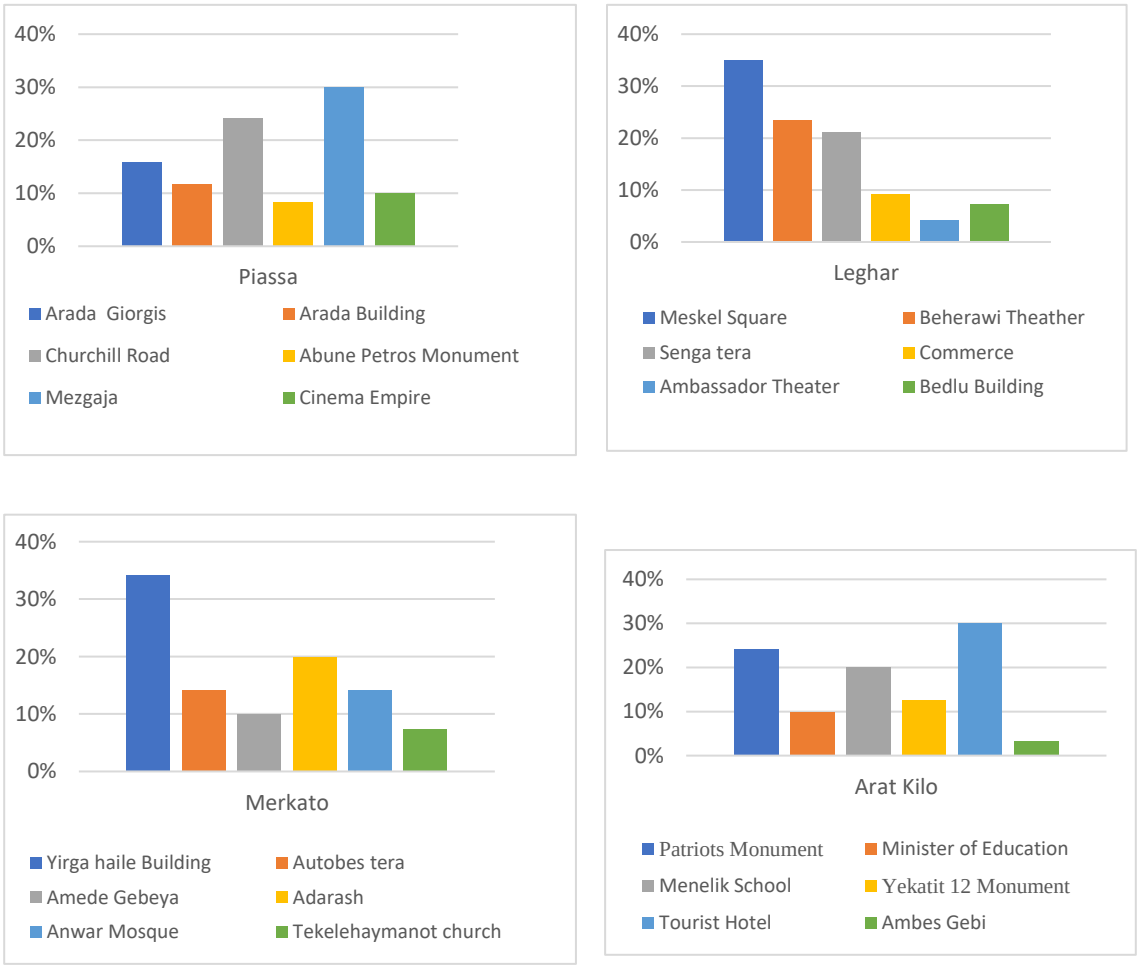


Figure 15. Summary of identifiable place of each selected study area.

The on-field participant was asked to rate their frequency of experiencing the street and place on a Likert scale, determining their familiarity with the location and their ability to compare the night and day environment. Figure 16 illustrates their responses in each relevant place. Participants were asked to compare the nighttime environment and daytime of their corresponding site, with responses considered from rarely 10% above.

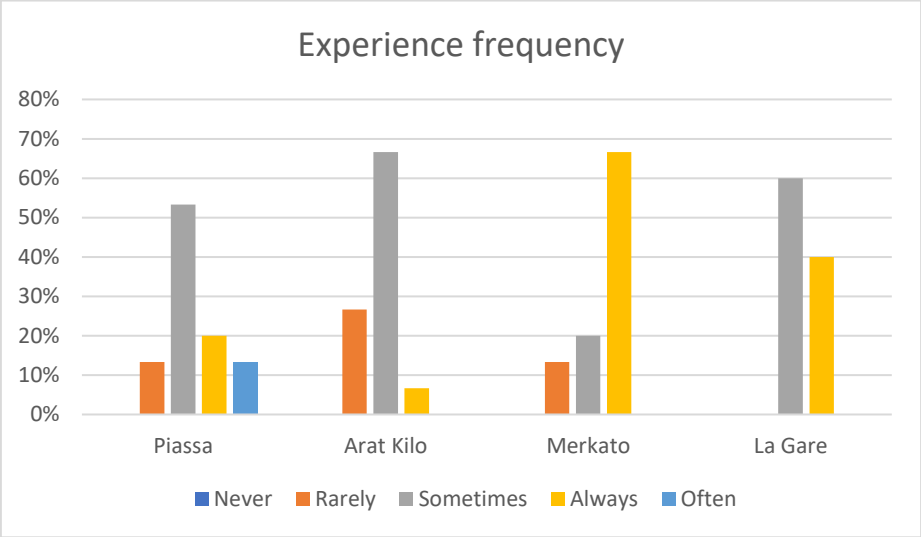


Figure 16. Summary of frequency of the participant on experiencing the study area.

Lastly, using a Likert scale to assess their answers, the on-field participants were asked to compare and contrast the nighttime and daytime environments of their respective areas: Dissimilar, Slightly Dissimilar, Slightly Similar, Similar, and Very Similar. The summary of their response, which discusses how metropolitan illumination affects a place's similarity throughout the day and night, is shown in Figure 17.

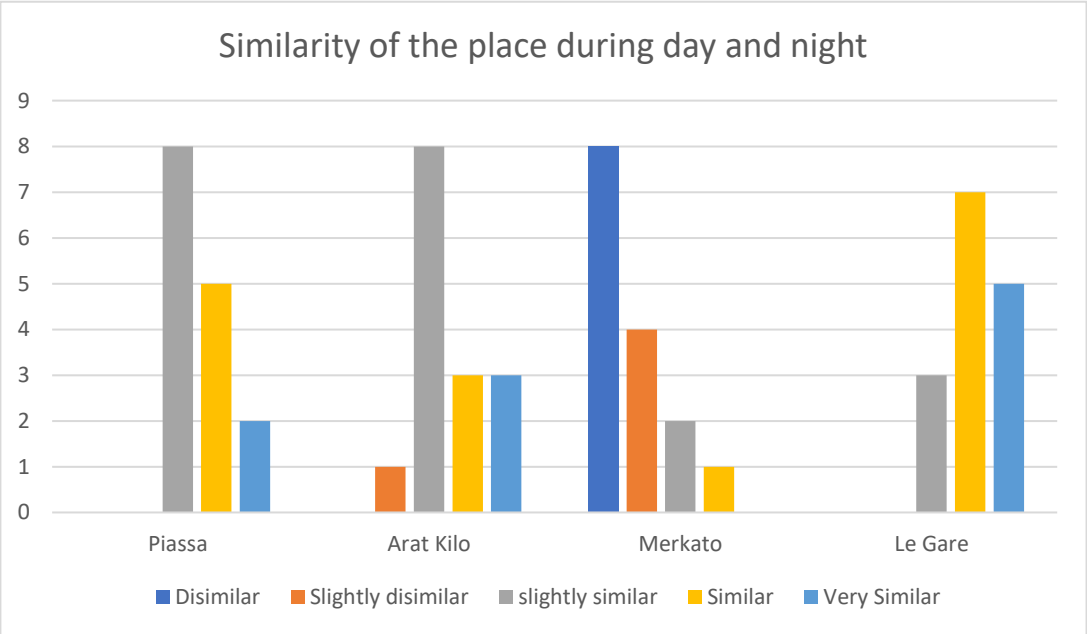


Figure 17. Summary of the resemblance of the study area during the day and night time.

Interview on professional participant

The majority of professional participants (93.33%) agreed that nightscapes were created by artificial light, while only 6.67% were unaware of the phenomenon Figure 18. This indicates a significant understanding of the phenomenon, as the majority of professionals were aware of the concept. This highlights the importance of understanding the phenomenon.

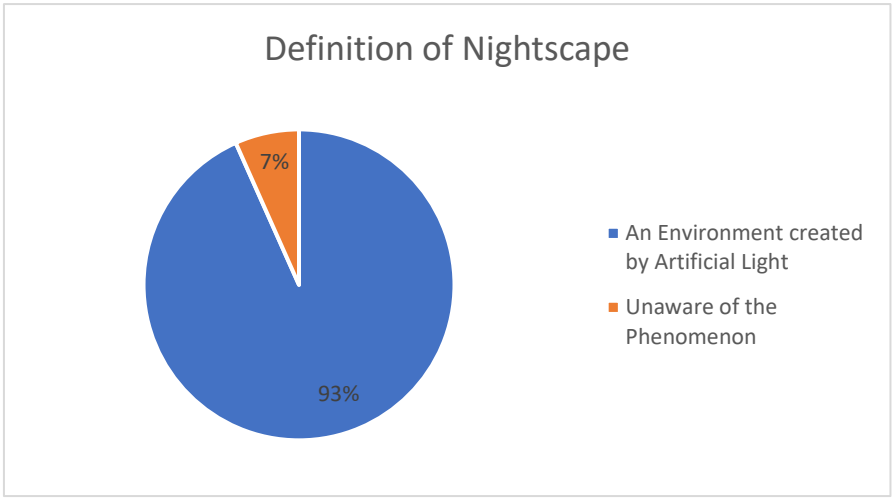


Figure 18. Summary of the feedback on the definition of nightscape by professionals.

A professional participant discussed the role of lighting in cities and its impact on the urban environment. About 80% of the responses mentioned safety, security, beautification, enhanced movement, vision, and crime reduction Figure 19. This highlights the significant impact of urban lighting on the physical and functional aspects of occupants.

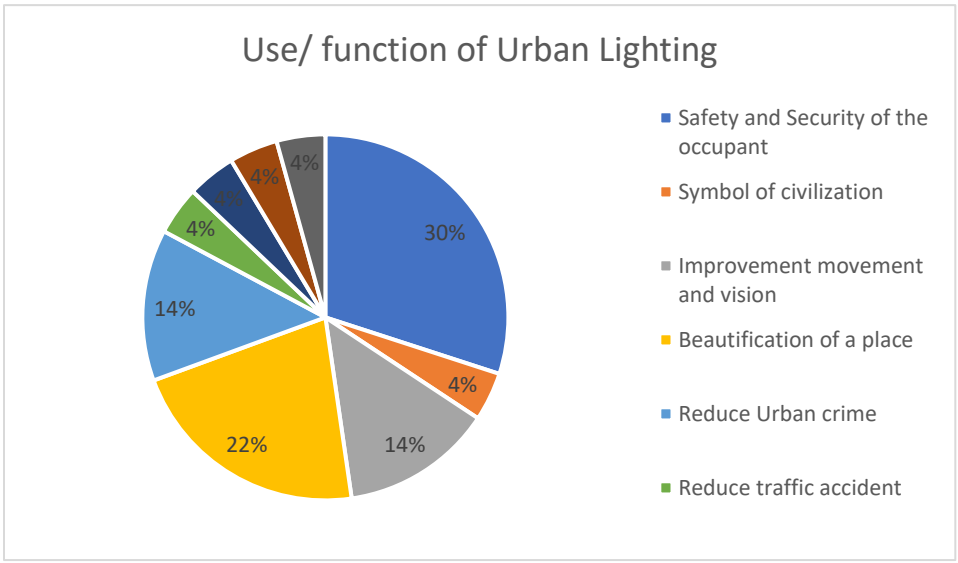


Figure 19. Summary of function of artificial lighting.

Table 4 shows the summary of feedback from the professional participants on the impact of on both safety and place identification in the selected study areas, the result shows that Merkato being 80% below the average whereas La Gare being the highest 73.3%.

Table 4. Summary of evaluation of artificial lighting on the contribution to safety and place identification

	Poor	Fair	Average	Good	Excellent
Piassa		5	7	2	1
La Gare		2	3	8	3
Arat Kilo		7	5	3	
Merkato	4	8	3		

Participants discussed the drawbacks of urban lighting during the designing phase and performance, highlighting issues such as lack of pedestrian consideration, high energy demand, inappropriateness, and visual discomfort Figure 20. During the performance, the effectiveness of lighting fixtures was questioned, and vandalism of cables and fixtures was also discussed.

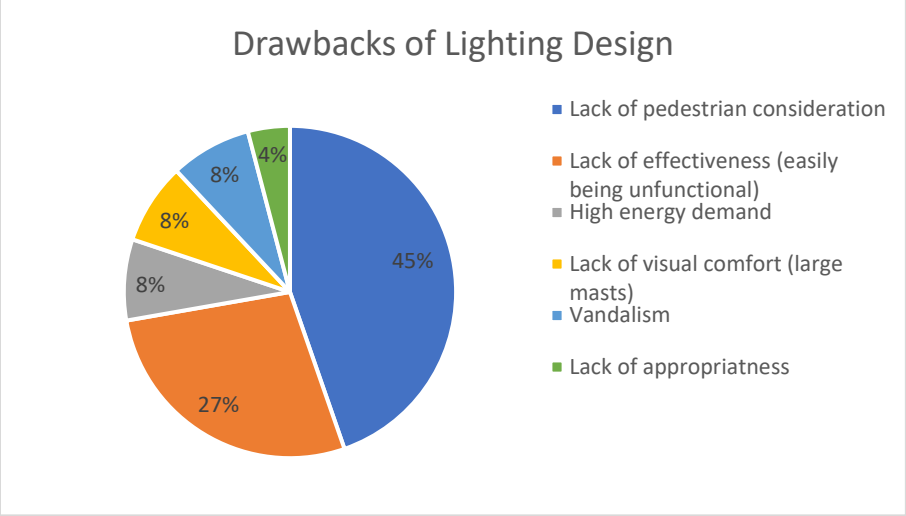


Figure 20. Summary of drawbacks on urban lighting in Addis Ababa.

The study revealed that over 50% of professionals in Addis Ababa believe that the current urban lighting system, particularly in the city center, is insufficient, as indicated by the summary of responses Figure 21.

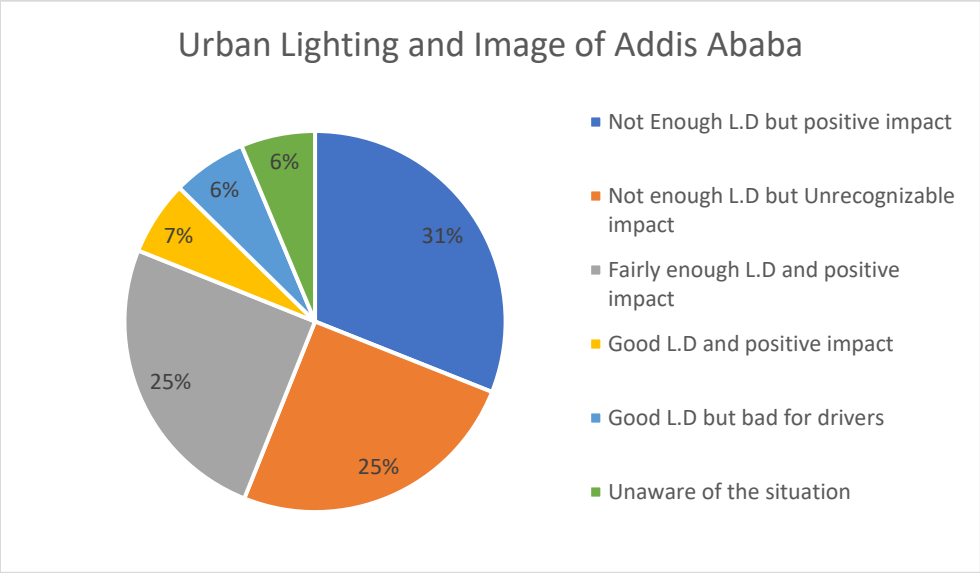


Figure 21. Summary of the evaluation by professional's city image by lighting.

Yekatit 12 Memorial

Yekatit 12 Memorial monument, constructed during Emperor Haile Selassie recognizable city feature located in 6 Kilo Figure 22, was identified by 54 out of 60 on-field participants (90%) from daytime photographs. Of these 54, 19 (35%) recognized the monument correctly, with 14 (73.68%) correctly identified and 5 (26.32%) with doubt, of the professionals 15, questioned in the office, 11 (73.3%) recognized the monument correctly from daytime photographs, with 4 (36.33%) correctly identified Figure 23.

Figure 22. Yekatit 12 Monument daytime (left) and night time(right)

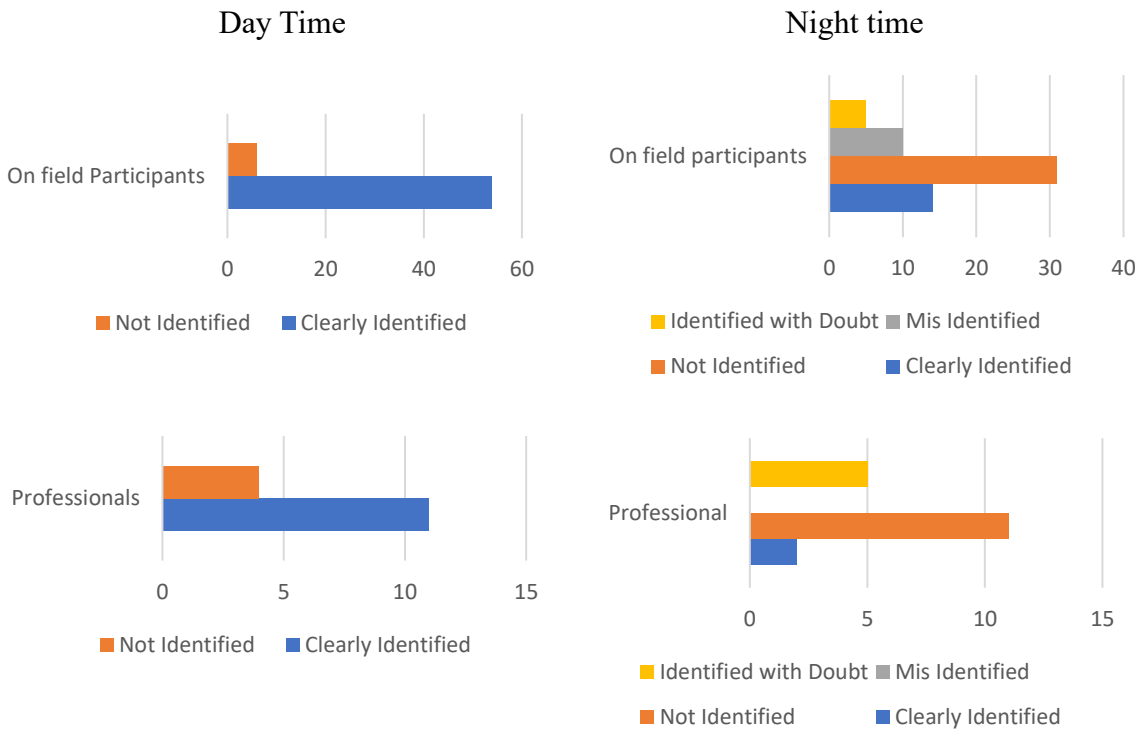


Figure 23. Summary of day and night time recognition Yekatit 12 memorial monument

Arat Kilo Patriots Monument

The Arat Kilo Patriots Monument, built during Emperor Haile Figure 24, was identified by 57 out of 60 on-field participants (95%) from daytime photographs. Of these 57, 28 (49.12%) recognized the monument correctly, with 23 (82.14%) correctly identified and 5 (17.86%) with doubt, of the professionals 15, questioned in the office, 12 (80%) recognized the monument correctly from daytime photographs, with 4 (33.33%) correctly identified Figure 25.

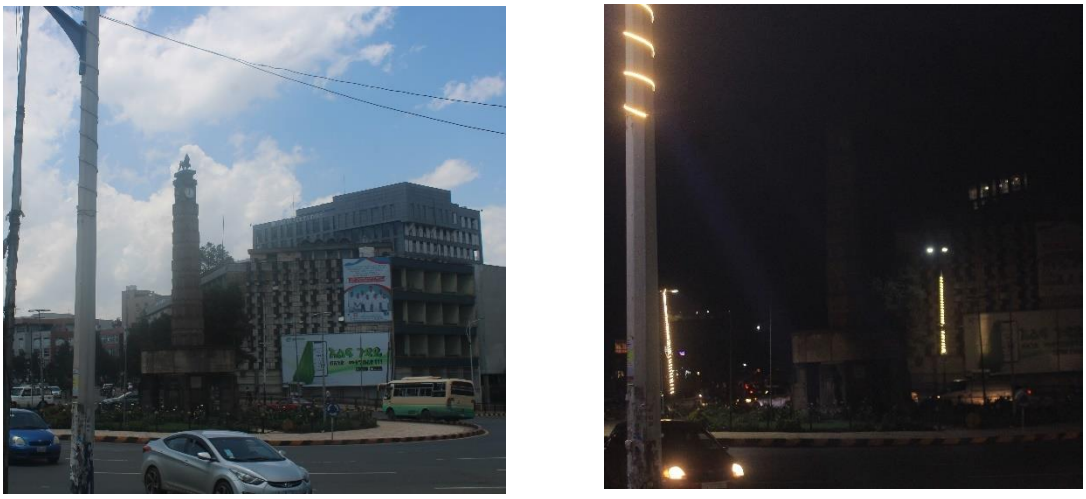


Figure 24. Patriot memorial monument day time (left) and night time (right)

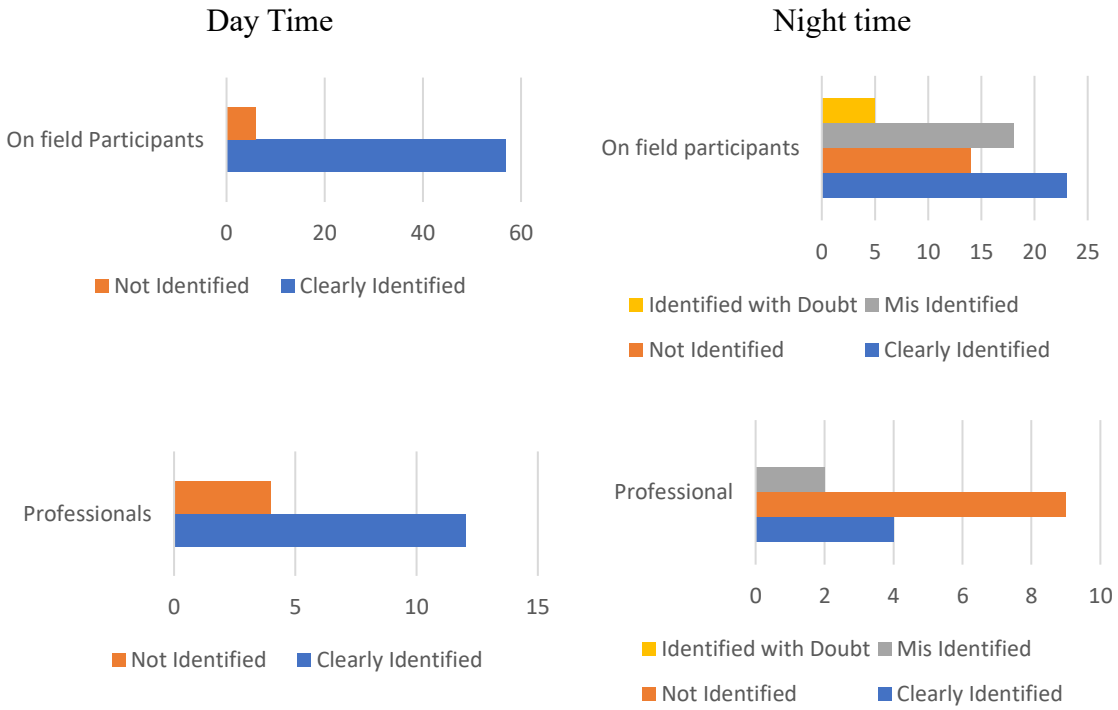


Figure 25. Summary of daytime and night time recognition Arat Kilo Patriot monument

Addis Ababa City Administration Building (Mezegaja)

The Addis Ababa City Administration Building, designed by Italian architect Arturo Mezedini during Emperor Haile Selassie, is a symbol of Addis Ababa Figure 26. was identified by 58 out of 60 on-field participants (96.67%) from daytime photographs. Of these 58, 51 (87.93%) recognized the monument correctly, with 48 (94.11%) correctly identified and 3 (5.89%) with doubt, of the professionals 15, questioned in the office, 12 (80%) recognized the monument correctly from daytime photographs, with 4 (33.33%) correctly identified Figure 27.

Figure 26. Addis Ababa City administration building daytime (left) and night time (right)

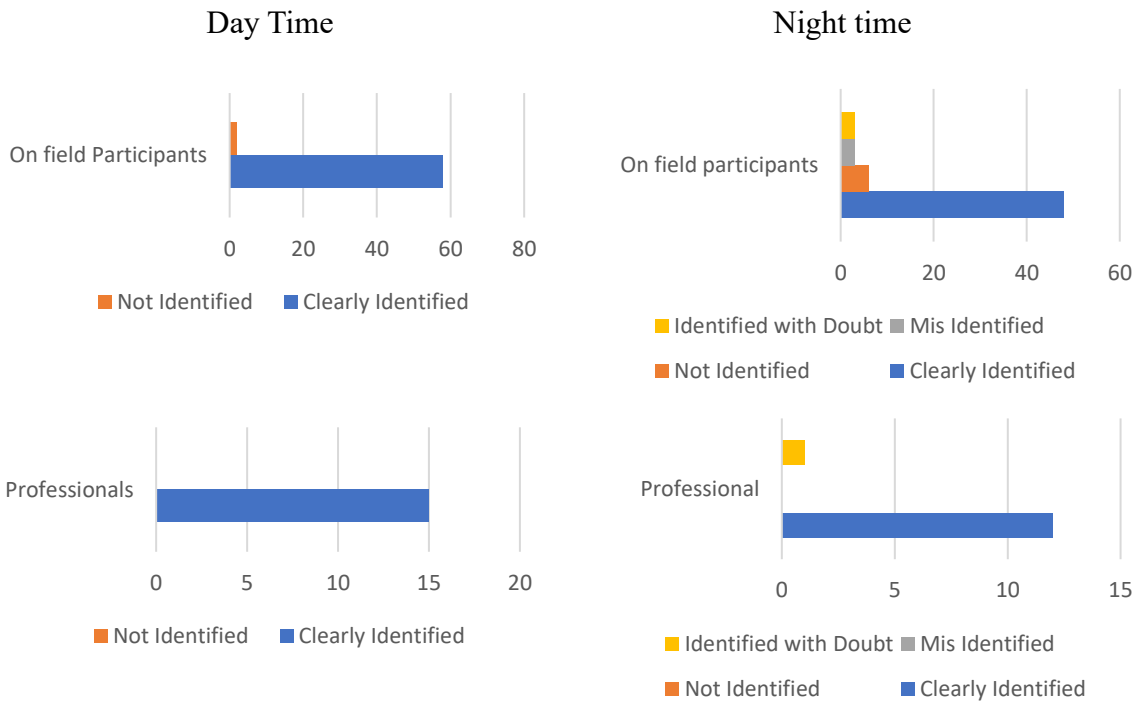


Figure 27. Summary of day and night time recognition Addis Ababa City Administration

Churchil Road

Churchill Road, a famous avenue connecting Addis Ababa city administration building and Le Gare old train terminal Figure 28, was identified by 54 out of 60 on-field participants (90%) from daytime photographs. Of these 54, 42 (77.78%) recognized the monument correctly, with 38 (90.47%) correctly identified and 4 (9.53%) with doubt, of the professionals 15, questioned in the office, 13 (86.67%) recognized the monument correctly from daytime photographs, with 7 (53.85%) correctly identified Figure 29.

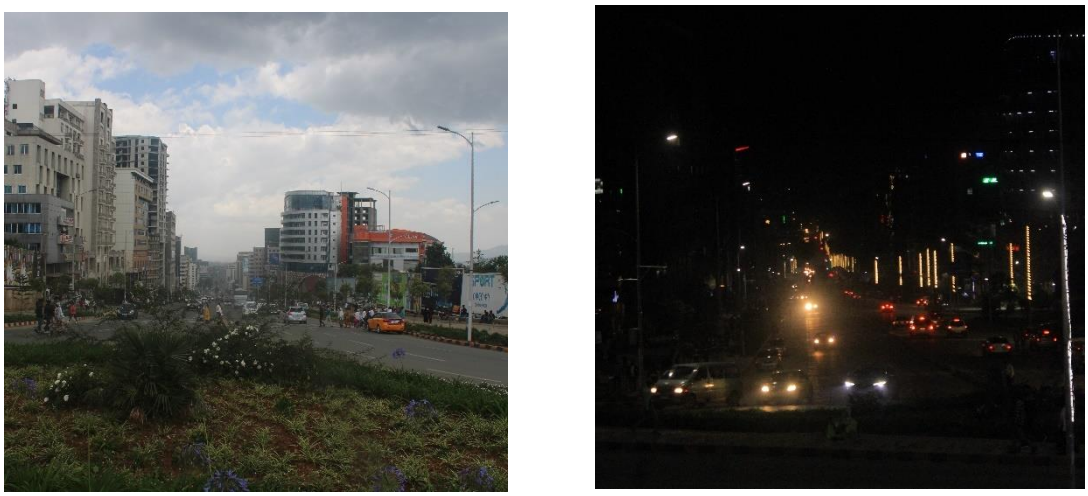


Figure 28. Churchill road daytime (left) and night time (right)

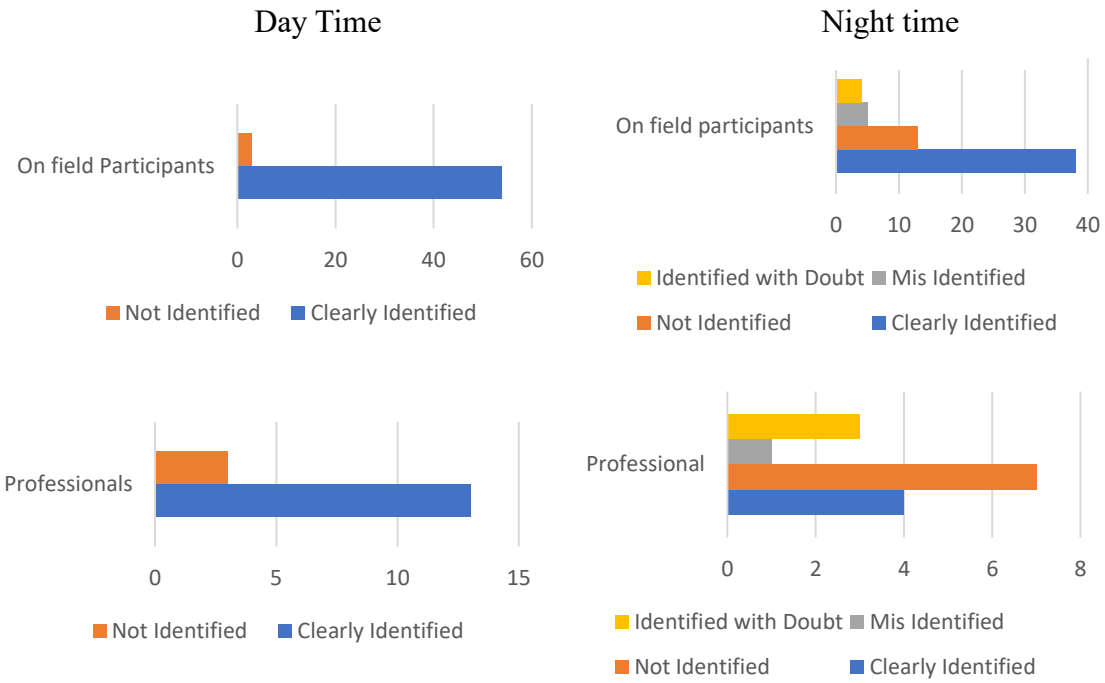


Figure 29. Summary of daytime and night time recognition Churchill Road

Ethio-Cuba Friendship Park

Ethio-Cuba Friendship Park, constructed during the Derg regime Figure 30, was identified by 48 out of 60 on-field participants (80%) from daytime photographs. Of these 48, 21 (43.75%) recognized the monument correctly, with only 21 (100%) correctly identified, of the professionals 15, questioned in the office, 12 (80%) recognized the monument correctly from daytime photographs, with 4 (33.33%) correctly identified Figure 31.

Figure 30. Ethio-Cuba friendship park day time (left) and night time (right)

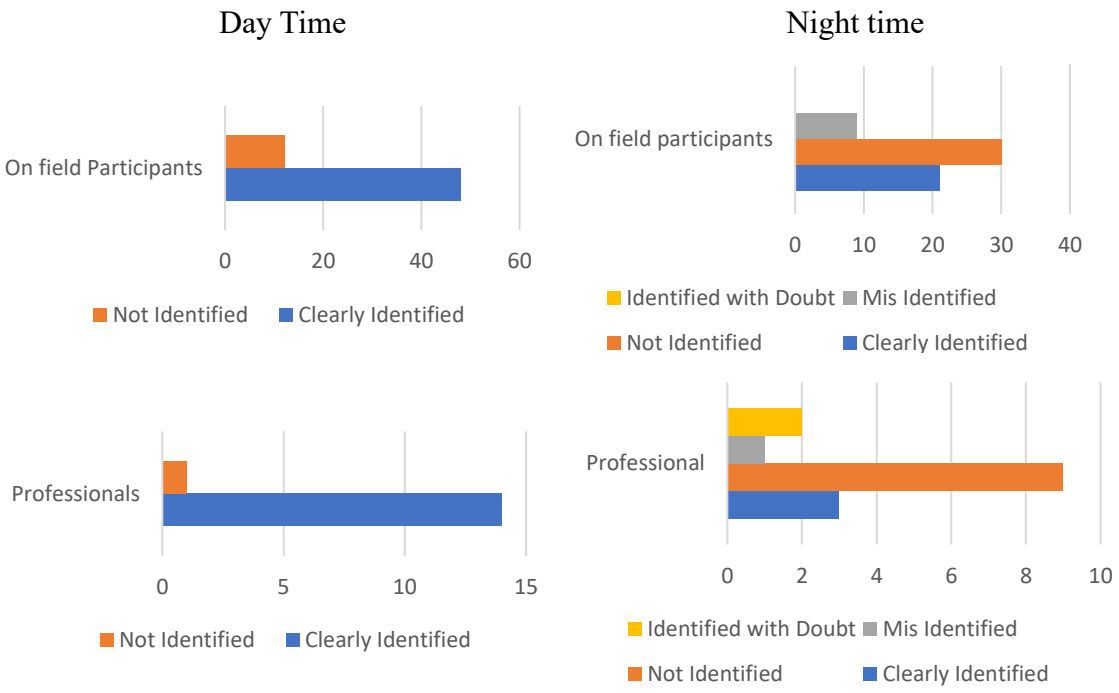


Figure 31. Summary of daytime and night time recognition Ethio-Cuba friendship park

Lion of Judah near Beherawi theater

The Lion of Judah near Beherawi theater, constructed during Emperor Haile Selassie designed by Maurice Calka Figure 32, was identified by 48 out of 60 on-field participants (80%) from daytime photographs. Of these 48, 18 (37.5%) recognized the monument correctly, with 15 (83.33%) correctly identified and 3 (16.67%) with doubt, of the professionals 15, questioned in the office, 13 (86.67%) recognized the monument correctly from daytime photographs, with 5 (38.46%) correctly identified Figure 33.

Figure 32. Lion of Judah Near Beherawi theater daytime (left) and night time (right)

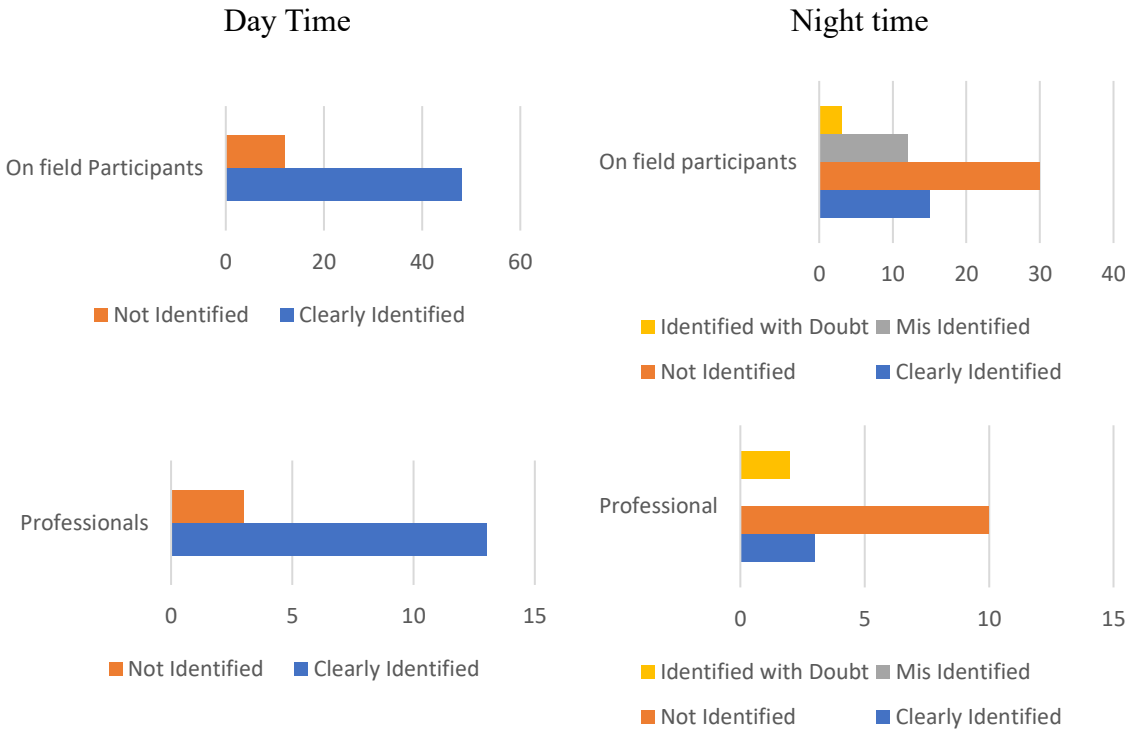


Figure 33. Summary of daytime and night time recognition Lion of Judah (Beherawi)

Le Gare Lion of Judah Monument

The Le Gare Lion of Judah Monument, built during Emperor Haile Selassie Figure 34, was identified by 46 out of 60 on-field participants (76.67%) from daytime photographs. Of these 46, 28 (60.87%) recognized the monument correctly, with 18 (64.29%) correctly identified and 10 (35.71%) with doubt, of the professionals 15, questioned in the office, 11 (73.3%) recognized the monument correctly from daytime photographs, with 4 (36.36%) correctly identified Figure 35.

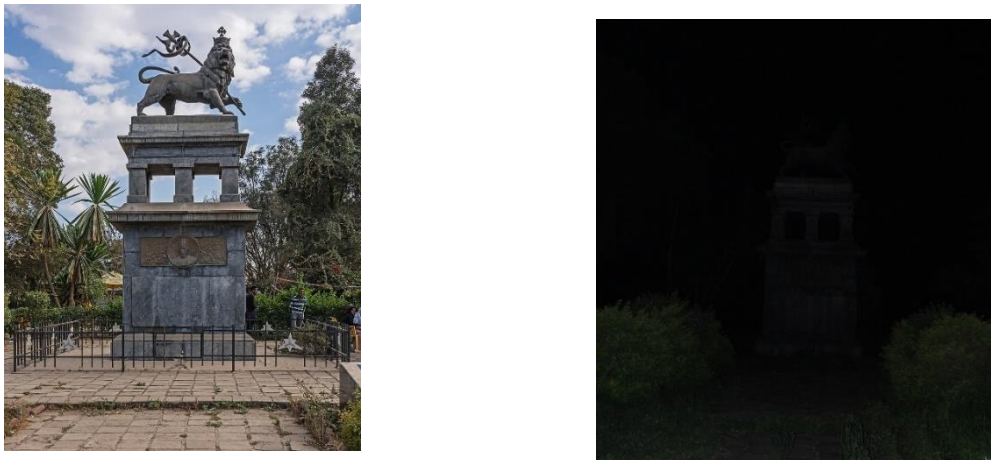


Figure 34. Lion of Judah around La Gare daytime (left) and night time (right)

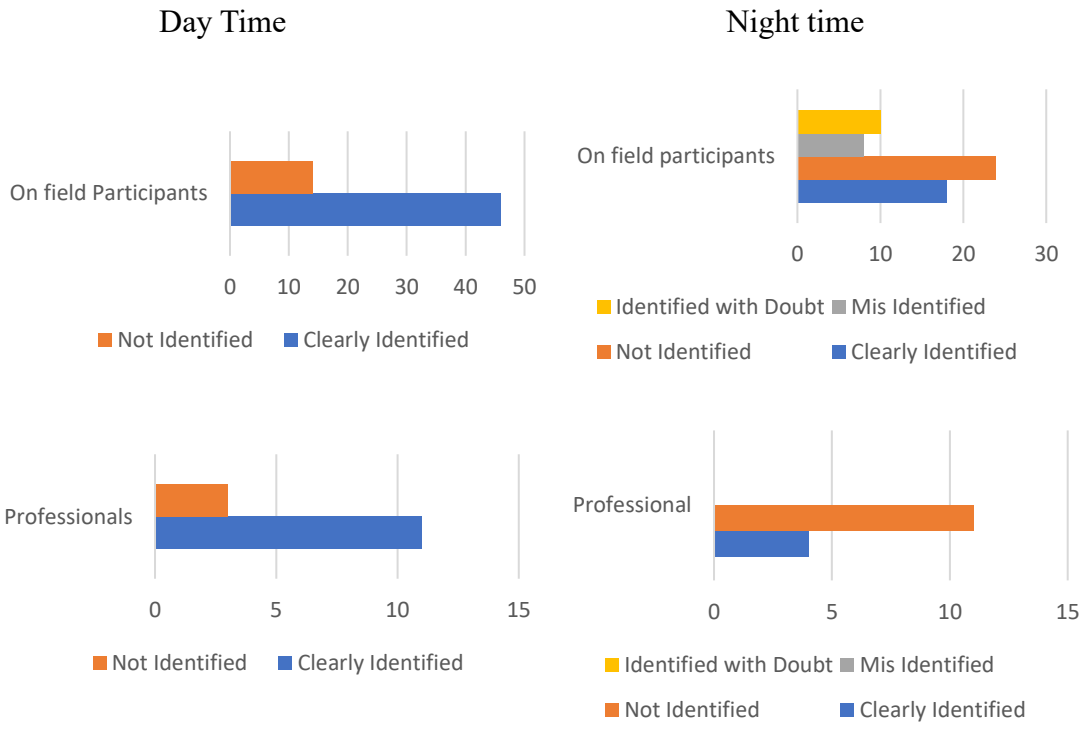


Figure 35. Summary of daytime and night time recognition Lion of Judah (La Gare)

Meskel Square

Meskel Square, a popular public space in Addis Ababa, has undergone a redevelopment to enhance its experience and upgrade various elements Figure 36. was identified by 60 out of 60 on-field participants (100%) from daytime photographs. Of these 60, 56 (93.33%) recognized the monument correctly, with 47 (83.93%) correctly identified and 9 (16.07%) with doubt, of the professionals 15, questioned in the office, 15 (100%) recognized the monument correctly from daytime photographs, with 11 (73.33%) correctly identified Figure 25.

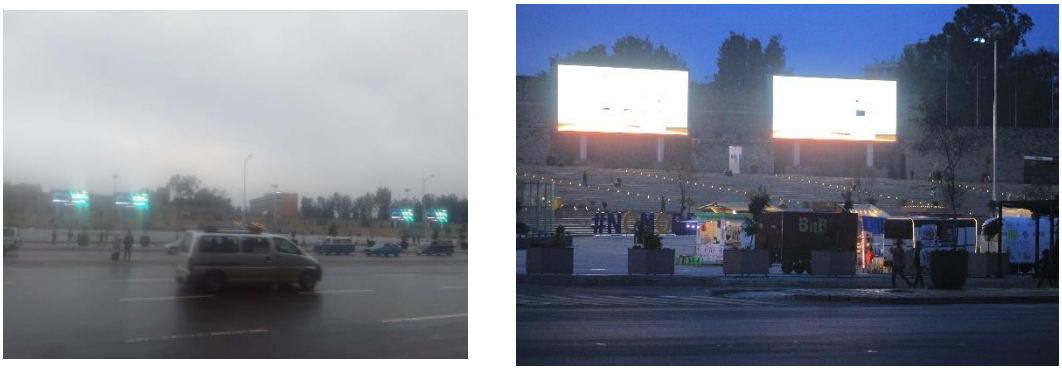


Figure 36. Meskel Square daytime (left) and night time (right)

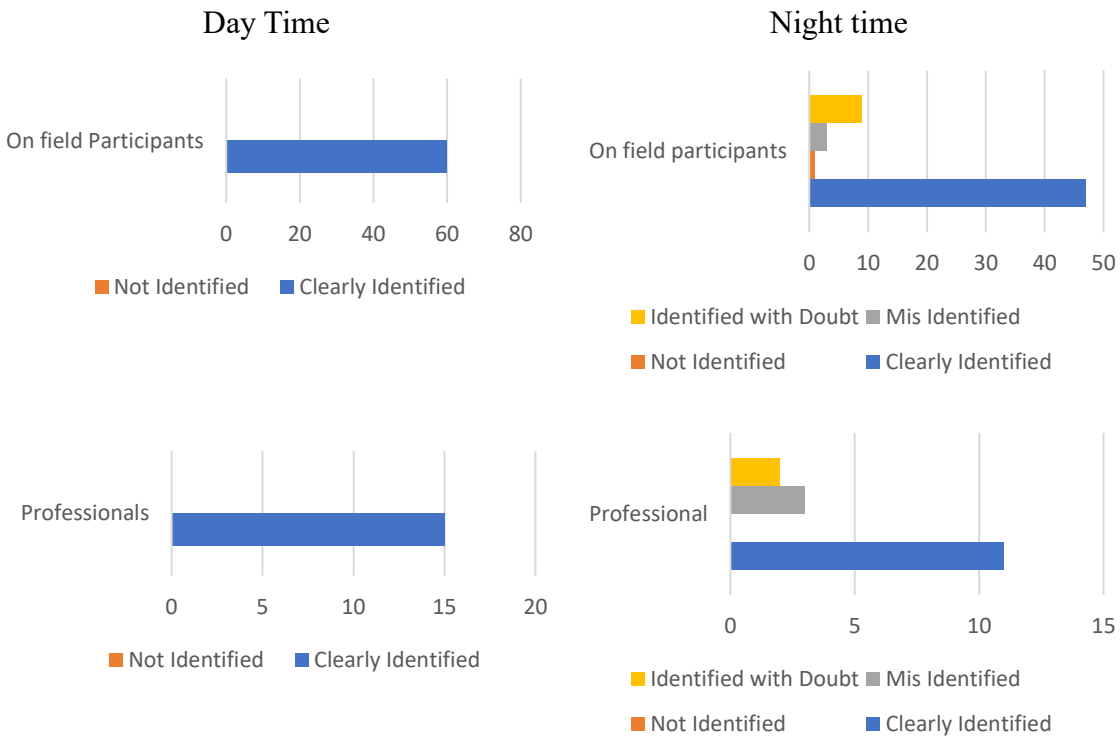


Figure 37. Summary of daytime and night time recognition Meskel Square

Photographic Interview Analysis and Result

The objective of this method was to test the hypothesis that urban lighting in Addis Abeba's main city center affects the identification and identifiability of the location from a nighttime photograph in comparison to the precise location taken from a daylight photograph.

There are two hypotheses: the null hypothesis, which states that urban lighting in Addis Abeba's main city center has no effect on identifiability and recognition, and the alternative hypothesis, which states that urban lighting in Addis Abeba's main city center has an effect on identifiability and recognition Figure 38.

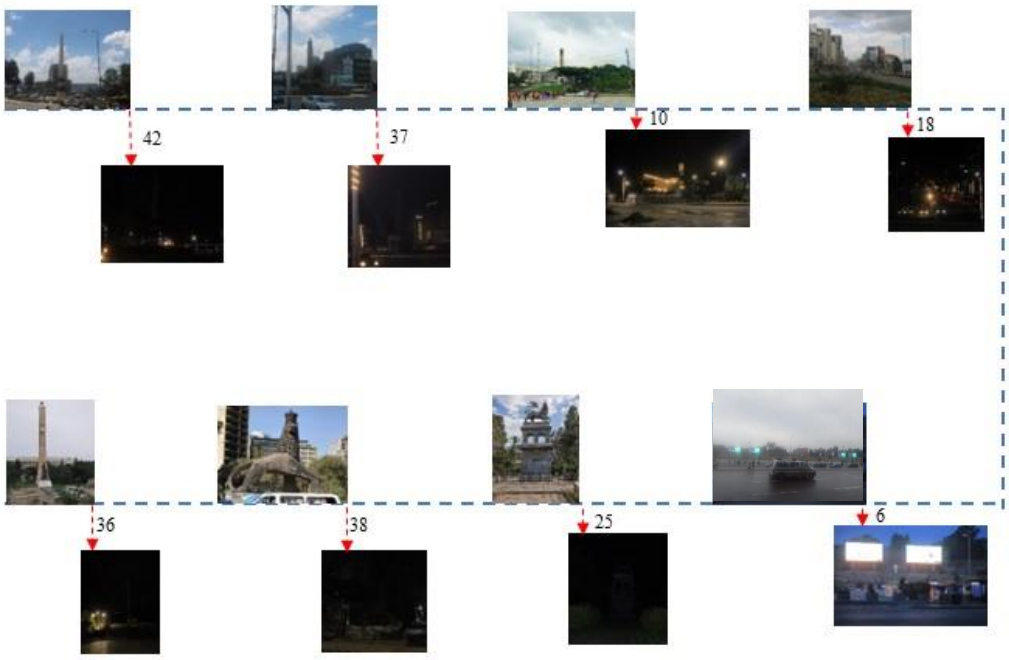


Figure 38. Summary of daytime and night time recognition variation.

Number of cases

N = 8

Degree of freedom

dƒ = n – 1 = 7

Mean

$$\dot{x} = \frac{42+37+10+18+36+38+25+6}{8} = 26.5$$

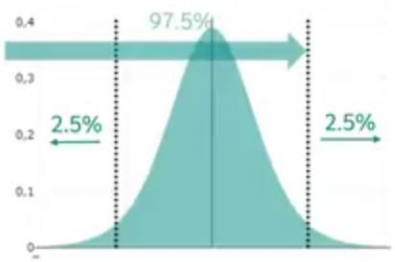
Standard deviation

$$s = \sqrt{\frac{(42-26.5)^2+(37-26.5)^2+(10-26.5)^2+(18-26.5)^2+(36-26.5)^2+(25-26.5)^2+(6-26.5)^2}{7}}$$

$s = 13.83$

Standard error of the mean

$$s_e = \frac{s}{\sqrt{n}} = \frac{13.83}{2.83} = 4.89$$



t-value

$$t = \frac{\dot{x}-0}{s_e} = \frac{\dot{x}}{s_e} = \frac{26.5}{4.89} = 5.42$$

Significance level

$\alpha = 0.05$, undirected hypothesis so we split the 5%, $1-\frac{\alpha}{2} = 0.975$

Degree of freedom

$df = n - 1 = 7$

Critical t-value

$t_{crit} = 2.365$

$t = 5.42$

$t_{crit} < t$

Table t-value

	Area one-tailed										
df	0.5	0.75	0.8	0.85	0.9	0.95	0.975	0.99	0.995	0.999	0.9995
1	0	1	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0	0.816	1.061	1.386	1.886	2.92	4.303	6.965	9.925	22.327	31.599
3	0	0.765	0.978	1.25	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0	0.741	0.941	1.19	1.533	2.132	2.776	3.747	4.604	7.173	8.61
5	0	0.727	0.92	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0	0.718	0.906	1.134	1.44	1.943	2.447	3.143	3.707	5.208	5.959
7	0	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0	0.706	0.889	1.108	1.397	1.86	2.306	2.896	3.355	4.501	5.041
9	0	0.703	0.883	1.1	1.383	1.833	2.262	2.821	3.25	4.297	4.781
10	0	0.7	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587

Figure 39. t-value test table and diagram

Assumptions

- Two dependent groups or samples were available from the same sample where the measured value was taken during the day and at night.
- The difference of paired value is normally distributed.
- Only successfully identified values were extracted from the daytime shot, which was used in conjunction with a nighttime recognition value.

Case 1, Piassa

A. Visibility of pedestrian and vehicles

Because of shop light sources and poor infrastructure, Piassa region street exhibit uneven illumination, especially in pedestrian zones, endangering pedestrian safety Figure 40.

Figure 40. Street of Piassa during the night that lack visibility

Research suggests that street illumination and traffic volume have a major impact on pedestrian safety. Both of these factors are deficient in Piassa's streets, making it difficult for pedestrians to recognize their surroundings.

B. Zonal clarity of urban design elements and spatial structure by Artificial Lighting

Urban design elements in Piassa lack diversification through lighting design, resulting in spatial similarities and unclear space definitions and lighting treatments, making them unrecognizable Figure 41.

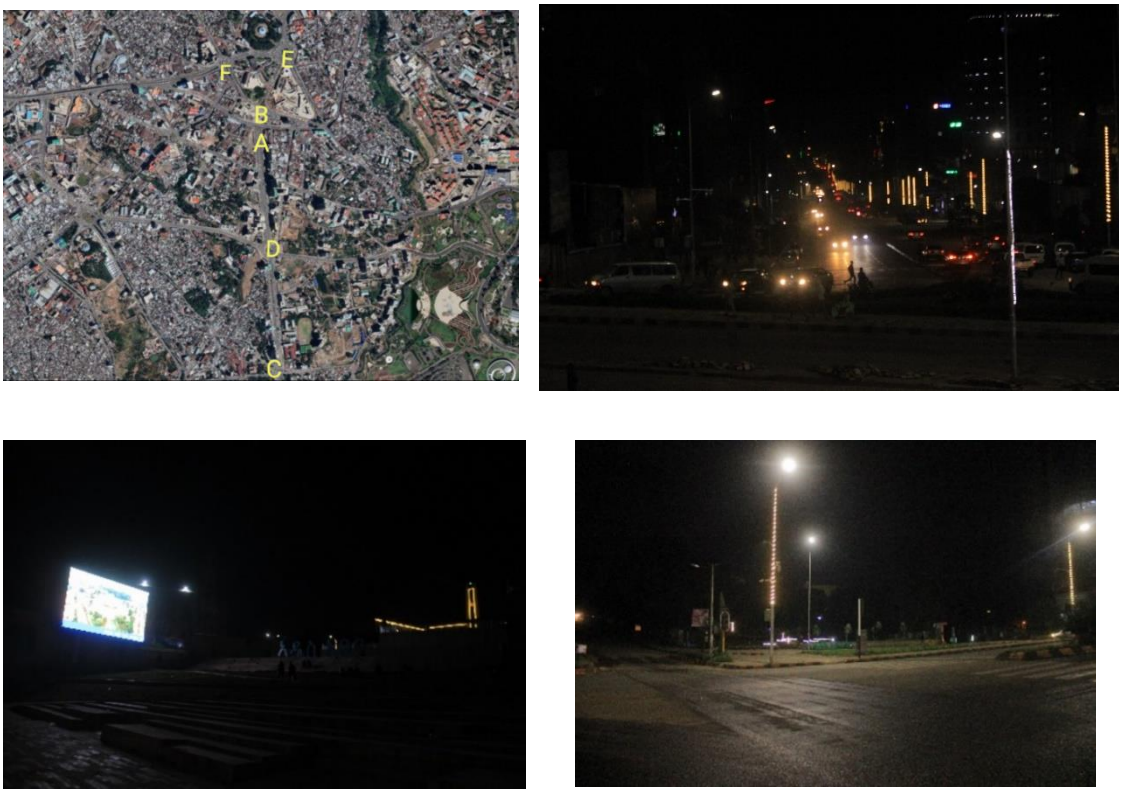


Figure 41. Open space and streets of Piassa area

For a straight path definition and visibility, Churchill Road in Addis Ababa employs street lights and yellow warn strip lights. In contrast, the illumination makes it difficult to distinguish landmarks such Menelik Square, Abune Petros, and Sebastopol, as well as public areas like Youth Park Figure 42.

Figure 42. Landmarks of Piassa Sebastopol (left) Menelik (middle) & Abune Petros (right)

C. Architectural Lighting Quality and Visual interest or Urban Design Elements

Piassa is home to both contemporary structures designed by well-known architects like Mezedini and old structures with distinctive architectural elements, materials, and techniques. This research assesses the architectural shape, features, and materials of buildings as well as their lighting design and contextual impact, emphasizing the structures' unidentifiability in certain locations.

1. The historic post office is a one-story horizontal structure with window and door decorations that the artificial lighting doesn't take illumination into account and only uses car lights.
2. The Arada Building is a well-known landmark in Piassa. Its vertical tower is lit by both internal and outdoor lighting, while the ground and first floors are lit by surrounding businesses such cafés, restaurants, and retail stores Figure 43.

Figure 43. Significant building around Piassa area

3. The Enat Building, Piassa landmark known for its architectural and decorative detail, lacks illumination at night, making its form and shape unidentifiable Figure 44.

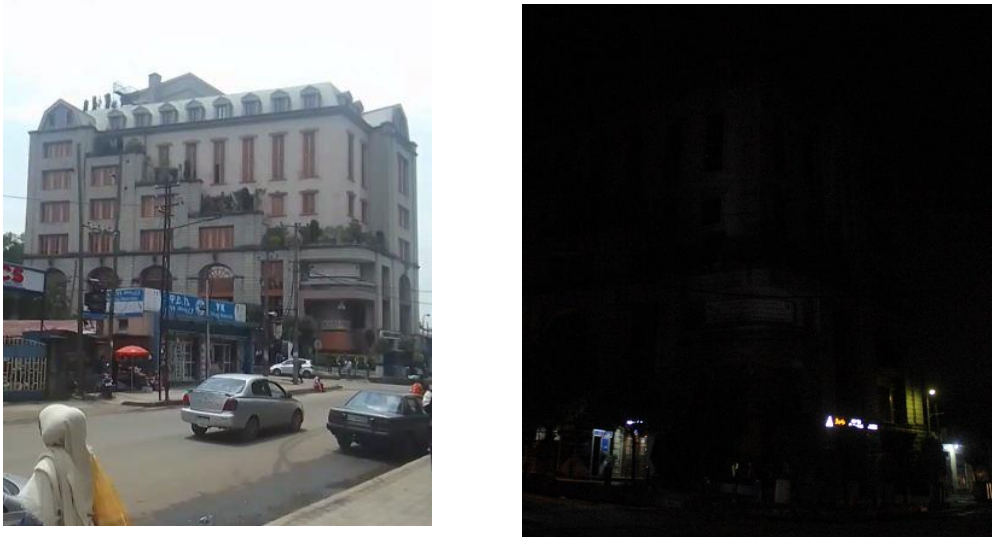


Figure 44. Enat building located in Piassa daytime (left) and night time (right)

4. Seytan Bet, which was formerly an Addis Ababa theater and movie theater, is well known for its distinctive architectural design and building materials. However, at night, its absence of illumination renders it indistinguishable from street light posts.
5. The electric and Zewditu buildings' surroundings are visible through the exterior light source from a vertical mast mounted in Degol Adebabay, providing a clear vision and visibility Figure 45 (left).
6. Yellow warm contour lights are used by the Addis Ababa City Administration building, a Piassa monument, to improve its visibility and architectural shape Figure 45 (right).

Figure 45. Electric building in (left) and Addis Ababa City Administration building (right).

Case 2, Arat Kilo

A. Visibility of pedestrian and vehicles

The well-defined paths and lighting systems in Arat Kilo's streets provide for a pleasant walking environment for people. Unfortunately, several of the streets in the 6-kilo are poorly lit, which creates a dangerous atmosphere Figure 46.

Figure 46.Arat Kilo street

Arat Kilo's street lighting draws a variety of activities, including a notable pedestrian population in locations with adequate illumination Figure 47.

Figure 47. 6 Kilo Street towards 5Kilo

B. Zonal clarity of urban design element and Spatial Structure by Lighting

Due to artificial light, the spatial organization of Arat Kilo's urban elements—monuments, memorials, key thoroughfares, and iconic buildings—is devoid of definition and thought. For instance, the road from 6-kilo roundabouts has clear definition, but the path to Ferensay and Menelik Hospital Road is unrecognizable Figure 48.

Figure 48. Streets of Arat Kilo

There are lighting poles, cafés, businesses, and cars that identify the 4 Kilo Patriots Museum path to Piassa, but the monuments in 6 Kilo and Arat Kilo lack identification because of different lighting systems Figure 49.

Figure 49. Street from AratKilo towards Piassa

C. Architectural lighting quality and visual interest of urban design elements

Arat Kilo has both modern and old government buildings, as well as both types of structures with similar architectural characteristics, urban forms, and building materials. Architectural illumination was evaluated for four different structures.

A. The poorly lit buildings from Habte Giorgi's bridge to Piassa street, with commercial services on ground and first floors and residential and office spaces in upper stories, caused numerous street posts to malfunction.
B. The 4-kilo Patriots Monument is facing the curving Ministry of Education building. There were no mounted fixtures or lighting considerations to be discovered; the sole nighttime light source was the street light poles from the roundabout Figure 51.
C. The National Museum, a five-kilo building with a distinctive architectural design and building method, is unrecognizable at night due to a lack of lighting systems across the complex that houses the sculptures and antiques Figure 50.

Figure 50. National Museum around 5 kilo that lack visibility

D. Because they rely only on street light poles and passing cars for illumination, the Addis Ababa University buildings on the 5-kilo campus are frequently missed.

Figure 51. Building around Arat Kilo mixed building(left) Ministry of education(right)

Case 3, Merkato

A. Visibility of pedestrian and vehicles

The Merkato region's pedestrian and street environments are unsafe and dark, with light sources coming from vehicles, services, and personal use by occupants Figure 52.

Figure 52. Street in Merkato that lack visibility due to unfunctional street lighting post.

Figure 44 shows dangerous street conditions with insufficient lighting systems, overpasses, and light sources from stores and restaurants surrounding Gojjam Berenda Place, the flyover of a bridge, and the Yirga Haile commercial structure Figure 53.

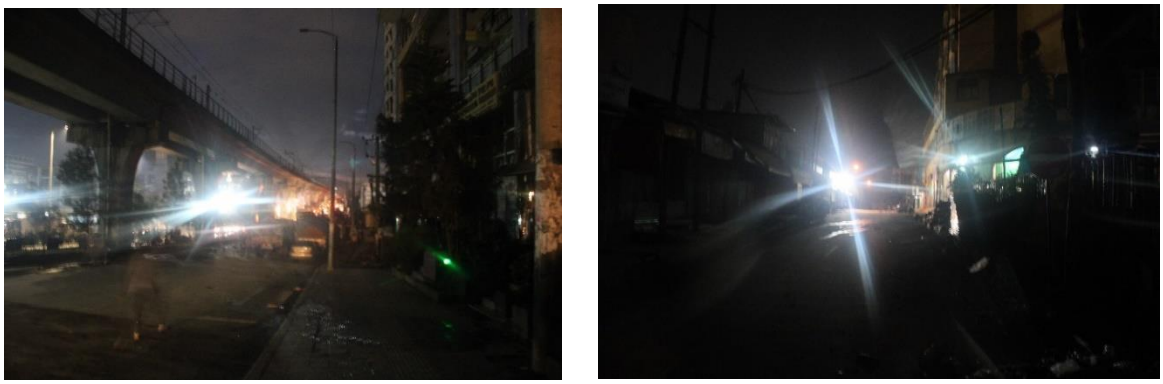


Figure 53. Street of Merkato towards Mesalemia (left) and Yirga Haile building

B. Zonal clarity of urban design elements and spatial structure by lighting

In Street lights, pedestrians, and urban features like the Abune Petros monument are all ignored by Merkato's lighting system, which lacks spatial organization. Roundabouts, overpasses, and pathways without adequate illumination are depicted in, whereas Teklahaymanot roundabouts with a well-defined lighting scheme are shown in Figure 54.

Figure 54. Merkato streets and landmarks during night.

C. Architectural lighting quality and visual interest on urban design elements

The lighting systems and factors of three particular buildings are the main subjects of this evaluation.

A. A famous landmark in Merkato, the Yirga Haile commercial complex has a bustling daytime ambiance with stores, banks, and restaurants. But the building only has ground level service light sources, which is inadequate lighting.

B. The renowned Amede Gebeya building, seen in Figure 148 with external lighting from the shops, is a one-story commercial complex containing stores, retail spaces, and services.

C. The utilization of internal light, as seen in Figure 46, makes the Adarash Building immediately recognized despite its unusual architectural shape and construction materials Figure 55.

Figure 55. Significant building in erkato areas with their night time illumination.

Case 4, La Gare

A. Visibility of Pedestrians and vehicles

There are designated street lights in the Street of La Gare area, although some of the poles aren't working correctly Figure 56.

Figure 56. Street that lacks visibility from La Gare towards Kirkose

For instance, there are perilous conditions on the route from Mexico to Meskel Square and on the pedestrian light-deficient road from La Gare rail terminal to Kirkose church. Strip lights are used to designate the street lighting throughout the Senga Tera region's perimeter.

B. Zonal Clarity of urban design elements and spatial structure by lighting

The La Gare region's lighting system primarily focuses on streets and individual buildings, but neglects monuments. For instance, Figure 57, Addis Ababa city administration is visible from La Gare due to a defined lighting system. Meskel square has lighting systems for stairs and advertisement screens, but there is a lack of lighting on monuments like the Lion of Judah in La Gare and near the Beherawi theater Figure 58.

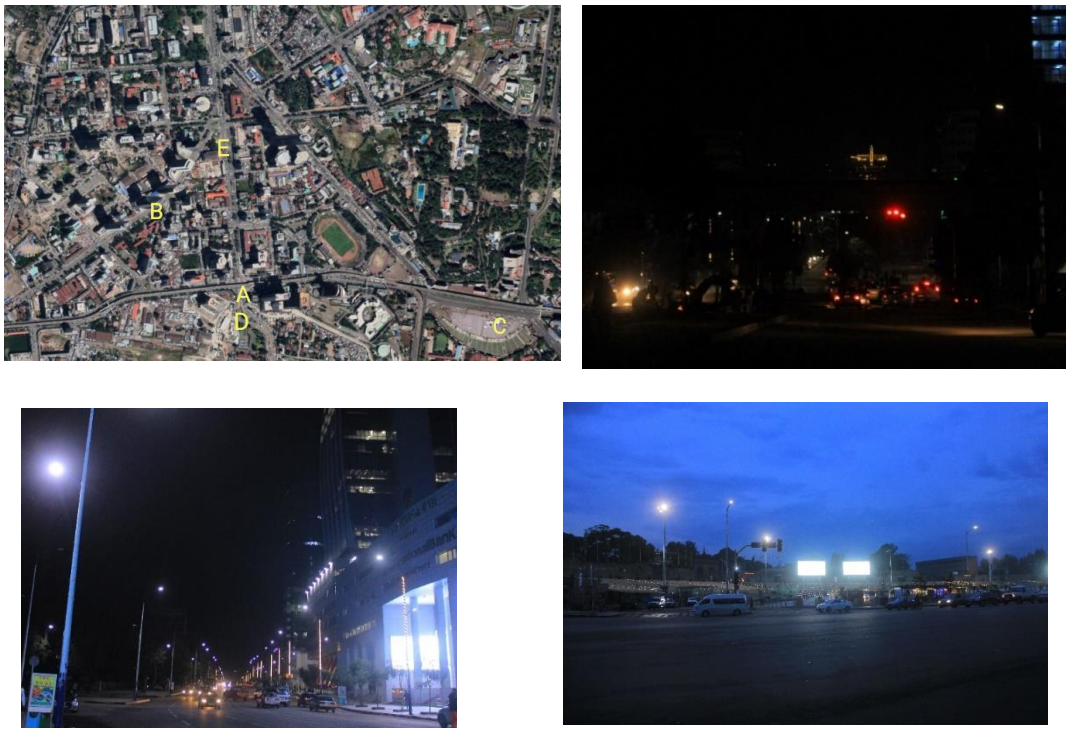


Figure 57. Streets in La Gare Around A.A stadium (left) and Around Nib bank (right)

Figure 58. Lion of Judah near La Gare (left) and Lion of Judah near Beherawi (right)

C. Architectural Lighting quality and Visual interests on urban design elements

The La Gare region is home to a variety of modern and historic skyscrapers, including five structures in the core business sector and one building that was chosen by the committee for evaluation Figure 60.

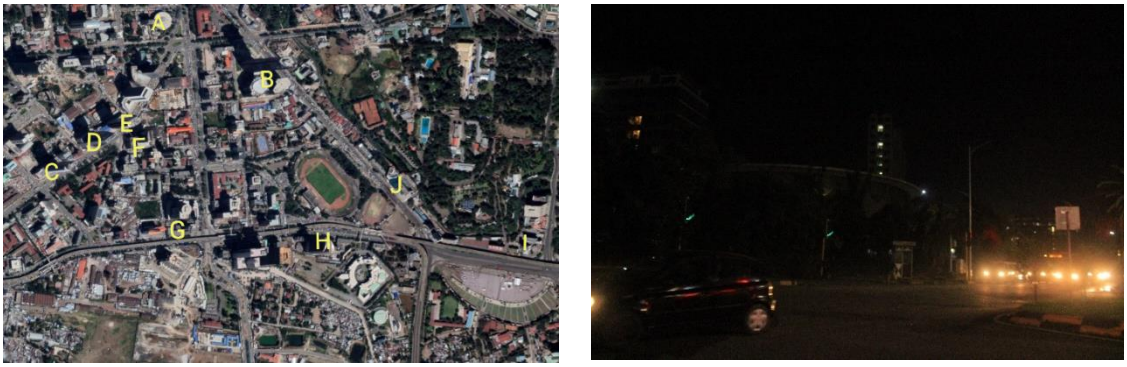


Figure 60. The old Commercial bank of Ethiopia (right) that lack architectural lighting

A. The oldest commercial bank, situated in Beherawi, boasts distinctive architectural and construction techniques, but lacks architectural lighting during the night Figure 60.
B. Ethiopia's tallest structure, the Commercial Bank of Ethiopia Headquarters, has a glass façade with sporadic outside lighting that displays information and symbols Figure 61.

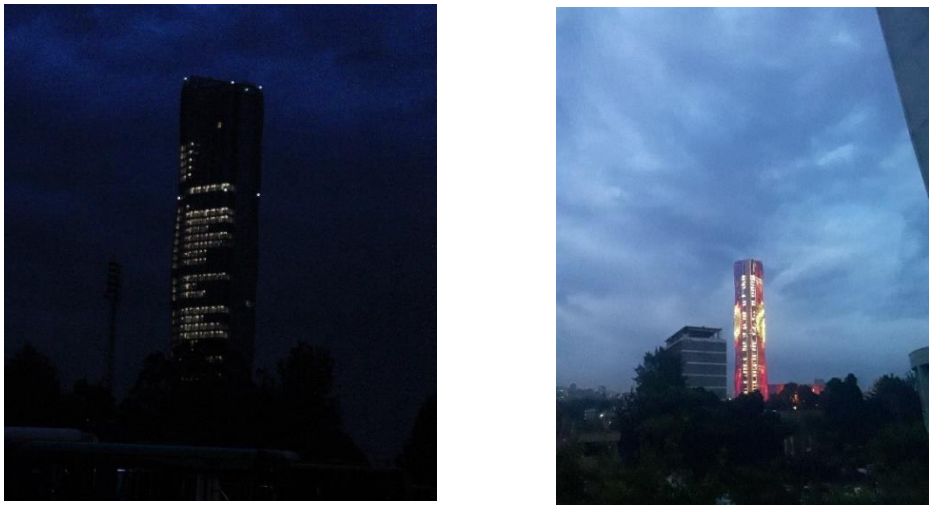


Figure 61. Commercial Bank Headquarter night time illumination

C. The CBD region's most well-known skyscraper, Hiberet Bank Headquarters, has a big advertisement screen that brightens the surrounding area, although it lacks outside lighting elements that indicate its architectural design Figure 62 (left).

D. Zemen Bank Headquarters is a newly constructed skyscraper with a unique architectural shape. Yellow light is used in the external lighting fixtures on the sixth level and entryway Figure 62 (right).

E. As seen in Figure 63 (left), the Nib Bank Headquarters has an extra light source in the form of an advertisement screen on the ground, but no inside lighting is utilized.

Figure 62. La Gare buildings Hibert bank HQ (left) and Zemen bank HQ

Figure 63.La Gare buildings Nib bank HQ (left) and Awash bank HQ

F. The Awash Bank Headquarters is immediately recognized because to its lighted logo on top and vertical green contour lights Figure (right).

G. The Medhen Insurance office, a renowned building in La Gare, is notably less recognizable due to its lack of a lighting system, as depicted in Figure 65 (left).

H. The Wegagen Bank Headquarters, Figure 65 (right) which is well-known for its unique architectural shape, was the focus of nighttime lighting design efforts, with external illumination receiving little attention.

I. Despite its architectural design and construction material, the Finfine building in front of Meskel Square did not take illumination into consideration, as seen in Figure 64 (left).

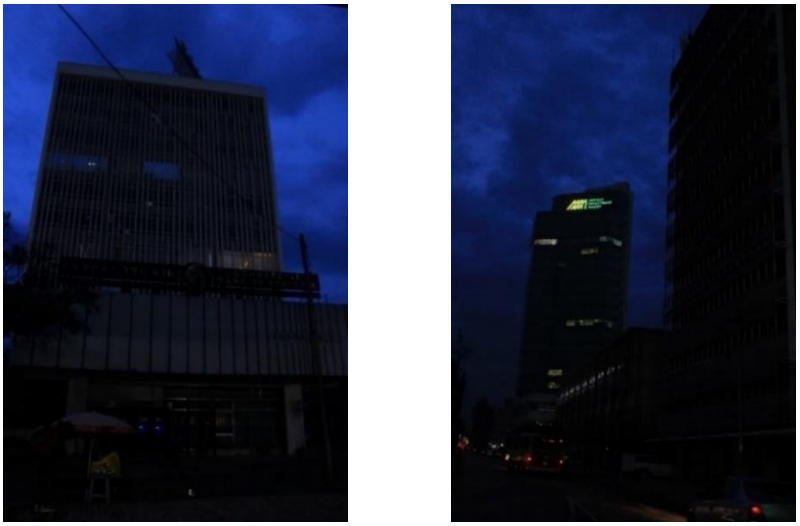


Figure 64. La Gare buildings Medhin Insurance office (left) and Wegagen bank HQ

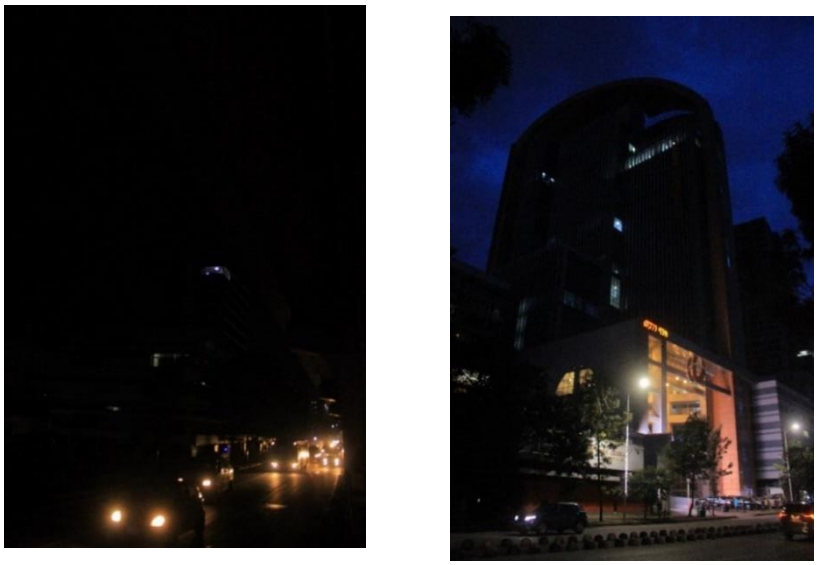


Figure 65. La Gare buildings Finfine building (left) and Medroc HQ (right)

J. Figure 64 (Right) shows the Medroc Investment Group Office Building without an external lighting system, as well as the nearby mixed-use building.

Observation Analysis and Result

The study aimed to evaluate the lighting design in Piassa, Arat Kilo, Merkato, and La Gare using international practices and guidelines Table 5.

Table 5. Summary of evaluation of the place-based visibility and identification of urban design elements on observation

		Sites			
No.	Parameters	Piassa	Arat Kilo	Merkato	La Gare
1	Visibility of Pedestrian and Vehicles	2	4	1	4
2	Zonal clarity of urban design elements and spatial structure by lighting	2	3	2	4
3	Architectural lighting quality and visual interest on urban design elements	2	2	2	3
	Totals	6	9	5	11

Table 6 displays the urban lighting values for the selected site, with La Gare region having the highest and Merkato having the lowest.

La Gare > Arat Kilo > Piassa >Merkato

There is a significant decrease in night time place recognition (in the selected 8 locations), Urban illumination has a big influence on nighttime image recognition and location identification, which changes how safe people feel in their communities. Professional participants react to the pedestrian safety and security feedback from on-field participants. On average, though, location identification drops from 66.13% to 39.38% when contrasted with daylight recognition Figure 66.

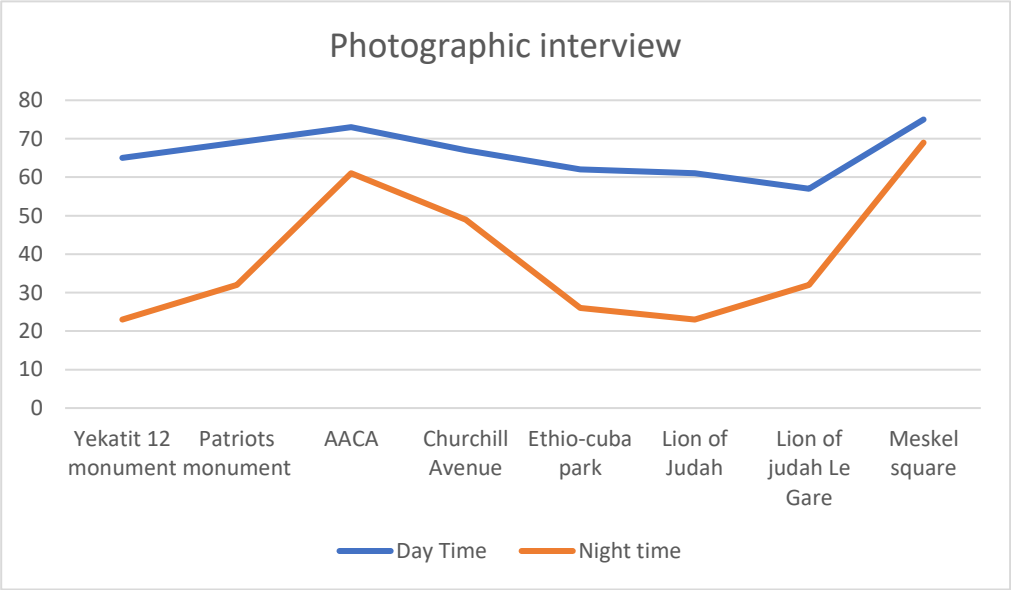


Figure 66. Summary of photographic recognition test

As Table 6 shows that the perceived safety of a pedestrian is directly related to the visibility of the surrounding, that is the result of adequate artificial lighting usage, for example let's take Piassa area which has a lighting evaluation above moderately effective which is 20% amount that has directly consequence on the perceived safety of the pedestrian which is 3.33% above the average Figure 11. This direct correlation shows that the safety and security of the pedestrian affected by artificial lighting.

Table 6. Summary of effectiveness of artificial lighting

	Extremely effective	Very effective	Moderately effective	Slightly effective	Not effective
Piassa		3	8	4	
La Gare	5	8	2		
Arat Kilo		5	9	1	
Merkato			2	8	5

As the result shows in table Q, from the observation parameters the result found 6, 9, 12 and 14 for Merkato, Piassa, Arat Kilo and La Gare respectively shows La Gare area has the highest value, whereas Piassa (9) and Merkato (6) this shows the urban design elements such as Paths, landmarks, historic buildings and monuments, in this areas this design elements lacks visibility and recognition due to improper and inadequate artificial lighting and lack of maintenance on lighting pasts that also has direct impact on pedestrian reassurance and safety, this two selected areas should have to consider their lighting system and must have proper follow up on lighting posts performance, whereas Arat Kilo (12) and La Gare (14) has a better quality of artificial light in their corresponding urban design elements this result also corresponds with their perceived safety of their pedestrians even though, it require professional involvements and references from international codes of practice in lighting of urban elements and skyscrapers (that just focused on interior light rather than strip light in the architectural form) and for monuments and landmarks artificial light integration that should focus on zonal clarity and both architectural and artistic details and construction materials.

4.2 Discussion

A city's architectural features, such as its streets, squares, buildings, bridges, and roadways, define its identity and profile. Technology and lighting advancements create new possibilities. The city is lit up in colors that give it a dramatic feel. People's impression of beauty is influenced by city illumination, which also improves people's quality of life. In

addition, it has a significant impact on politics, the economics, and culture while also helping the city grow and improve its reputation. A charming light environment may be created by carefully planning the lighting to showcase the city's culture and unique features. We'll examine the lighting plan using the "holistic design approach." According to this perspective, the lighting design needs to incorporate every element of the outside urban environment, maximizing the value of the night and minimizing all potential adverse effects. The urban lighting conditions will be analyzed through a checklist and preferences of users will be evaluated through a questionnaire (Rana Kutlu and Banu Manav, 2013).

More attention is being paid than in the past to the formation of a city image, and the city identity has been split into two main categories: night and day, in light of the competition between the cities to become more visible and to establish a higher reputation. It is thought that building and urban lighting play a significant part in the formation of urban night identity and night image. At night, the influence of lighting around us is felt. Thus, developing a nighttime city identity calls for the use of techniques relevant to city branding. On the other hand, as every kind of structure contributes to the nighttime character of a city, designers must pay careful consideration to lighting (Mohammadjavad Mohdavinejad, 2020). According to the procedure outlined in the feeling of belonging model, Belonging Lighting has the ability to create shared memories that maintain a common identity in the urban setting. In actuality, lighting may create a mood by encouraging conversation and outdoor experiences with others, or it can serve as a memento when it takes on symbolic meaning (Laura de Frutos, 2024). The identifiability and recognizability of places, monuments, and landmarks were related to luminance contrast, visibility of its elements, and visual hierarchy of lighting design (Diana, 2016), this study demonstrates that, in contrast to corresponding daytime recognition tests, there is a significant decrease in place identification and recognition during the night due to a lack of consideration for artificial lighting on urban design elements. The aforementioned studies also suggest that people's perceptions of a place and the nighttime urban environment are correlated with appropriate artificial lighting, which improves the quality and well-being of the residents.

Although previous research has demonstrated that lighting increases pedestrian reassurance, it's possible that the methods employed caused the respondent to identify the relationship between lighting and fear; for example, because lighting was one of the few available

responses, because there was a clear distinction between the scenes under evaluation, or because the rating scales that were given to the respondents focused on lighting and fear, making it unlikely that they were allowed to mark something as "not relevant.". In 130 of the 210 locations discussed in interviews, road lighting was mentioned as a reason for the presence or absence of reassurance, a similar frequency to spatial features, less frequent than access to help, but more frequent than familiarity or the presence of threatening other people. These results suggest that road lighting can play an important role in improving reassurance. The method provides more confidence than previous studies because the effect of lighting was not enhanced by obvious changes of lighting (). Numerous significant advantages are offered by street lighting. It may be used to artificially lengthen daylight hours so that activities can occur, therefore improving quality of life and promoting security in metropolitan settings. Additionally, street lighting increases pedestrian, cyclist, and motorist safety. According to a 2003 Department of Transportation study, increasing street lighting was thought to have a major positive impact on traffic safety. According to the poll, 63.8% of participants said that "better street lighting would lead to fewer accidents on the roads," and 73% of respondents said that "better street lighting would improve the safety of children." (Rospa, 2018) additional research shows that people feel safe when they have a good review of the space and environment, which is the result of good lighting (Greene & Greene, 2003) and light-affected reassurance (Loewen, Steel, & Suedfeld, 1993), this study shows that from the selected four study areas the perceived safety of this residents related to the visibility of the surrounding and the ability to visible for the fellow pedestrians.

The impact of lighting altered how space was seen. The distribution of lights determined the location and movement of users, according to a mapping study of outdoor activities and user dynamics. An analysis of space utilization (differences in frequency, duration, and types of outdoor activities) has revealed that space livability decreases at night. The findings demonstrated how people's use and perception of open public areas alter as daylight fades. In addition, the quality of artificial illumination affects users' perceptions of safety and comfort, as well as outdoor leisure and recreational activities (Ivana Rakonjac, 2022).
This thesis finds that while assessing the illumination in the metropolitan areas, individuals heavily consider the "contrast" component. Lighting contrast is crucial because it enhances

the appearance of three-dimensional forms. In contrast, it is easy to discern textures, other physical characteristics, and the forms of three-dimensional things. This thesis concludes that the opposing effects of light are connected to sentiments of choice, interest, safety, and comfort in lighting throughout all urban parts. Furthermore, the findings indicate that a high degree of contrast appears to be more harmful than a low one. The results of this thesis support the conclusions of the literature about the relevance of the "contrast" variable in urban lighting and emphasize its importance.

Furthermore, this research found that consumers placed a high importance on how lighting design related to the purpose, historical context, architecture, and daylight look of urban areas. While the literature's findings emphasize the significance of establishing this relationship, people's preferences are taken into consideration while analyzing this relationship. The study's findings showed that respondents favored lighting schemes that enhanced the iconic urban areas' aesthetic, historical, and practical qualities over entirely changing their look at night. At first look, bold and distinctive lighting designs stand out from their surroundings. People's attention is quickly drawn in by the use of eye-catching and vivid colors in lighting, flashing lightbulbs, and intense light sources. But attracting attention from others doesn't always mean that something is more aesthetically pleasing.

Because there were no studies documenting lighting design, its implications in urban design, safety, and other associated urban-related concerns, comparing and contrasting with contextual research was challenging.

CHAPTER FIVE

Conclusion and Recommendation

5.1 Conclusion

The study's goal was to demonstrate how the urban lighting system relates to safety and location recognition at night. According to the findings of this study, appropriate lighting enhances felt safety and can improve inhabitants' cognitive maps. This is the first research to link urban lighting and illumination to city image, perception, and recognition of landmarks in Addis Abeba's city center, and it provides an important addition to nighttime urban studies. The findings discussed above also show that present understanding and practice patterns in nocturnal urban areas should be improved.

Urban lighting significantly impacts urban design and is crucial for nocturnal use of urban exteriors. People prefer environments where they can see what happens, which is a survival instinct. However, the emotional value of light in urban spaces cannot be denied. The functional significance of urban lighting is only one dimension, and people respond to lit urban scenes in several dimensions. The thesis presents a scientific falsification of the common misconception that the brighter the lighting, the better it is. Other variables of lighting also contribute to pleasant urban spaces at night, creating a difference between "putting light against obscurity" and "illumination." People expect lighting to illuminate public spaces by providing legible, balanced, harmonious, and cohesive nocturnal landscapes.

Because the study was confined to a small number of participants and was performed in a single study region (the major city center), the findings cannot be generalized. Despite these limitations, the study provides an essential addition by revealing how urban lighting and illumination might connect to both safety and place recognition through the use of three methods: interviews, photographs, and observations. Further study with a larger sample size and additional nighttime-related activities, brightness measurement, and social components that serve to generate a deeper knowledge of diverse facets of nightlife is advised.

5.2 Recommendations

- The artificial lighting around landmarks and public features must be reconsidered and improved, as the result shows in chapter 4 image recognition test that corresponds to

specific objective 1, artificial lighting significantly affect identification of places. The enhancement of pedestrian visibility in Addis Ababa's city center is imperative as it directly impacts safety and comfort levels. This involves adhering to international guidelines and best practices for artificial lighting design and illumination, as well as maintaining and assessing the effectiveness of street lighting posts. While VIP streets are more well-lit and monitored, other streets and landmarks in the area are less well-lit and require adequate lighting intervention.

- Particular consideration and design standards should be given to artificial lighting systems in main Addis Ababa city center. The artificial lighting around landmarks, historic buildings, monuments, and public places necessitates a visual hierarchy, zonal clarity, and a lighting theme.
- The Addis Ababa City Administration needs to create guidelines for urban lighting and assemble a team of experts in the field, including planners, architects, urban designers, lighting engineers, sociologists, and other relevant fields. This team will be in charge of maintaining the city's image, artificial light illumination, and urban lighting-related experiments.
- In order to assist and encourage city residents to interact with the evening environment and take part in socioeconomic activities that draw both domestic and international visitors, the Addis Ababa City Administration should organize events and activities throughout the night.
- Further studies are needed to explore the potential of urban night environment and city nightscape in terms of city’s image in the global context, enhancing economic and cultural exchanges as well as economic values.

The professional association in charge of the city's image will generally concentrate on the nighttime quality of life, including street friendliness, tourist attractions, standard urban lighting design and implementations, the ability to clearly identify and modify scenes of visual discomfort within the city, the improvement of nighttime economic activities, the elimination of energy-consuming lighting fixtures, and the development of maintenance lighting fixture execution mechanisms.

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Appendices

Appendix 1 Publishable Manuscript

Ethiopian Institute of Architecture, Building Construction and City Development (EIABC)

Chair of Urban Design and Development

Urban Nightscape: An assessment of Artificial lighting on place recognition in the street and landmarks, the case of Addis Ababa main city center.

Elias Endale and Wossen Woldekidan

09/26/2023

Abstract

The aim of the study is to identify the role of artificial lighting on place recognition and perceived safety reassurance of the pedestrians. Urban nightscape is the result of artificial lighting from both utility and architectural lighting. Addis Ababa city center was selected for this study for its historical relevance, urban design elements and rapid transformation in both infrastructure and construction. Pedestrians believe that the cause off unsafe and unrecognizable nature of places results by lack of maintenance. Urban design elements lighting has given no attention, in order asses the influence of lighting on place identification eight urban design elements selected. This place recognition test accessed by comparison of daytime and night time recognition tests and excel charts used and for t-value test utilized to show the statistical significance of the variation. The result shows that an average of 58.89% recognition in comparison from daytime and nighttime photographs. Finally, its recommended to integrate lighting illumination on urban design elements to increase the visibility of this elements and to improve city image at night and the responsible authority should establish professional team to design and maintenance street lighting systems.

Key words: Nightscape, Landmarks, Artificial lighting, Urban design elements

1. Introduction

Urban nightscapes are influenced by both natural and manmade interventions, with street light and architectural lighting from shops, cafes, restaurants, and residential spaces being manmade interventions, while stars and moon are natural sources.

Addis Ababa, a vibrant African city, is renowned for its economic vitality and social interaction. Urban night life and fabric evolve significantly due to urban lighting, including utility lighting on roads, streets, playgrounds, parks, sports and industrial areas, rail and port installations, and architectural lighting on public buildings and landmarks.

Urban lighting plays a crucial role in a city's functionality and image. In Addis Ababa, a city with diverse social, economic, historical, and rapid transformation, poor luminance levels cause lack of visibility. The study focuses on the importance of lighting for pedestrian safety and self-identification, emphasizing the need for careful design and continuous follow-up to effectively harness its potential.

This research aims to examine the urban nightscape's perceived safety and security, identify the place's lighting, compare street light functionality, and recommend solutions to reduce security and enhance the place's identity identification.

The research explores Addis Ababa's city center, specifically Piassa, Arat Kilo, Merkato, and Le Gare, focusing on roads, streets, architectural landmarks, public buildings, open spaces, and modern skyscrapers. It also examines the urban nightscape, its impacts, and perceived safety for occupants.

2. Literature Review

Cities are characterized by complex activities, diverse lifestyles, and cultural and economic activities. The urban nightscape, a night environment illuminated by artificial illumination from buildings, streets, billboards, advertisements, and vehicles, is an integral part of cities' nighttime activities. Urban night corresponds to the urban entertainment economy, providing a rigor to thriving commercial activities and defining the nighttime activity in cities.

Lighting technologies were one of the most influential and transformative technologies in the 19th to 20th century, this technological development played a crucial role in nighttime behaviors, activities, image of a city by carving the space out of darkness and shaping urban and rural nightscapes not only providing illumination at night, this nighttime lighting can be perceived as a socio-cultural force affecting multitude ideas and practices that include safety, mobility od dazzling and operational society and civic and artistic expression (Taylor, 2019).

During the night city functions and activities become less cause of the nocturnal presence and new character and ambiance settled in (Dunn, 2016), as night advance The urban offer diminishes the city shrinks and the city huddles around its historic centers (Gwiazdzinski, 2016), this phenomenon and exchange of character and meaning has its own perception of the city dwellers.

In addition to involving safety, cost, maintenance, and energy consumption there are three factors to be considered in lighting design and illumination, the architectural, aesthetic, and emotional value that this light brings (Santen, 2006), Evaluating these 3 factors may render how artificial light illumination relevance in the society.

Lynch explained how mental image is created between people by the physical environment, as he pointed out legibility/imageability of people's behaviors and the physical should be the target in urban configuration. In his theory urban space can be understood as a "mental map" and physical composition of the path, edges, districts, nodes, and landmarks (1960), This clarity of composition connects people's behavior and the physical environment (Hongxiang, 2014), this increases the degree of how peoples understand their environment, pattern and structure and their relation to each other towards places and to relate place to place.

The nightscape of the city needs to have legible character (Hongxiang, 2014), even though the participants spent at night spent less time, there are different factors such as safety and security, night-time economy, and beautification of the city, the illumination of the city and lighting design must consider its urban elements and its imageability to resemble into daytime experience and presence. In urban areas street is an important element and its intersection is vital for shaping and for the identity of the city the city's safety is defined by

the presence of humans at night and nightlife plus the visual vocabulary of the nightscape element (Rezakhani, 2018), this increases the perception of urban space.

The night image laid over the modern city sky as a veil can be perceived as a counterpose to be electrified light as a blanket (Straw, 2013), which brings safety and comfort to urban life Night is seen as both form and matter rather than territory not just time, the urban night is a world with its own population and activities an inverted substitute for the daytime city (Dewdney, 2004), the nocturnalization of cities has been identified by clustering and unravelling of nighttime activating of different practices (Straw, 2013), artistic forms and activities evolve through time so does the type of exhibiting and performance time that focus on night.

The environment which is physical also perceived as temporal and can be seen as the organization of time, first as the large-scale cognitive structure of time how time is valued, linear or cyclic, future or past, and second as themes and rhythm of human activity (Rapoport, 1977), both peoples and their artifact should be included in the perceived environment.

As Rapoport noted the mutual interaction between an individual and the environment is determined by individual perception and interpretation of their relevance or meaning (1977), Environmental perception involves past stored information and stimulus and present one and allows the current state of mind and characteristics (Warr & Knapper, 1968).

There are two manners in which humans extract information from an environment, first direct information from sensory experience of that environment and processed image/ perception of the environment about personal and cultural experience (Hongxiang, 2014). After industrialization light exists during both day and night, In the evening light is based on artificial lighting and its effects (Santen, 2006), this accent of light and its effect create a perceivable space and environment during the night, physical elements during the day such as lamp post and street furniture may have a different expression, paving material, different facades, and other visual elements influence the light at night. The continuity and depth of urban space and characteristics can be disturbed by lighting conditions (Vassilva & Kollhoff, 2006).

Cities at night are unique, with the play of light and shadows which is more distinct and spectacle when compared to daytime (Dunn, 2016), with different economic and socio-cultural activities at night this constellation of light and shadow becomes an identifiable character of many modern urban spaces.

Artificial light shapes public spaces and architecture at night, guiding pedestrians and cars, influencing speed and serving as a wayfinding tool, reinforcing the identity of the places and guiding their movement.

3. Materials and Methods

3.1 Description of the study area

Addis Abeba, Ethiopia's capital, is located between 8° 50′N-9° 5′N and 38° 38′E-38° 52′E, at an elevation of 2015 to 3150 m a.s.l. It is located at the base of an isolated mountain known as Entoto, which was the city's origin. Its proximity to the equator means that the temperature is rather stable from month-to-month Figure 67.

Except for the northern flank, which is constrained by topography, the city has expanded in every direction. It presently houses 30% of the country's urban population, but its population is steadily expanding. Addis Abeba has a total population of 2,738,248 as of the 2007 census, and the current forecasts predict that figure will continue to climb, reaching 12 million by 2024 (UN HABITAT, 2006).

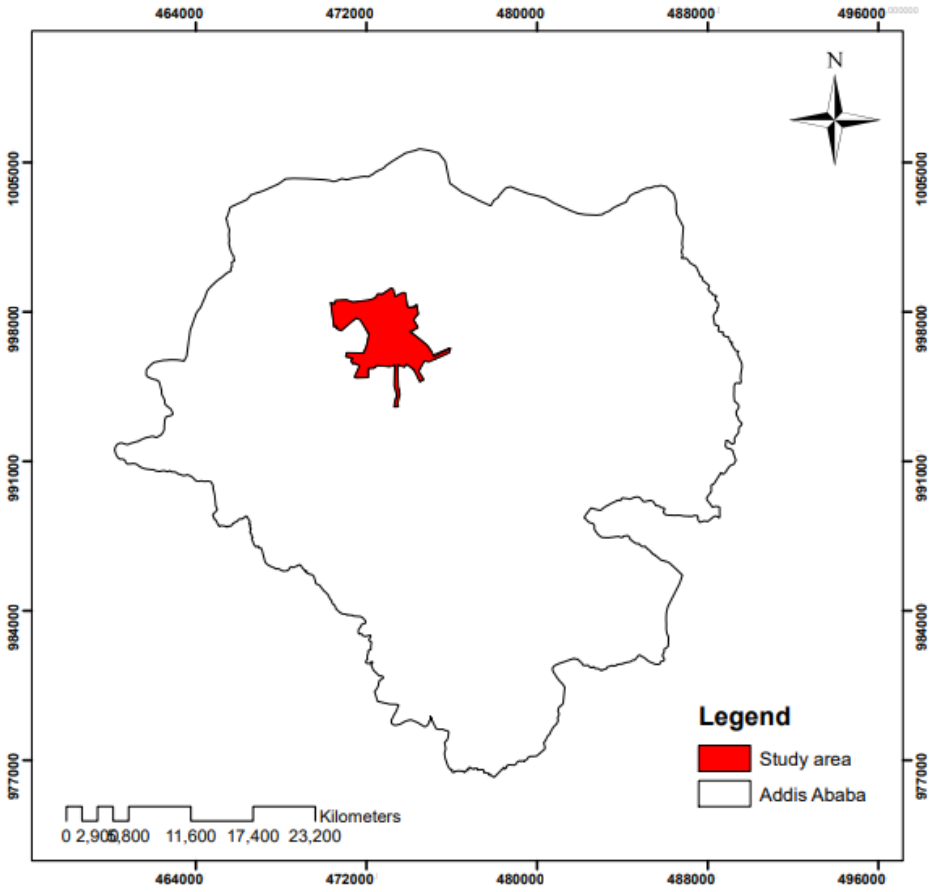


Figure 67.Location map of study area from Addis Ababa

Method

As primary data source, Ghels observation techniques was used (photographing, test walk and journaling) and semi-structured interview on the field and office participant. Non probable/ purposive sampling was used on selecting the landmark and street for this study whereas interview participant was selected randomly on the site from 6:00 pm to 8:00 pm evening.

Figure 68 depicts the chosen landmarks, historic buildings, and streets in the research region for the photographic interview. Both daylight and nighttime photographs were shot from the same location to better compare and contrast the location. Eight areas were selected for this study, Yekatit 12 memorial monument, Arat Kilo patriot's monument, Addis Ababa City Administration building, Churchil road, Ethio-Cuba friendship park, Lion of Judah near Beherawi theater, Lion of Judah in La Gare and Meskel square.

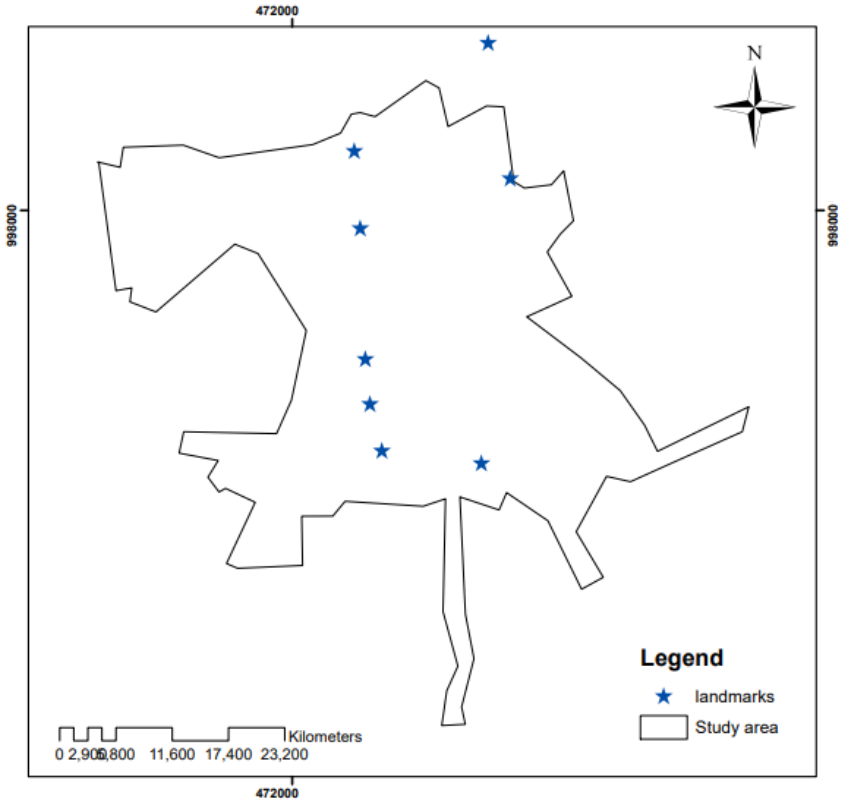


Figure 68. Location map of selected landmark and streets in the study area

Method of data analysis

Comparative analysis: a process of comparing sets of items and contents with their similarities and differences; this analysis was used on the photographic interview/image recognition test from daytime and nighttime photographs, and t-test statistical tests were used to test the statistical significance of the difference.

The verbal interviewee was requested to participate in image recognition test, then required to identify the daytime photograph and to match this day time photo with corresponding night time photo. After this data was collected and recorded to calculate the percentage excel

sheet was used, to show the statistical significance of the difference t-test analysis method utilized.

Table 7 shows the day time image recognition test, out of 75 participants 60 on-field and 15 office professional participants that shows the result summary.

Table 7. Summary of daytime and night time recognition test

No.	Landmark and Street	On-field participant	Office participant
1	Yekatit 12 Memorial	54	11
2	Arat Kilo Patriots Monument	57	12
3	Addis Ababa City Administration Building (Mezegaja)	58	15
4	Churchill Road	54	13
5	Ethio-Cuba Friendship Park	48	14
6	Lion of Judah near Beherawi theater	48	13
7	La Gare Lion of Judah Monument	46	11
8	Meskel Square	60	15

t-test analysis

Number of cases

N = 8

Degree of freedom

dƒ = n – 1 = 7

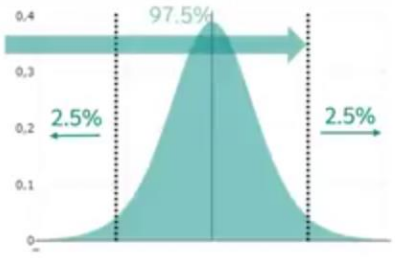
Mean

$$\dot{x} = \frac{42+37+10+18+36+38+25+6}{8} = 26.5$$

Standard deviation

$$s = \sqrt{\frac{(42-26.5)^2+(37-26.5)^2+(10-26.5)^2+(18-26.5)^2+(36-26.5)^2+(25-26.5)^2+(6-26.5)^2}{7}}$$

s = 13.83



Standard error of the mean

$s_e = \frac{s}{\sqrt{n}} = \frac{13.83}{2.83} = 4.89$

t-value

$t = \frac{\dot{x}-0}{s_e} = \frac{\dot{x}}{s_e} = \frac{26.5}{4.89} = 5.42$

Significance level

$\alpha = 0.05$, undirected hypothesis so we split the 5%, $1-\frac{\alpha}{2} = 0.975$

Degree of freedom

$df = n - 1 = 7$

Critical t-value

$t_{crit} = 2.365$

$t = 5.42$

$t_{crit} < t$

Table t-value

Area one-tailed

df	0.5	0.75	0.8	0.85	0.9	0.95	0.975	0.99	0.995	0.999	0.9995
1	0	1	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0	0.816	1.061	1.386	1.886	2.92	4.303	6.965	9.925	22.327	31.599
3	0	0.765	0.978	1.25	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0	0.741	0.941	1.19	1.533	2.132	2.776	3.747	4.604	7.173	8.61
5	0	0.727	0.92	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0	0.718	0.906	1.134	1.44	1.943	2.447	3.143	3.707	5.208	5.959
7	0	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0	0.706	0.889	1.108	1.397	1.86	2.306	2.896	3.355	4.501	5.041
9	0	0.703	0.883	1.1	1.383	1.833	2.262	2.821	3.25	4.297	4.781
10	0	0.7	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587

Figure 69. t-value table and figure

Assumptions

- Two dependent groups or samples were available from the same sample where the measured value was taken during the day and at night.
- The difference of paired value is normally distributed.
- Only successfully identified values were extracted from the daytime shot, which was used in conjunction with a nighttime recognition value.

Figure 70, compares the results of recognition tests conducted during the day and at night. The blue line represents the results of the daytime recognition test, while the red line represents the results of the nighttime recognition, which demonstrates the capacity to identify and recognize locations that are directly tied to artificial illumination at night.

Daytime and night time recognition comparison

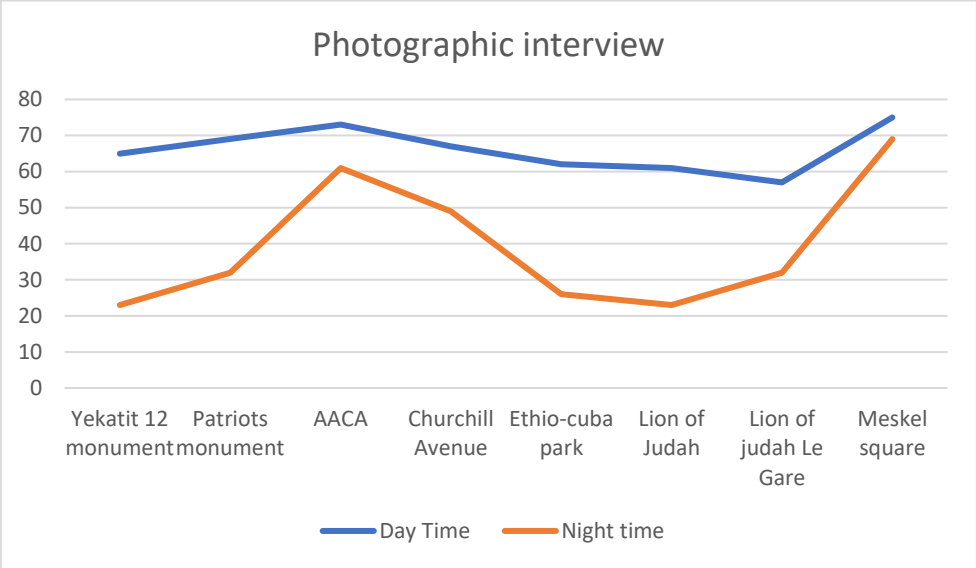


Figure 70. Summary of Image recognition test in both daytime and night time

4.Result and Discussion

The study reveals that lighting usage directly affects the identifiability and recognition of places, with artificial lighting involvement in urban areas being an independent variable and recognition of place being a dependent variable. This research highlights the connection between orientation in place and time, navigational ability, and urban lighting, including utility and architectural lighting, at night. The study focuses on the practical and expressive qualities of urban lighting.

The study reveals that urban lighting and artificial illumination during nighttime affects occupants recognize ability and perceived safety and security. It found that identifiability and recognizability of places, monuments, and landmarks are related to luminance contrast, visibility of elements, and visual hierarchy of lighting design (Diana, 2016).

Despite the small sample size of 75 and the usage of 8 landmarks and streets in the analysis, this study found that the mean difference and variance were statistically significant in terms of comprehending the value of artificial lighting illumination in urban night.

5. Conclusion and Recommendation

Inadequate maintenance on street lighting posts and design considerations lead to a decrease in the familiarity and recognizability of landmarks and streets, according to the study, which examines the influence of urban lighting on place identification and expressiveness in Addis Ababa. However, the place's character may be restored with meticulous lighting design and ongoing infrastructural upkeep.

To improve the visibility of historical landmarks and streets, conventional urban and street lighting rules should be implemented. Together with emergency and auxiliary AACRA groups, a responsible party for lighting fixture upkeep and functionality should be established.

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Warr, P. D., & Knapper, C. (1968). *The perception of people and events.* London: Wiley.

Appendix 2 Verbal Interview (Field)

Questionnaire paper (On-field participant)

My name is Elias Endale, I am a student in Addis Ababa University at EIABC studying Urban Design and Development, working on a master's thesis research on "Urban nightscape in Addis Ababa city center". The main purpose of this research is to observe and investigate how artificial lighting and illumination design has been studied and implemented in urban design elements and visual perception. So, you have been selected for a verbal and photograph interview to participate in the study, you will be required to provide honest and accurate response, your response will be vital to achieve the research's objective. Your response and identity will be confidential and used only for academic purposes. For further information you may call 0923247489

Thank you for your collaboration

General data

Date of response _____

Questionnaire paper _____

Name of data collector _____

…….

1. Sex ☐ M ☐ F
2. Age
   - 15 - 18 ☐
   - ☐ 18 - 25
   - ☐ 25 - 40
   - ☐ Above 40
3. Occupation
   - Worker ☐
   - Unemployed ☐
   - Student ☐
   - Self employed ☐
4. Residency
   - Addis Ababa ☐
   - Another place ☐

If the answer is yes, please describe your place _____

_____

5. Reason for walking/ jogging or engaging in the activity?
   Leisure/refreshment ☐
   From work to home ☐
   To work ☐
   Other _____
6. Travel route to this destination
   Define your path to arrive at this destination point? _____
   _____
   Why do you prefer this route? _____
   _____
   Characterize your route character and identity? Describe in terms of physical environment.
   _____
   _____
7. In this space/path/square what element do you think gives its distinctive character? Tell us what you easily remember and identify about this place? _____
   _____
   _____
8. Discuss what is the importance of lighting design and illumination?
   _____
   _____
9. Discuss how a lighting design and illumination can affect the place at night?
   _____
   _____
10. How do you evaluate this area's lighting?
    Very Good ☐
    Sufficient ☐
    Poor ☐
    Needs improvement ☐
    Why? _____
    _____
11. How do you describe your feeling of safety around this place (due to lighting system)
    Extremely unsafe 0 – 20 ☐
    Unsafe 21-40 ☐
    Average 41-60 ☐
    Safe 61-80 ☐
    Very safe >80 ☐
12. How does the lighting design/illumination in this area resemble with the day?
    _____
    _____

13. Any additional comment and insights about lighting design and illumination (optional)

_____

_____

_____

Thank you for your patience.

Appendix 3 Verbal Interview (Professional)

Questionnaire paper (Professional participants)

My name is Elias Endale, I am student in Addis Ababa University at EIABC studying Urban Design and Development, working on a master's thesis research on urban nightscape in Addis Ababa city center. The main purpose of this research is to observe and investigate how artificial lighting and illumination design has been studied and implemented in urban design elements and visual perception. So, you have been selected for a verbal and photograph interview to participate in the study, you will have required to provide honest and accurate response, your response will be vital to achieve the research's objective and your response and identity will be confidential and used only for academic purpose. For further information you can call on 0923247489

Thank you for your collaboration

General data

Date of response _____

Questionnaire paper _____

Name of data collector _____

…….

1. Sex ☐ M ☐ F
2. Profession
   - Architect ☐
   - Engineer ☐
   - Urban designer ☐
   - Lighting designer ☐
   - Lighting technician ☐
   - Other profession ☐
3. How do you define urban nightscape?

   _____

   _____
4. How do you define the benefit of lighting design and illumination at night?

   _____

   _____
5. Have you ever engaged in the lighting design in the city of Addis Ababa? If you do, name the place and discuss your contribution

   _____

   _____

6. Does your lighting design group/team include the following,

- Safety and security of pedestrians Yes ☐ No ☐
  Why? _____
  _____
- Aesthetic and visual perception Yes ☐ No ☐
  Why? _____
  _____
- Differentiation of light for different urban elements Yes ☐ No ☐
  Why? _____
  _____
- Check technical and practicality of lit environment Yes ☐ No ☐
  Why? _____
  _____
- Environmental control such as light pollution and glare Yes ☐ No ☐
  Why? _____
  _____
- Control on advertisement illumination Yes ☐ No ☐
  Why? _____
  _____

How frequently do your team maintain and measure the performance of lighting fixtures?

_____
_____

7. How do you evaluate the nightscape of Addis Ababa city center?

_____
_____

8. How do you describe the current lighting design impact on the image of Addis Ababa?

_____
_____

9. How do you describe the drawbacks of lighting design in Addis Ababa city center?

_____
_____

10. Any additional comment and insights about lighting design and illumination (optional)

_____
_____

Appendix 4 Photographic interview

1._____

2._____

3._____

4._____

5._____

6._____

7._____

8._____

Appendix 5 Photographic interview

1._____

a.

2._____

b.

3._____

c.

4._____

d.

5._____

e.

6._____

f.

7._____

g.

8._____

h.

Appendix 6 Observation check list

Date of Observation	
Observed site	
Observation time	
Name of the observer	

No.	Observed quality	Value	Remarks
1	Visibility of pedestrians and vehicles		
2	Zonal clarity of urban design element and spatial structure by lighting		
3	Architectural lighting quality and visual interest on urban design elements		

Appendix 7 Checklist value

Visibility of vehicles and pedestrians
5. Clear visibility of pedestrian movement and vehicles by lighting and active frontage
4. Only Street light with no pedestrian lighting
3. Dark spots between pedestrian and street light
2. Non uniform street and pedestrian light
1. Unfunctional lighting fixtures
Zonal clarity of urban design element and spatial structure by lighting
5. Distinguishable character of the urban element with distinct lighting
4. Recognizable urban element by same lighting as the surrounding
3. Recognizable urban design element by surrounding light only
2. Un-recognized by surrounding lighting
1.No lighting consideration
Architectural lighting quality and visual interest on urban design elements
5.Visible form (all sides) and detail of urban design element (building, monument and landmark) by lighting
4.Visible form (at least 2 sides) with considerate details by lighting
3. Recognizable form and detail by lighting
2. Recognizable form and detail by context lighting only
1.No lighting consideration