A STUDY ON OCCUPANT SATISFACTION IN OFFICE SPACES WITH POST-OCCUPANCY EVALUATION APPROACH: AN OFFICE BUILDING EXAMPLE IN UMRANIYE

by
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ABSTRACT

A STUDY ON OCCUPANT SATISFACTION IN OFFICE SPACES WITH POST-OCCUPANCY EVALUATION APPROACH: AN OFFICE BUILDING EXAMPLE IN UMRANIYE

This thesis study is to increase the level of satisfaction in an office space. In this context, the method of the study is Post Occupancy Evaluation (POE). The scope of this study is discussed primarily on the concept of architectural space, occupant satisfaction and quality of life. This study is based on the explanation of POE approach and the investigation of POEs at office structures via technical, functional and behavioral perspectives. Current scientific investigations on office structures are built in the framework of theoretical and practical space readings based on disciplines including POEs, environment-behavior studies and spatial character parameters. In this study, the office space is handled as a combination of (1) technical performances, (2) performance on space utilization (functional) and (3) performance on occupant's mood (behavioral). ANEL Business Premises is selected for space study and a survey detection study is performed on 82 individuals. Findings reveal that there is a positive correlation between technical performance and functional and behavioral performances.

ÖZET

KULLANIM SÜRECİNDE DEĞERLENDİRME YAKLAŞIMI İLE OFİS MEKÂNLARININ KULLANICI MEMNUNİYETİNİN İRDELENMESİ: ÜMRANİYE'DE BİR OFİS BİNASI ÖRNEĞİ

Bu tez çalışması, ofis mekânına duyulan memnuniyetin artırılmasına yöneliktir. Bu çerçevede, araştırmanın yöntemi olarak Kullanım Sürecinde Değerlendirme (KSD) yaklaşımı uygulanmıştır. Araştırma kapsamında öncelikle, mimari mekân, kullanıcı memnuniyeti ve yaşam kalitesi kavramı bağlamında ele alınmış, KSD yaklaşımının anlatılması ve temsili bir uygulama ile KSD'nin ofis yapılarında teknik, işlevsel ve davranışsal açıdan irdelenmesi esas alınmıştır. Ofis yapılarına yönelik güncel bilimsel araştırmalar, KSD, çevre davranış araştırmaları ve mekânsal karakter parametreleri disiplinlerine yönelik teorik ve uygulamalı alan okumaları çerçevesinde kurgulanmıştır. Bu araştırmada ofis mekânı (1) teknik, (2) mekân kullanımına yönelik (işlevsel) ve (3) kullanıcı duygu durumuna yönelik (davranışsal) performansların bir bileşkesi olarak ele alınmıştır. Alan çalışması için ANEL İş Merkezi seçilmiş ve 82 kişi ile anket saptama çalışması yapılmıştır. Bulgular, teknik performans ile işlevsel ve davranışsal performans arasında pozitif yönde bir bağ olduğunu göstermiştir.

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LIST OF SYMBOLS/ABBREVIATIONS

m^2	Square meter
O	Observational
R	Responsive
s.	Seconds

BPD	Building Performance Evaluation
CIC	The Construction Industry Council
DTI	Department of Trade and Industry
DQI	Design quality indicator
E-A	Environmental assessment
IEQ	Indoor environment quality
JSC	Joint Stock Company
OGC	The Office of Government Commerce
POE	Post occupancy evaluation
TDK	Turkish Language Institution

1. INTRODUCTION

20.1 percent of the total global energy consumption belong to construction industry, and the expected annual increase from 2012 to 2040 is 1.5 percent [1]. In addition, people spend 90 percent of their time in indoor areas and there are many evidences showing that the quality of indoor area has impacts on health, wellbeing and productivity of occupants [2].

The general approach is Post Occupancy Evaluation (POE). This approach investigates feedback on the occupation performance of the building including its energy performance, indoor environmental quality (IEQ), occupant satisfaction, efficiency, etc. This thesis study investigates an office structure using Post Occupancy Evaluation (POE).

While POE is defined as a method of During/At/Post Occupancy Evaluation, it is called Post Occupancy Evaluation (POE) in world literature. Friedmann, Zimring and Zube suggested "Environmental Design Evaluation" for POE in 1978. Different investigators handle this subject under titles such as "Environmental Audits" and "Building-in-use Assessment." Recently, POE is addressed as "Building Evaluation" and "Building Performance Evaluation." However, it is commonly used as "Post Occupancy Evaluation" due to its wide recognition [3].

Post Occupancy Evaluation (POE) is a process of evaluating the performance of a building used at least a couple of years. Investigators provided comprehensive and critical examinations for the qualitative and quantitative descriptions of POE. These include the definition, history and benefits of POE.

The growing trend towards energy saving in construction industry and the objective of better designed indoor spaces result in the higher level of adoption of green building certificate systems or at least the influence of these systems (whether certified or not) on designing conditions. Up to day, at least 150 certificate systems (green building rating systems), building assessment and comparison methodologies have been used [4]. The main examples to these systems are BREEAM, BEPAC, HK-BEAM and LEED. However, it has been discussed in the literature whether certified buildings offer energy saving or they offer better indoor environmental quality (IEQ) [5]. In this context, POE gained

importance in order to investigate buildings that follow various green building certificates or uncertified buildings.

Certification systems are used generally at the designing step; some certificates require ongoing measurement and verification at construction step. Besides, the key indicators for green buildings should not only be its design objective but also its real performance; however, this is taken into consideration only in a few rating systems. Thus, POE is a crucial tool to verify whether these buildings offer the target performance.

Another importance of POE is that green building certification systems focus on the design and production steps of buildings, but they fail to evaluate the step after the initiation of building occupation which is a step that reveals the real performance of these buildings. However, POE approach examines the processes and performances after the completion of the buildings and after its occupation; thus, providing sustainability for the buildings.

There are a couple of exemplary systems based on real performance instead of modeled or expected performance in building certification systems which has similar characteristics with POE. WELL Building Standard, The Sustainability Tracking, Assessment & Rating System™ (STARS®) are examples to a couple of these systems.

Only a couple of rating systems include the measurement of real performance and the verification by an objective third party. Thus, POE is an assessment method necessary for buildings to obtain their real performances. While POE can be a part of the green, it can also be used to establish a certification system and together with these systems; moreover, it can also be used in buildings that are not green as the total of a separate approach and techniques.

A comprehensive literature scan revealed that all POE methods used today go back to 1960s, but all these studies were not called as POE. In 1960s, Sim Van der Ryn from Berkeley, California University and Victor Hsia from Utah University conducted a systematic evaluation of occupant opinions and hall of residences. In addition, Peter Manning from Liverpool University, England investigated the physical environments and emotional senses of individuals living in the buildings [6]. The first publication on POE is written by Herb McLaughlin from KMD Architecture in San Francisco on AIA Magazine in 1975. The other pioneers in 1960s and 1980s are Thomas A. Markus, David Kernohan from Strathclyde University, England and their college friends from architectural study

group, and Gerald Davis from Victoria University, New Zealand and International Services Center [7]. Its concept and terminology became more general when in 1988, Preiser, Rabinowitz and White wrote a course book on POE in which POE is defined as "a systematic and comprehensive process sometime after the buildings are constructed and occupied [8]. In a book called "Building Evaluation Techniques" written by George Baird et. Al. in 1996, the application of POE is introduced with 120 different technical evaluations and tools [9]. As the scope and objective of POEs widened, it became widely recognized in the industry, and in 2002, POE was defined as "any activity arouse from the interest on learning about the structure of the building after its construction and how building occupants are influenced from the created environment" [10].

The concept of POE became wider in 1997 when Preiser and Schramm suggested an integrated framework on building performance evaluation (BPE). In this context, POE represents only one review cycle out of six. It is shown in "Figure 1.1." BPE focuses the whole life of the building from planning, programming, design to construction, reuse or recycle [11].

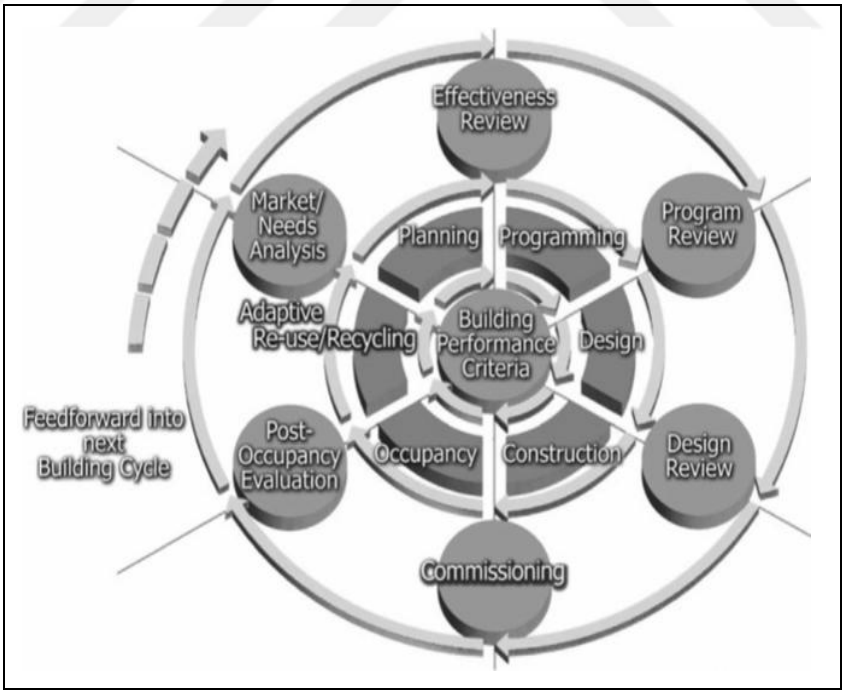

Figure 1.1. Building Performance Evaluation (BPE) process model [6]

POE offers a wide range of benefits including the evaluation of building performance, investigation of relations between inter-building behaviors, the occupation of building

resources, indoor optimization for building occupants, more deliberate decisions on future building designs and building development opportunities.

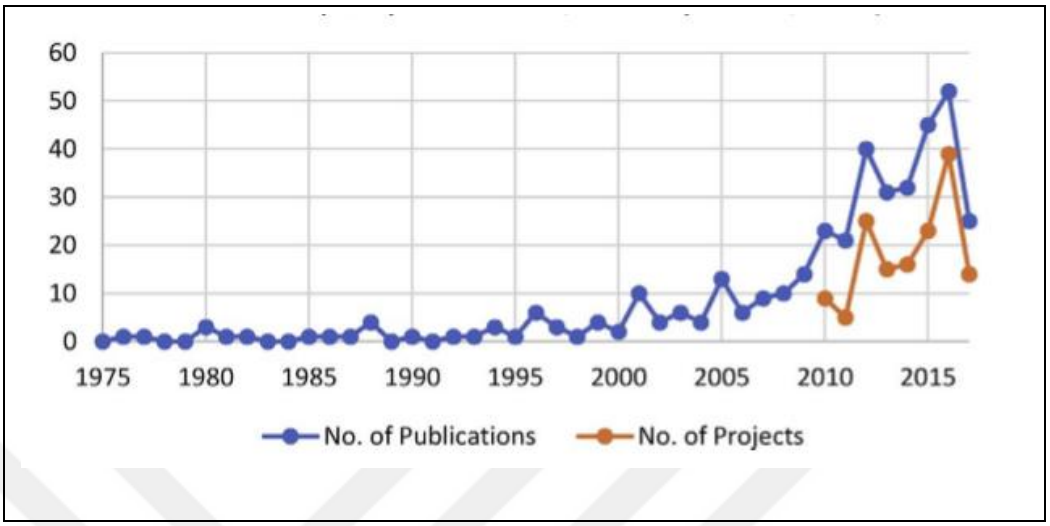

Figure 1.2. Number of POE publications and POE projects [12]

"Figure 1.2" shows that the number of publications on POE in Web of Science increased strikingly in 2010. It is obvious that many building types were investigated in regards to POE in 2010 [12].

Li and others state that the building types that can be used in POE investigation are as follows [12]:

- Commercial buildings: Supermarkets, clubs, congress centers, etc.
- Office buildings: Commercial buildings for mixed occupation
- University building: Sports center, canteen, cafes etc. in universities
- Educational buildings: Kindergartens, preschool, nursery, libraries, and galleries
- Medical buildings: Hospitals, oncology support centers, etc.
- Residential buildings: Residences, apartments, villas, dormitories, etc.
- Communication buildings: Train stations and airport terminal buildings
- Public buildings: State buildings, courts, museums, post offices, etc.

Multiple buildings can be evaluated using a POE project. "Figure 1.3" done by Li and others shows the number of projects and buildings organized according to building types. Thus, it is revealed that the residential buildings are the most popular investigation subject.

They are followed by university buildings and office buildings. This is not a surprising result as these building types are spaces where people spend most of their time, where they live, work and study. For different building types, POEs are generally very different both for their targets and methodologies. POEs of residential buildings focus generally on the experience of building occupants and their occupation; thus, a survey or interview is used as a study method almost in all projects. POEs of buildings are typically related to the comfort and productivity of users. POEs of university buildings are variable, but they can be similar to POEs of residential buildings depending on the target. POEs of kindergartens and schools focus generally on the analysis of children's behaviors and the productivity of learning activities; and observation is the basic component methodology. POEs of medical buildings are typically quite different from other POEs: on one hand, variable methods are used to evaluate general occupant experience (for instance; accessibility and guidance); on the other hand, indoor quality of medical buildings (e.g., audio insulation) has firm methods that require physical measurement. In addition, China, Australia, Canada and Malaysia are more active in POE investigation in regards to both project numbers and building numbers [12].

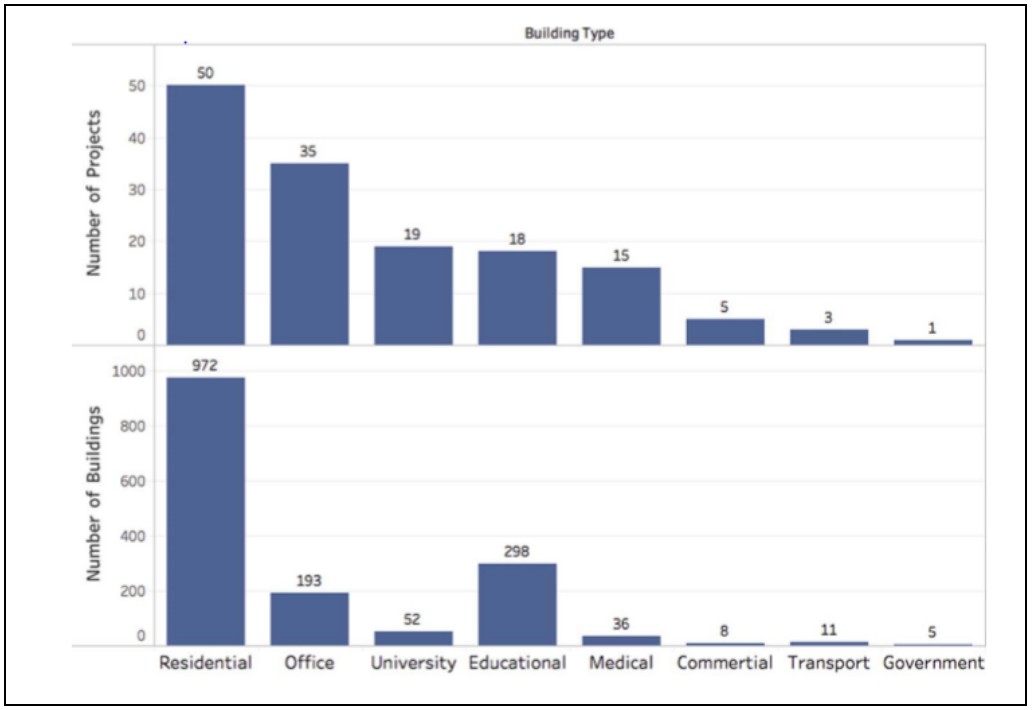

Figure 1.3. Number of projects and number of buildings per type of building [12]

POE projects are conducted for various reasons. In 1995, Preiser classified POE into three phases: demonstrate, investigative and diagnostic [13]. In 2008, Hadjri and Crozier defined the objective of POE as “to ease usable information / knowledge to improve it later” [14]. Although there are many resources available on POE, the literature lacks a systematical review and a nuance typology based on objectives. Investigators used voyant-tools.org to analyze the frequency of words used in POE method. Based on this, the most frequently used words in a POE investigation are listed in “Table 1.1.” [12].

Table 1.1. Number of projects and number of buildings per type of building [12]

Frequency Rank	Word	Count	Frequency Rank	Word	Count
1	building(s)	46	11	use	14
2	performance	27	12	design	13
3	occupants	24	13	investigate	13
4	evaluate	20	14	comfort	12
5	energy	19	15	quality	12
6	environment(al)	19	16	green	10
7	user(s)	19	17	IEQ	10
8	satisfaction	18	18	post	10
9	assess	14	19	occupancy	10
10	indoor	14	20	thermal	9

The Post Occupancy Evaluation method whose description and intended use are explained in this study is used to investigate the spatial satisfaction of occupants. The studies reveal a relation between the spatial satisfaction and physical characteristics the buildings provide. In this thesis study, the relation between human - space is interpreted as the relation between occupant - architectural space. The architectural space is limited due to office structures, while the occupant is limited due to office structure employees.

This study tries to detect the occupant satisfaction specific to Anel Business Premises. The foundation of occupant satisfaction is dealt with holistic approach in regards to performance requirements, spatial character parameters, the concept of the quality of life and POE. These four disciplines are analyzed according to offices and basic concepts

independent of building types. The literature study asserted that studies with similar qualifications touch more on specific subjects. Only one subject (privacy, lighting, work flow, social interaction... etc.) is dealt in the studies mentioned. This study reveals a more holistic approach. The holistic structure is created by the absorption of spatial character parameters and POE together with office type description and functional information of the quality of life investigations.

The process in this study is done in three steps as shown in “Figure 1.4.” and is classified into three: 1) literature scan (preliminary study), 2) space-POE set up study (connection study) and 3) field study.

The preliminary study is conducted in phases of theoretic, spatial readings (POE, offices, scientific studies). The relation between space and POE is dealt in setting up the connection model. The field study is conducted in a process of interview, observation, taking photographs, preparing and applying survey forms.

POE study starts with the definition of the space. “Office space” which is one of the leading spaces where individuals spend most of their time throughout the day is selected as a field study; and the objective is to evaluate the quality of life of spaces for occupants. Based on this objective, the spatial character parameters are investigated, the concepts of spatial quality and the quality of life in a space are examined via the definition of space. POE study which investigates the performance evaluation of a space according to occupant factor measures the spatial quality through technical and functional performances and the the quality of life of a space through behavioral performance while measuring the technical, functional and behavioral performances of a space.

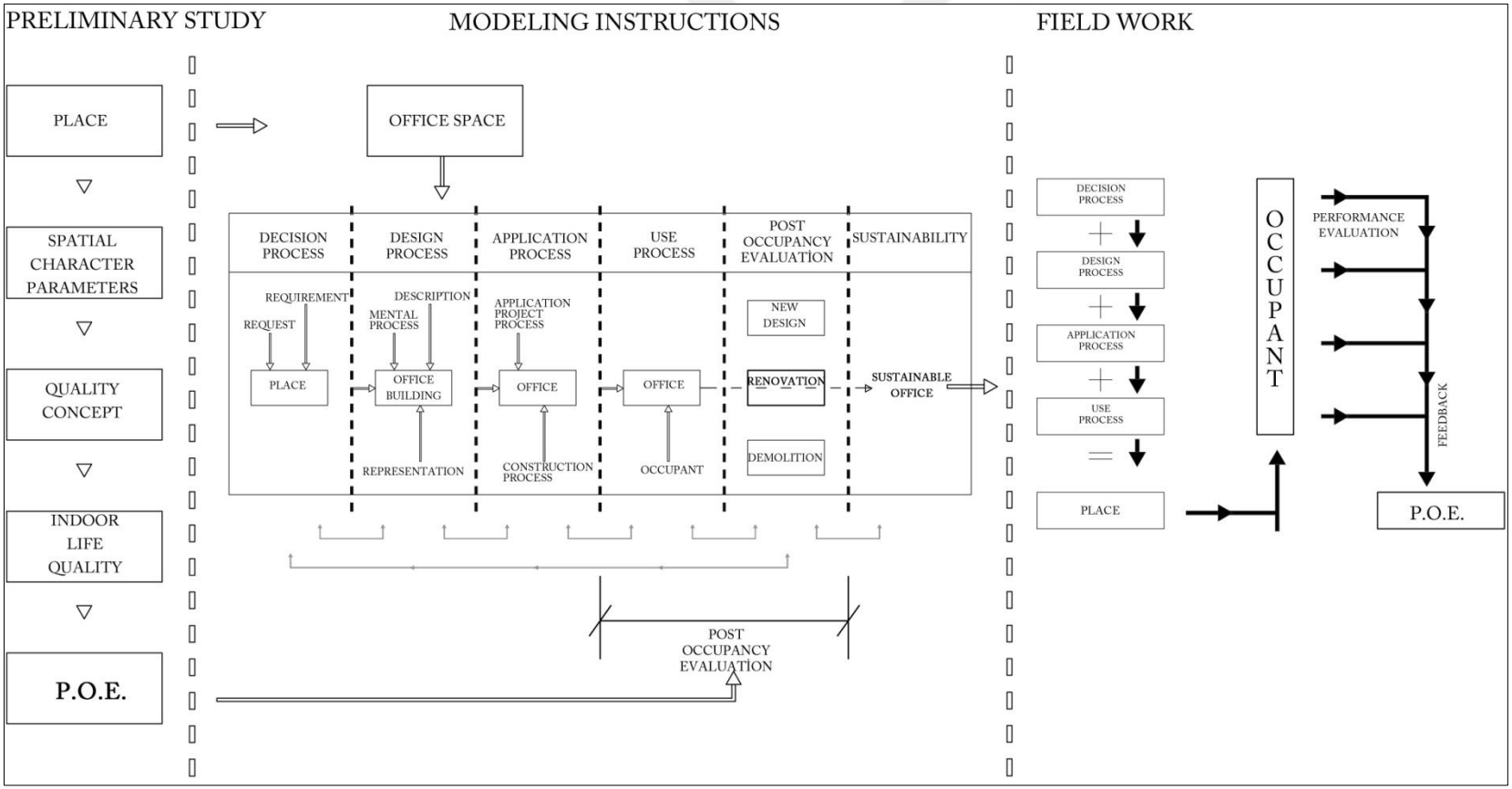

Figure 1.4. Study Model

1.1. OBJECTIVE OF THE STUDY

In relation to a building, POE project aims to contribute generally to the information about the building or ideally to generalize what is learned for a wider application. These may include problem identification, design strategies or problems a building's performance create.

POE contributes to design teams and owners in taking more conscious decisions, developing future POE methods, reviewing building standards or green rating systems, and in evaluating the efficiency of technology.

"The Investigation of Occupant Satisfaction in Office Spaces through Post Occupancy Evaluation Approach: Anel Plaza Example" which is the subject of the study is basically occupant oriented. Office buildings where individuals spend their time the most provide occupant comfort, aim to obtain productivity at maximum level. This minimize the energy consumption. The investigation subject of Post Occupancy Evaluation (POE) is a method to create satisfactory spaces for individuals that use and manage office structures.

This study aims to identify whether office spaces have the expected spatial quality of life. Moreover, this study emphasizes the necessity of a holistic approach in technical, functional and behavioral evaluation of office spaces by occupants, in the evaluation of quality only by the experts in addition to the inclusion of occupant participation.

1.2. THE SCOPE OF THE THESIS

This study focuses on post occupancy evaluation and examines the spatial quality of office structures in the context of occupant satisfaction.

Thus, the conceptual framework of the study consists of space, architectural space, spatial character parameters, quality, quality of life, occupant, post occupancy evaluation and satisfaction. Concepts including space, architectural space, spatial character parameters, quality, quality of life, occupant, post occupancy evaluation and satisfaction will be investigated throughout the study. The subjects are limited to whether the office space selected as the sample study field fulfills the spatial character parameters and inhibits the conditions required for space quality.

The study field as a physical space is Anel Business Premise situated in Umraniye district. Surveys and analyses on occupants and functions are conducted for the whole office space. As a result of the evaluations, the satisfaction level during occupation process will be measured, redesigned/reproduced and design criteria based on feedbacks will be submitted to office spaces.

2. THE CONCEPT OF SPATIAL QUALITY AND THE QUALITY OF LIFE

2.1. DEFINITION OF SPACE

The lexical definition of space is ‘vacancy, place’ [15]. The definition of space has changed throughout centuries. Different disciplines such as philosophy, psychology, physics and mathematics started to deal with space as a different concept in time. In astronomy, the space is linked with boundless aerospace. In renaissance, Copernicus and Bruno who mentioned the astronomic space, namely the infinity of space, Newton defined this space as a finite, homogeneous or empty place. This scientific approach on space has formed the basis for a long time period. In mathematics, the space is defined with Euclidean geometry and three dimensions. Later on, Rieman suggested that every spot in the space can be linked to another spot creating a finite space. This geometry lets us think that the space is infinite with boundaries.

It handles intelligent space within an idealist framework, establishes a relation between S. Giedion’s space and Euclidean geometry, a structural relation that exceeds this geometry beyond the daily activities of individuals [16]. Schulz defined space as a psychologically large and complex formation which has a very substantive structure depending on the perception [17].

The limits of a tree’s shadow that touches the light the sun spreads can be defined as space. Here, light may identify a space although there is no blocker. This means that the limitation that forms the space can be with physical elements or can be visual only. Depending on the definition of Aristo which stresses some kind of subsequent envelopes that include all things from the smallest to the biggest, that are limited to sky, Meiss defined space as a need-based pit that is completely full on the inside and limited from the outside. Meiss added that there is nothing called the blank, everything has a position, state and place [18].

The first known approach to the concept of space in literature comes from the oldest known, written source, the Vitruvius. It is stated that Vitruvius considers the vertical position of human body as an archetypal space. Depending on the Vitruvius approach,

Norberg Schulz calls the reflection of this verticalness on a horizontal plane as "existentialist space." Schulz stated that the word 'space' may include many meanings; and after investigating its definitions throughout history, Schulz concluded that today, it can be used for mathematical (3-dimensional geometry) and perceptual space concepts. In his book called Existence, Space and Architecture, Schulz examined the space as existentialist and architectural space and defined the architectural space as the solidification of existentialist space [17].

The most explicit characteristic of social space is that it has to sustain a life that depends on the earth. Thus, "place" concept was on the fore in his architectural theory and expressions; he even used "place" concept instead of "space" in some movements [19]. As stated by various opinions, the concept of place is a spatial phenomenon created around a constructed environment [20].

Hertzberger discussed the space at multiple levels. However, the starting point is "the idea of space." For him, space and precision are foreign. The idea of space is on the side of everything that has available limitations that widen and move and of everything that is more open to possibilities. This is opposite of things that are very tightly closed / alchemy, that are devastating and awkward, closed and sectional, that are classified, proven, appointed before and unchangeable and absolutely structured [21].

Kahvecioğlu mentioned that the space is 2-dimensional:

- It can be explained as the physical dimension of space and physical limitations and characteristics that form the space.
- They are the dimensions that develop within the mind of an individual but that do not physically exist; and they are the characteristics that are revealed in time depending on the perception and experience of space.

The physical dimension of space is processed in the sensation step of perceptual process, whereas the conceptual dimension of space is the result of intellectual steps of perceptual process [22].

Physical space, namely the traditional space concept is of the same age with humanity. It came out when human beings need for shelter. Physical space is a confined blankness shaped according to the needs of human beings in real world.

The relation of human beings with space makes it meaningful. The space becomes defined with the existence of human beings. The blankness forms the place, namely the space as it is defined as view points overlap based on the values. Not only the space exists because of people's needs, but also it requires individuals who exist as sensing elements [22].

2.2. ARCHITECTURAL SPACE

The starting point when the concept of space exists conceptually in architecture coincides to the beginnings of 20th century. To create space is the fundamental labor of architecture. Yücel defines "space" which is considered as the center of architecture as a blankness that separates human from its environment to a certain extent and enables human beings to sustain their actions within [20].

Space is defined in its perceptibility. It has perceptual borders. These borders do not always have to be physical such as walls, upholstery, ceiling, etc. Characteristics such as light, sound and color enable a space to be perceived. The space can only be perceived when its borders are revealed. If it has no borders, then the space may not be perceived [23]. Another condition of perceiving the space is that it should have a function. A definitive space is not enough, there has to be a sustaining movement and life in itself. The key characteristic that distinguishes space from a geometrical shape is its ability to be experienced. According to Zevi, architecture is not made of the width, length and height of structural elements that surround the space. These can only help a space be defined. In reality, space is a blankness in which one lives and moves and that is surrounded by these elements. However, this does not mean that it is made of these elements [24].

Bozkurt defines architecture as a space prepared and covered for a certain function, for a certain purpose [25]. Architecture creates functional borders by blustering mass and blankness. These borders establish the 3-dimensional space in which people live. The space whose emergence target is to respond to the instinct of human beings to take shelter started to respond to the physical, emotional and social problems of individuals nowadays. Thus, architecture fulfills not only the primary needs of individuals for taking shelter, but also the secondary needs such as excitement, education and communication.

> Architecture is the solidification of an image that lies beyond the existent environment. The architectural space can (then) be defined as the solidification of existentialist space [17].

> Architecture that is a structured environment forms the structure of spaces whose impact on human beings increase and that can exist simultaneously every where and that forms the most significant part of societies. Individuals do not accommodate themselves passively to their environment; rather, they actively structure it according to their needs. They establish individual communication; this characteristic interaction varies depending on the conditions and individual [26].

One of the fundamental concepts that form the space is its borders. When one mentions the architectural space, she/he talks about physical and structural elements such as walls, upholstery, ceiling, etc. Architectural space has perceptual characteristics too in addition to these physical properties. In order to understand architecture and architectural space, one needs to perceive the space, to live in it, move in it and experience it. Jeodicke stated that an architectural space can be perceivable due to its confined structure and carries a holistic meaning with the life in itself [23]. Similar to Jeodicke, Hoogstad stated that the architectural space exists according to the life that exists in itself and the perceptions that are obtained based on the movement. As long as the concepts of scale, border, movement and time are not completely defined in a space, then they will be left as ungrounded concepts. This can only become real with the perception and experience of an individual [27].

What comes to mind when one mentions an architectural space is a work that is limited from above, from below and from sides. Frankly, space is a limited blankness [28].

Architectural design represents a regular process in designing a space that forms the basis of architecture and in making products out of space-creation acts. This regular process is, at the same time, an act of organization. The space that a designer forms by getting together his/her ideas is a product of design and gains meaning when the occupant starts to respond to space relations and interactions. Each step till the establishment of space, namely the construction of an idea product (abstract) as a physical object (concrete) is the result of an organization.

According to Norberg-Schulz, there are two methods used for developing space theory. First is the “Euclidean Space” depending on the 3-dimensional geometry. The latter is space theory based on observation and perception [17].

A connection between two different dimensions of a space that Kahvecioğlu mentions can be established using these two methods. Euclidean space can be considered in exchange for physical dimension, while the space based on perception and observation can be considered in exchange for cognitive dimension.

Norberg-Schulz classifies the space as pragmatic, perceptual, existential, cognitive and abstract:

i. Pragmatic Space: A material space that exists with its physical dimension. A space that has certain ambient conditions that are limited and identified using architectural elements. According to Norberg-Schulz, pragmatic space takes in individual to its natural environment and defines its behaviors.
ii. Existential Space: A space in which an individual lives in at every moment, performs activities, connects with its environment, a space that is renewed and shaped every time under the influence of this interaction. Existential space that is formed as a result of a person's interaction with the environment is the symbol of the existence of human beings on the earth. Norberg-Schulz identifies the elements of existential space as center/place, direction/road (sustainability) and area/region (border).
iii. Perceptual Space: Sensory, symbolic and impressionistic whole that is obtained when an individual perceives the data of elements that create the space forms the perceptual space. Perceptual space is quite variable and individualistic because of its nature.
iv. Cognitive Space: This space concept which is also expressed as a conceptual space can be explained rather with cognitive schemes created over the physical space and spatial relations of those that are professionally and scientifically interested with the idea of space. We perceive the cognitive space with multiple senses and all of these senses form the real space in our minds.
v. Abstract Space: This space includes the logical relations at abstract level and tools necessary to establish rational relations that enable generalization on other levels of spatial existence. Such kind of space is a geometrical space that is defined with four walls. This is the state of space independent from everything but itself [17].

Quite different from space classification based on observation and perception of Norberg-Schulz, Mahesh Senagala classified the space depending on the flow of information [29]:

i. Somatic Space: It is the space of a body that exists with the individual. The movement of information is concurrent with the movement of the body. Architecture is at the center of society and communication in physical space. Architecture is timeless. (B.C. 10.000 - present)
ii. Textual Space: With the emergence of printing, physical space lost its impact on individuals. With the printed press, information started to move independently from human body. Architecture is still the center of the society; however, the center of communication has become the printed press. (A.C. 1400 - Present)
iii. Broadcast Space: Information does not need to move to be spread via electronic media. While printed media shook the position of physical space to be adjacent, electronic media made the same thing as experience and connection. Information can reach out the whole world simultaneously without moving. Books and body can be blocked by structures, but electromagnetic waves cannot be blocked. The concepts of physical space such as walls and perspectives lose their meaning via media. This can be considered as an identification of insubstantiality in architecture. (A.C. 1900 - Present)
iv. Cyberspace - time): Cyberspace created by computer took the independent movement of information from the body to the speed of light. Information that can be accessed to a limited extend in television and cinema become accessible anywhere any time. Now, information is not only active, but also interactive and changeable. (1946 – present)

2.3. SPATIAL CHARACTER PARAMETERS

Rapoport deals with spatial values as differences that are distinguished and leap out in design. The diversity that is formed in the perceived or observed order is among these aspects. Rapoport states that he considers potentially distinguishable differences and his study is limited to them. To understand actually whether these are totally distinguished is a question depend on the experimental experience. It should be discovered whether it is distinguishable for the occupants. If it is not, then the differences are not the distinguishable differences. The inter-compliance and learning of personal and group

variants are beyond the control of the designer. Rapoport stated that designers are capable of controlling the thresholds / steps and the power of signals. The aim of the designer is to take the potentially distinguishable differences within different groups to a desired level. The characteristics of this potentially distinguishable differences can be identified. Thus, efficient number of elements can become distinguishable. Rapoport states that the complexity that is perceived with this approach can reach to appropriate levels [31].

According to Gibson, the distinguishable differences are, in fact, related to those that are on the background. Distinguishable differences, models and associations that address to different emotions become more powerful when they are more in harmony with perceptual qualities and when they support each other. Thus, generally, the key objective in identifying the quality, status and social identity of spaces is to strengthen the precision and significance of these elements [30].

Rapoport classifies the distinguishable differences, namely the parameters required to examine the spatial character in “Table 2.1” [31].

Table 2.1. Rapoport, spatial character parameters [31]

A. PHYSICAL DIFFERENCES	
A1. VIEW:	• *Objects: Shape, size/volume, height/length, color, materials, tissue, details.* • *Space quality: Size/Volume, Shape, Barriers and Linkages, Saturations, Transitions, etc.* • *Light and shadow: Light and shadow, light levels and light quality, transitory changes in light.* • *Natural habitat type versus man-made environment* • *Visual point of views of perceived density* • *New vs. Old* • *Order vs. diversity/ change* • *Well-arranged vs. untended, neglected* • *Scale and the smallest unit of urban structure* • *Road tissue: Topographic - Natural or man-made* • *Location: To be at an important place, at decision points, at hills, etc.*
A2. KYNESTETICS:	• *Changes in level, slopes, velocity of movement, etc.*
A3. SOUND:	• *Noise vs. silence* •*Man-made sounds (industry, traffic, music, speaking, laughter) vs. natural sounds* *(wind, trees, birds, water, etc.)* • *Death vs. living* • *Transitory changes in sound*
A4. SMELLS:	• *Natural ones (herbs, flowers, sea, food….)*
A5. AIR MOVEMENT:	
A6. HEAT:	
A7. TOUCH:	• *Tissue under the feet*

B. SOCIAL DIFFERENCES	
B1. PEOPLE:	*The language they speak, their behaviors, clothes, physical appearances*
B2. ACTIVITIES:	*Diversity and density, clubs, restaurants, markets, etc.*
B3. OCCUPATION:	*Those that has a single purpose such as shopping, resting, industry, etc. vs. mixed purpose occupation*
B4. CARS VS. PEDESTRIANS	*Other transportation tools, movement vs. dullness*
B5. OBJECTS:	*Signs, adds, food, used objects, fences, herbs, gardens, decoration materials, etc.*
B6. HOW THE CITY IS USED:	*Regions at the front / on the back, private / public regions, regions for inside vs. regions for outside*
B7. HIERARCHY AND SYMBOLISM:	*Meaning, signs of social identity and statue*
C. DIFFERENCES IN TIME	
C1. LONG-TERM:	*Sustainability and stability vs. transition from A status to B status All differences can be evaluated at short-term and long-term or as good or bad.*
C2. SHORT-TERM:	*Day/night use, weekly vs. use density* *Rhythm of activities*

Stephen Boyd Davis classified the qualifications a space should have [32]:

Dimension and Measurement:

- Height, Depth, Width

Position and Movement:

Passive Visual Qualities:

- Color: Tone, Saturation, Value; Transparency; Reflection (Dull, Shiny, Partially Mirror), Tissue (Surface Tissue, Tough Tissue)

Active Visual Qualities:

- Light Source Type, for instance Bulb, Phosphorus; Color of Light; Distance, Direction and Dissemination of Direction and Light Sources

Dynamics and Additional Buildings:

Physical Qualities – Passive:

- Mass, toughness, fragility, flexibility, crystallization; for instance, division into small pieces in the form of breaks, isotop and orientation, insulation/permeability properties for heat, sound, electric wave, etc.

Physical Qualities – Active:

- Dissemination of Heat and Other Radiation Shapes

Textural Qualities:

- Swelling, Turbidity

Behaviors:

- Falling, tracking throughout orbit, changing color, degradation, growth, sitting, dissemination, cooling, losing or obtaining humidity, widening or pulling trends, animal behaviors and tendencies, human attitudes and tendencies

Atmosphere:

- Color, Dullness, Humidity, Air Flows

Sounds:

- Reactive Sounds, autonomous sounds (for instance water, sounds of living beings) [32].

2.4. 'QUALITY' PARAMETER IN THE EVALUATION OF SPATIAL CHARACTER

Occupant satisfaction is a key element of quality in architecture. Today, occupant satisfaction surveys focus on human perceptions, assessments and the importance of behaviors. Satisfaction which is regarded among quality assessment criteria is identified by measuring the influence of the perception of evaluations of occupants about the objective environment on their own satisfaction. Technical standards are not adequate for a physical environmental quality description and occupant-based standards should be created according to the psycho-social requirements of occupants. Quality is dealt as a bilateral phenomenon. First one deals with the process and addresses the managerial dimension of quality. Second one deals with the product. In the quality parameters model of Altaş developed to encompass product - process relationship for physical environments, parameters that define spatial quality gathers under sub-headings of design, manufacture, maintenance - attitude and occupation. Design quality includes the quality of project management, the quality of preparation studies, conceptual quality, the quality of detailing, and the quality of the compliance of parts with each other. The aesthetics quality of the product, structural (technical) quality, functional quality and psycho-social quality (behavioral) are the sub-topics for conceptual quality. Since Vitruvius, conceptual quality has been the most attractive subject [33].

Gerald Franz conducted a measurement study through isovist and graphical analysis method on space quality by visually using the concepts identified by Joedicke, J. [23], Appleton, J.[35], Kaminski, [36] in identifying the basic spatial quality parameters [34].

When shaping his study, he built his investigations on isovists that are offered as the basic elements with which one can take objective decisions to examine the spatial characteristics of small-scale environments in his isovist and visual graphic analysis based on the studies of Benedict [37]. Franz defined "isovists" a space that can be seen from a simple observation point and identified them as polygons that offer vision that dominates spatial characteristics. He stated that various quantitative definers may derive from these polygons that reflect the local physical characteristics of equivalent spaces such as the length of space and environment and the length of closed or open borders [34].

DQI (The Design Quality Indicator) was founded in 1999 with the support of many companies and institutions (The Construction Industry Council (CIC), Department of Trade and Industry (DTI), Constructing Excellence and OGC (The Office of Government Commerce)) to evaluate only the school buildings and their surroundings in regards to quality. But today, it is also used to evaluate influential buildings and their surroundings in spatial spaces. (The evaluation of Peckham Pulse Healthy Living Center and its surroundings) The first studies started at 2005. The studies are conducted in three phases under FAVE topic; Fundamental: Factual; Added Value: value that is added; Excellence: to be excellent. The studies are conducted using interview technique. The quality parameters used can be seen in "Table 2.2" [38].

Table 2.2. DQI main quality principles [38]

PARAMETERS	**Indicators**
1. Functionality	• Access • Space • Occupations
2. Construction Quality	• Performance • Engineering • Construction
3. Impact	• Urban & Social Integration • Internal Environment • Form & Materials • Character & Innovation

According to Yazıcıoğlu Halu, Voordt and Wegen deal with spatial character parameters in regards to "Quality" concept in the parameters study they conducted. They relate architectural character parameters with quality and examine them under four topics. These parameters are available in "Table 2.3."

- Functional quality
- Aesthetic quality
- Economic quality
- Technical quality

i. Functionality or capability value of space:

Practically, it is about the usability of a space and how suitable the place is to include activities that a space must have.

ii. Aesthetic Values of Space:

These are about to what degree a building or a place is perceived beautiful, encouraging or original. These are related to how much a space is perceived fine, hot, wide, etc. or to what extent it is seen as a part of the culture. Cultural value includes originality, expressionism, relationship with the environment, historical value, design quality and experimental quality. The future value includes data on the sustainability of the space, its suitability to other purposes (flexibility) and the value it gains in time (value as part of cultural history). All of these values constitute the aesthetic value of that space.

iii. Economic Values of Space:

It is about how much of financial resources of a space are used effectively and efficiently. If the building/place/space is regarded as an investment object, its economic value depends on the level of revenue.

iv. Technical Values of Space:

These are the physical quality that describes the characteristics of its structure, material, and technical services of the structures established in a space. Technical properties define how safe, healthy and suitable in regards to heat a building or a space is. How much elements such as humidity, lighting, natural light and acoustic are perceived or should be perceived are defined based on these values [39].

Table 2.3. Spatial Character Parameters of Voordt and Wegen [66]

PARAMETERS	**Indicators**
A space's **FUNCTIONALITY**	• Transportation and Parking Means • Accessibility • Effectiveness • Flexibility • Safety (ergonomics, public) • Spatial Orientation • Regionalism • Privacy • Social Relations • Being physically good (lighting, noise, heating, ventilation, humidity) • Sustainability
A space's **AESTHETIC VALUES**	• Visual quality • Order • Complexity • Presentational Value • Symbolic and Semiotic Value • Historical and Cultural Value
A space's **ECONOMIC VALUES**	• Investment Costs • Utilization Costs • Revenue Obtained in Time • Public and Private Regulations
A space's **TECHNICAL VALUES**	• Fire Safety • Structural Safety • Structure Physics • Environmental Compatibility • Sustainability

Sherwin Greene identified four main principles for design-related space quality. Each main principle includes four quality parameters. These parameters are shown in "Table 2.4" [40].

i. Function
   (1). Connection (2). Safety (3). Comfort / Spaciousness (4). Diversity
ii. Order
   (1). Consistency (2). Clarity (3). Continuity (4). Balance
iii. Identity
   (1). Focus (2). Unity (3). Character (4). Property (Exceptional)
iv. Appeal/ Attraction
   (1). Scale (2). Suitability (3). Vividness (4). Harmony

"Table 2.5" shows the holistic version of spatial quality principles defined according to DQI spatial character parameters, Voordt and Wegen's Spatial Character Parameter Suggestions and the basic design elements by Greene. The parameters of the investigators are dealt technically, functionally and in behavioral manner.

Table 2.4. Quality principles identified based on the basic design elements by Greene [40]

PRINCIPLE	**QUALITY**	**DIRECTIVES**
FUNCTION Design should be useful for everybody.	1) Connection	Access / Interaction / Overlapping
	2) Security	Safety / Privacy / Efficiency
	3) Comfort / Spaciousness	Physical Easiness / Visual Peace / Utilization Easiness
	4) Diversity	Selection / Change (Variation)
ORDER Design should be perceived easily.	1) Compatibility	Entrance / Edge / View / Silhouette
	2) Clarity	Structure / Closeness
	3) Continuity	System / Sequence / Rhythm
	4) Balance	Pattern / Emphasis
IDENTITY Design should be discriminative and recognizable.	1) Focus	Visual Focus / Vital Point
	2) Unity	Concept / Repetition
	3) Character	Integrity / Simplicity / Style
	4) Property (Exceptional)	Historical Quality / Symbolism / Appearance
APPEAL/ ATTRACTION Design should be nice and attractive.	1) Scale	Human / Humanistic
	2) Suitability	Ratio / Originality / Familiarity
	3) Vividness	Stimulant / Opposite / Tension
	4) Harmony	Light / Color / Tissue / Line / Sound / Smell

Table 2.5. Space quality parameters

	Voordt and Wegen (2005)	**Grene, S. (1992)**	**DQI (1999)**
TECHNICAL DIMENSION	Safety	Connection	Robustness
	Sustainability	Security	Durability
	Fire Safety	Clarity	Performance
	Structural Safety	Continuity	
	Structure Physics		
	Environmental Compatibility		
FUNCTIONAL DIMENSION	Transportation Means	Balance	Access
	Accessibility	Diversity	Capability
	Efficacy	Compatibility	Utilization
	Flexibility	Character	
	Being physically good	Comfort	
BEHAVIORAL DIMENSION	Privacy	Character	Impact
	Social Relation	Exceptional	To be satisfied
	Spatial Orientation	Scale	Beauty
	Visual Quality	Vividness	
	Order	Harmony	
	Complexity		

2.5. THEORIES THAT EXAMINE QUALITY CONCEPT IN REGARDS TO THE QUALITY OF LIFE

The concept of the quality of life is a multi-dimensional concept that aims to evaluate various elements that influence life through different aspects and different perspectives, and at the same time, it is a concept that each discipline and activity within the society deals with.

Various definitions, special to different dimensions, of the quality of life are available. As a psychological definition, M. Abrams defined the quality of life as "the degree of satisfaction or dissatisfaction for human beings from the different aspects of life." Andrews relates the quality of life to "a person's relation of satisfaction and pleasure to one's life." Similarly, Dalkey and Rourke evaluated the quality of life as "a person's feeling well, his/her satisfaction or dissatisfaction from life or happiness or unhappiness in life," while Hanested defined the quality of life as "a person's living status, individual life experiences and his/her feeling well." The living conditions of the quality of life includes a condition that occurs within one's psychology based on its life experiences. Szalai implies the life character of "the quality of life" with the degree of satisfaction or excellence. Szalai relates the quality of life with one's existence, comfort and the level of satisfaction from life, and states that the quality of life is shaped through objective realities and factors on one hand, and subjective factors based on individual perceptions and assessments on the other hand [41].

Veenhoven defined it as the product emerge due to life expectancy, namely "happiness" [42].

The quality of life is a complex concept with multiple directions such as residences, training, work and environment [43].

There is a very rigid cooperation between an individual's quality of life and the environment. It is not possible to consider the quality of life away from the quality of environment. The quality of life does not deal only with the level of income as a definition, rather, it focuses on sustaining a life that respects the honor of an individual in subjects that define the lifestyle such as education, health, culture and consumption [44].

The quality of life represents different meaning for different people. Individually it includes “health and happiness, comfort,” while spatially it includes “a good place” definition [45].

Since 1930s, the quality of life has been the study subject of various investigators from different disciplines. These investigators endeavored to define the components of the quality of life and compared geographical areas such as cities, regions and countries with quality of life indexes [46].

The quality of life is added both as a subject and assessment to cultural and social status. Moreover, poverty, crime rate and pollution that contribute mainly to the objective characteristics of a society are added to individual’s evaluation on its lives [47].

National Environmental Action Plan defines the quality of life as the qualification and quantification of factors that positively impact the physical, spiritual, intellectual and cultural developments, and as the way and level of utilizing these factors. In regards to National Environmental Action Plan, the quality of life is among the strategic targets and supported with the aim of simplifying the access to basic environmental infrastructure and services and minimizing exposure to environmental dangers [44].

According to Veenhoven, the concept of the quality of life is used in exchange for prosperity and happiness. The following classification is suggested for certain meanings of these terms: between the chance of living and the consequences of life and between internal and external qualities. This duality implies a quartet quality of life: (1) A Livable Environment (such as ecological environment [mild climate, clean air, spacious residences], social environment [freedom, equality, friendship], economic environment [rich nation, social security, proper economic development], cultural environment); (2) The Ability to Live (such as physical health, mental health, knowledge, talent); (3) The Benefits of Life (external benefit [to be a good citizen, spending time with friends, to be morally good, etc.); (4) To Appreciate the Value of Life (the methods of benefiting from life [to be satisfied from work life, etc.), dominant conditions, excellent evaluations) “Table 2.6.” [48].

Table 2.6. Quartet quality of life [48]

	External Qualities	**Internal Qualities**
Chance of Living	Livable Environment	The Ability to Live
The Consequences of Life	The Benefits of Life	To Appreciate the Value of Life

General views on the quality of life:

i. The quality of life is a multi-dimensional and wide concept.
ii. Life consists of social, economic, psychological and physical (natural and man-made environment) environments. The quality of life is the combination that emerges when the qualities of these environments interact with each other one by one.
iii. Generally, one may mention objective and subjective indicators. However, it is generally acknowledged that life data must be perceived and thus subjective assessments should be made.
iv. The components of the quality of life may vary from culture to culture and country to country.

Here, the key is how the basic factors (such as health, sports, education, shopping, transportation and culture services in addition to residences and security) are perceived by that society.

Basically, there is a general agreement on the 2-dimensional form of the quality of life. These are:

i. Internal psychological mechanisms that enable an individual to be satisfied with his/her own life,
ii. External conditions that trigger internal mechanism [49].

The key point these definitions put forward is the existence of both objective and subjective components in the foundation of the concept of the quality of life. As long as

objective factors are not converted into subjective factors, the quality of life either remains stable or falls based on the perception [50].

In the literature investigation of Kamp et.al. on the quality of life, this concept is defined based on the shapes in which its components and basic elements are classified [51].

Human requirements are defined as "environmental conditions in which an occupant sustains its life without being exposed to social, psychological and physiological disturbances within a space, and that create the possibilities that will help a person be more productive in his/her works." Most of the time, the concepts of "need" and "demand" are intertwined and used as if they have the same meaning. However, a need addresses a necessity or a must, the least qualifications a space may have. Any compromise from these qualifications will be the cause of a disturbance. On the other hand, demand is more of a subjective notion, defining the occupant's objectives which can have limitless quality and quantity [52].

According to Maslow, human behavior arises from needs. Needs that shape the behaviors are in an array from the most obligatory and most vital to less obligatory and less vital and elegant. Nutrition, sleeping, reproduction are among physiological needs, while security, sense of belonging, affection, prestige, etc. are among upper level and elegant needs. When a need becomes an activity, physiological and upper level needs differ from each other as the activity and need have a one-to-one relationship. Although there are some differences between cultures and societies, activities that fulfill physiological needs basically remain the same. In regards to upper level needs, one may observe some changes in the activities that fulfill the needs. Individuals may satisfy from these upper level needs through different ways [53]. Maslow's hierarchy of needs is given below:

i. Physiological needs (nutrition, reproduction)
ii. Safety needs (physical harm and prevention from threats)
iii. Sense of belonging, love needs
iv. Esteem, prestige needs
v. Self-actualization, self-proof needs
vi. Intellectual, sensory and aesthetic saturation

In this hierarchy, the needs can be classified into first and primary needs (physiological and safety needs) and upper level needs. In one's life, primary needs should be fulfilled followed by upper level needs [54].

Individuals perceive the needs according to their current intellectual scheme. The intellectual scheme depends on the socio-cultural and personal characteristics of a person, life experiences, quantity and quality of information he/she obtained from the environment, and values and attitudes. Individuals interpret and assess the speculations he/she gets from the society based on his/her intellectual scheme; and give a response he/she finds appropriate. This intellectual scheme grows and develops as the stimulants from the environment changes. As time passes, the evaluation criteria of these scheme becomes more comprehensive and upper level [55].

When one mentions the quality of life, Abraham H. Maslow's hierarchy of needs theory becomes an ideal indicator. This theory which was developed in 1960s suggest a quinary separation in regards to the level of obligation between fulfilling one's functions and needs [56].

Maslow's hierarchy of needs that shapes according to an individual's life and lifestyle is a concrete evaluation of the concept of the quality of life. In Maslow's theory, the fundamental one is the physiological needs. These are the needs that must be fulfilled for a sustainable life such as air, water, food and sleeping. The second one is the safety needs. When all physiological needs start to be fulfilled, safety needs come forward. This need enables stability and consistency in the environment an individual lives in. The third one is the belongingness and love needs (social). (These are about believing in one's self that he/she is required in the society he/she lives in, that they are loved and not alone). When this level of needs is fulfilled, then esteem needs (prestige) come forward. One's self-trust increases when he/she protects his/her self-esteem and is respected by others. At top, there is the self-actualization needs. Maslow sees this five-level needs theory as relevant everywhere and any time. Believing that a lower level need must be fulfilled for individuals to require an upper level need, Maslow used graphics that represent each necessity step in a society with a pyramid. Maslow's hierarchy of needs is shown in "Figure 2.1" [56].

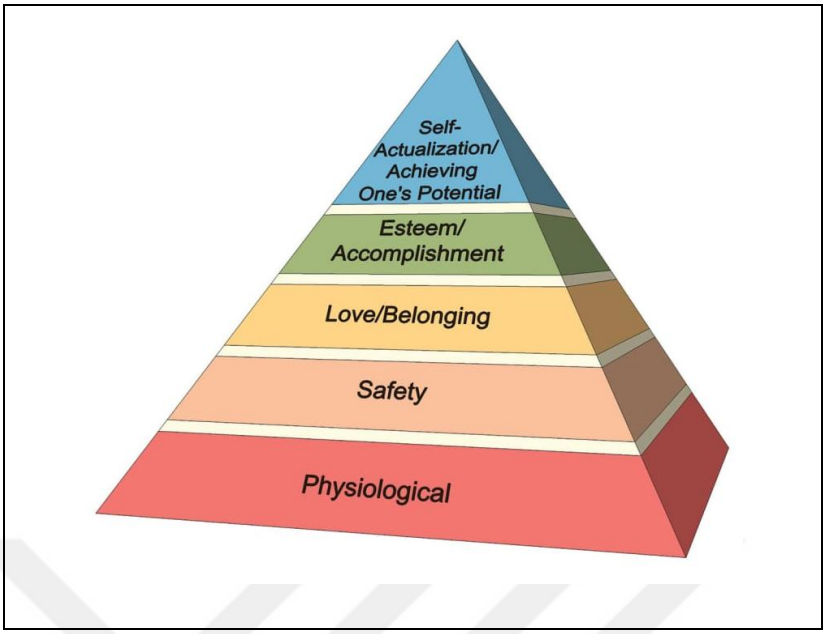

Figure 2.1. Maslow's hierarchy of needs pyramid [56]

There are physiological needs on the basement of the pyramid and self-actualization needs on top. The basement of the pyramid consists the foundation and as it develops, so does the level of the quality of life. According to Maslow's hierarchy of needs seen in this pyramid, the following criteria come forward in regards to the quality of life.

i. The physical quality of life environment is a need that shows how effective the environment is for the quality of life.
ii. The environment's general wealth and the level of accessibility of this wealth or general value encompasses the wealth that the environment offers to an individual to improve one's potential and the elements related with the easiness of accessibility to this wealth. The wealth of the environment in regards to interaction resources and the encountering opportunities it offers can be considered within this framework. The higher the safety of an environment is, the more effective the concept of the quality of life becomes. The notion of safety is an indispensable condition for the quality of life.
iii. Environmental stability or ambient homeostasis (to be at balance) encompasses the predictability of environmental elements, their precision, their level and the surprising degree of changes for an individual. Environmental stability and the awareness of a person about his/her environment can be effective with social

synergy. This can be perceived in more of a cultural and traditional dimension. According to this, Maslow's hierarchy of pyramids is given in "Table 2.7." [56].

Table 2.7. Maslow's hierarchy of needs scheme [56]

PARAMETERS	**Indicators**
PHYSIOLOGICAL REQUIREMENTS	• Air • Water • Food • Sleeping
SAFETY REQUIREMENT	• Psychological • Physical
SOCIAL REQUIREMENT	• Love • Belongingness • Friendship • Attachment
PERSONAL REQUIREMENT	• Esteem • Ego • Prestige • Success
SATISFACTION REQUIREMENT	• Personal Saturation • Satisfaction

The quality of life is added both as a subject and an assessment to cultural and social status. Moreover, poverty, crime rates and pollution which mainly contribute to the objective characteristics of a society are added to the evaluation of individual's lives.

In his study, Marans aimed to measure the quality of life of those living in Detroit Metropolitan Area using objective and subjective indicators. During his study, he investigated the traveling and transportation, district and neighbor relations, gardens and recreation areas, residences and mobility, the presence of outdoor areas and their expansion.

The quality of a space or a geographical formation (city, district or residential area) is a subjective phenomenon and differs according to the perspectives of individuals. The perception of and awareness on environmental and urban conditions affect the way of evaluation and occupation of individuals.

This study prepared for Detroit Metropolitan Area has for distinctive purposes:

i. To produce faultless and believable information about the quality of life,
ii. To identify and measure the perception of people in regards to the aspects of the collective quality of life that draw attention from the beginning of the century and the definitions on the concept that has been changing since 1950s.
iii. To create a quality test that evaluates the changes in the quality of life, in society and in environmental conditions throughout 21st century,
iv. To identify how related the perceptions of people are with the social and environmental conditions.

Based on these objectives, the necessary information is gathered through surveys conducted at the work field. As a result, this study, a study on the space or the quality of life in Detroit region is designed to get together scientific and theoretical concepts with their political interests. From a political point of view, this study endeavored to gather information about the quality of life experiences of local and private sector planners, decision-makers at other regional levels and the people living in a certain area. At the same time, the fundamental objective of this study has become the information about the quality of life experience which contributes to the space [47].

Individuals, playing the role of an occupant, expect that a space should fulfill their needs and satisfy their targets. Thus, although they are not aware, the occupants and the designers who directly influence each other and their relation with each other gain importance. In this study, individuals who are in the model of space - occupant - designer communication cycle is a mechanism of perception, awareness and behavior. Perception is the act of obtaining information through senses; awareness is the act of interpretation, citing the memory, sensation and evaluation; while behavior is the response the organism gives to perceptions through motion and other reactions according to its objectives and motives. Due to its definition, spatial quality's ability to fulfill psychological needs of a space such as safety, comfort, prestige, social relations, activity, peace and beauty will provide

psycho-social quality. In addition to many definitions, as cultures identify some ideas that limit the moods and behaviors, its selections and decisions of individuals who believe that they belong to that group and as cultures carry the clues of acceptable attitudes of that particular period, it becomes important for the designer to find these clues. Designer should give meaning to the behaviors of the occupant who exhibits acceptable behaviors of the particular society and of that particular period. This is because the occupant will then be happy and satisfied when he/she exhibits these behaviors. Psycho-social and Cultural Concepts Corresponding to Human Needs are shown in "Table 2.8." The Quality of Life and Occupant Needs Parameters are shown in "Table 2.9."

Table 2.8. Psycho-social and cultural concepts corresponding to human needs [65]

The Hierarchy of Human Needs	**The Concepts of Psycho-social and Cultural Design**
Physiological (Biological)	Shelter, comfort, to continue one's bloodline, sustainability, permanence, contextuality
Safety	Safety of life and property, privacy, prevention of the feeling of crowdedness, prevention of the feeling of loneliness, identification of the sovereignty areas, defense, easy orientation, way-finding
Sense of belonging (Attachment)	Socio-cultural compatibility, joining human organizations, socialization, establishing social interactions, identification with the 'place,' citing the social memory, claiming the symbolic values
Esteem	Identity-ego, priority, appropriation, individualistic, class or group-related status Imageability of the symbols, distinctive alerts, perceptibility
Self-actualization (Developing one's talents)	Participating in social organizations, the freedom of selection, production, flexibility, to be improvable, dynamism, incompletion
Intellectual, Emotional and Aesthetic Saturation	Diversification of formal aesthetic concepts, complexity, sensitivity to energy and living, focusing on future problems, consolidation of social awareness, helping people and humanity

Table 2.9. Quality of life and occupant needs parameters [47]

	Veenhoven (2000)	**Maslow (1964)**	**Marans (2003)**
TECHNICAL	Livable Environment		
	Health		
	Safety		
FUNCTIONAL	Prosperity		
	Transportation		
BEHAVIORAL	To Appreciate the Value of Life	Physiological	Peace
	Happiness	Esteem	Comfort
	Satisfaction	Personal Saturation	Social Relations
		Satisfaction	Beauty

2.6. THE DIMENSIONS OF ARCHITECTURAL SPACE IN REGARDS TO THE QUALITY OF LIFE

This section examines the spatial character parameters and the quality of life relation, and investigates the concept of the quality of life from the perspective of architectural space dimension. The criteria scheme of the concept of the quality of life is examined in regards to the dimensions of spatial character parameters and combined under joint topics. These dimensions are summarized below:

Technical Dimension: Subjects dealing with the physical space such as the physical quality of life of spaces, air pollution / purity, noise pollution, visual pollution/purity, the level of access to outdoor areas, infrastructure, etc.

Functional Dimension: When the social phenomenon such as social connections, neighboring relations, preserved traditions, urban occupation are taken into consideration, having a "good or beautiful" physical space means having a good quality of life. Perspective on the space emotion addresses to the conceptual society the sociologists refer to and to "human at space" in which the space is important but not free from human [57].

Behavioral Dimension: Sense of belonging for a particular space occurs in areas that are significant for individuals. Mazumdar and Mazumdar suggested that there should be a social factor in which the sense of belonging emerges via rituals of a space in order to feel attached to a particular space [58].

Spaces to which individuals identify themselves with, feel that they are a part of it and remember with love are probably the spaces that offer good quality of life for them. After moving away, leaving or destruction, the owners of that space may long for that space, feel a sense of losing, or even mourn for that space. Here, this is beyond a reference to the general feeling of loss an individual feels; rather, it is a strong sadness arising from the finalization of a deep connection. Such connection is a factor of the quality of life [57].

2.7. CONCLUSION OF THE SECTION

No common literature in a theoretical framework is observed between satisfaction from life and satisfaction from the space a person works. However, Veenhoven, who is among the

researchers of the quality of life, suggested that satisfaction from work life has a relation with satisfaction from life. As can be seen in the quality of life studies in Section 2.5., these studies focus on the behavioral dimension between environment and human behaviors. But, the characteristics that form the space quality and that are defined in Sections 2.3 and 2.4 qualify the space not only according to the behavioral characteristics of the occupant, but also according to the physical characteristics a space has. Thus, when a space is dealt in regards to satisfaction from life, it influences the occupant not only through behavioral characteristics but also through other characteristics.

Studies on human-environment behavioral studies focusing on the ability of life to be of good quality focus on the satisfaction of occupant on the resulting target.

3. INVESTIGATION METHOD POST OCCUPANCY EVALUATION (POE)

This section, firstly, gives information on the method of Post Occupancy Evaluation (POE), then introduces POE methods used in the world literature. There will be a general introduction to offices and then to indoor and mixed plan scheme offices.

3.1. POE "POST OCCUPANCY EVALUATION"

Certifications that include evaluations at occupation and management steps of structures may carry high values in regards to the continuity of the occupation of spaces and places. This type of evaluation is known as "Post Occupancy Evaluation" (POE) in the literature. "Figure 3.1." shows the steps established between space and POE method. These are the design, occupation and management steps of a space.

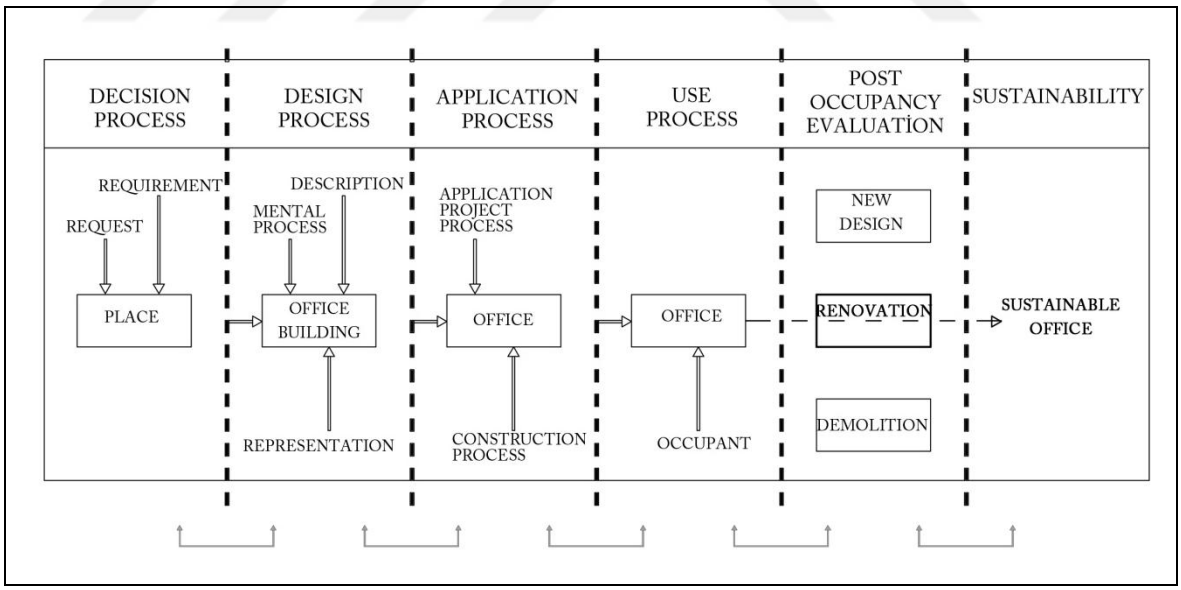

Figure 3.1. Design, occupation and management steps of a space.

In these studies that focus on the interaction between human and environment, the analyses of the existing environments strive to conceptualize the cooperation types between establishing the methods and POE with the architectural design [59].

Gür stated that the problematic areas of environment and behavior studies can be gathered under two main groups, and classified them as:

i. "Studies evaluating the past and present,
ii. Studies that investigate the future."

He calls the first group as POE (Post Occupancy Evaluation). Stating that the second group was not named, he emphasized that there were a smaller number of studies compared to the first group [60].

The meaning of POE in literature is the evaluation of structures, any place or space after they are occupied.

Gür states that one should work on various options of the subject that is investigated in order to generalize, and that scanning plenty of options at multi-dimension is as possible as scanning plenty of options at a single dimension. "The objective of applicability" focuses on the objective of identifying perspectives, characteristics and standards that can be applied in POEs without losing their validity in long-term. Many researchers argue that Post Occupancy Evaluations add value to components such as simple arrangements or a proper arrangement of a space or the perception of the general form, indoor air condition (climate), and behavioral factors (utilization area, privacy, social communication, spatial harmony, etc.) [60].

Van der Voort, T.J.M., & Van Wegen, H.B.R. emphasize that in POEs, the design can be dealt not only as "an independent variant" but also evaluated as self-reliant; and it is included only to dimensional calculations as it influences the utilization of technical aspects (carrier structure, technical volume, etc.) and occupant's wellbeing [61].
Marans and Spreckelmeyer state that sometimes this concentration is completely on evaluating architectural quality as a whole [62].

Post Occupancy Evaluations encourage learning subjects related to developing the project at the investigation phase, and to generally developing the management of programming, design, structure or structured environment. The reasons for application can be both ideological and economic such as improving the health and prosperity of the living space or decreasing occupational rate due to the characteristics this space has within the developing market. In addition, some application targets can be evaluated as scientific

targets; many auxiliary targets can be obtained from these main targets as they can contribute to the creation of new theories or development of new tools.

3.1.1. Description, Approach and Area of Use of POE

The approach that searches for responses on how buildings operate, whether this operating system is designed, whether it can be improved and how this system would be used in future, and that offers results and creates feedbacks to new-designed systems with these results, is defined as "Post Occupancy Evaluation" (POE). POE searches for responses to the following four questions, and aims to offer the responses through a systematic method:

- How the buildings operate?
- Is the operating system of the building designed?
- How can this operating system be improved?
- How should this operating system be in future? [63]

> Generally, Post Occupancy Evaluation is a systematic process that evaluates the occupant needs of the buildings used and how related they are with the corporate targets [64].

In other words, Post Occupancy Evaluation is a process of accurately discovering the aspects that enable good improvement in environments designed for occupants by using interviews, observations, surveys and other methods. This evaluation is an activity based on feedback conducted with an aim to improve the design quality.

Prieser defines POE as the systematic and meticulous process to evaluate structures that are constructed and being used for some time, and considers building occupants and their needs as the focus of POE [65]. "Figure 3.2." shows the relation between the actors that play a role in constructing the building and the occupation period. As a result of this relation, the aim is to reach the active occupants.

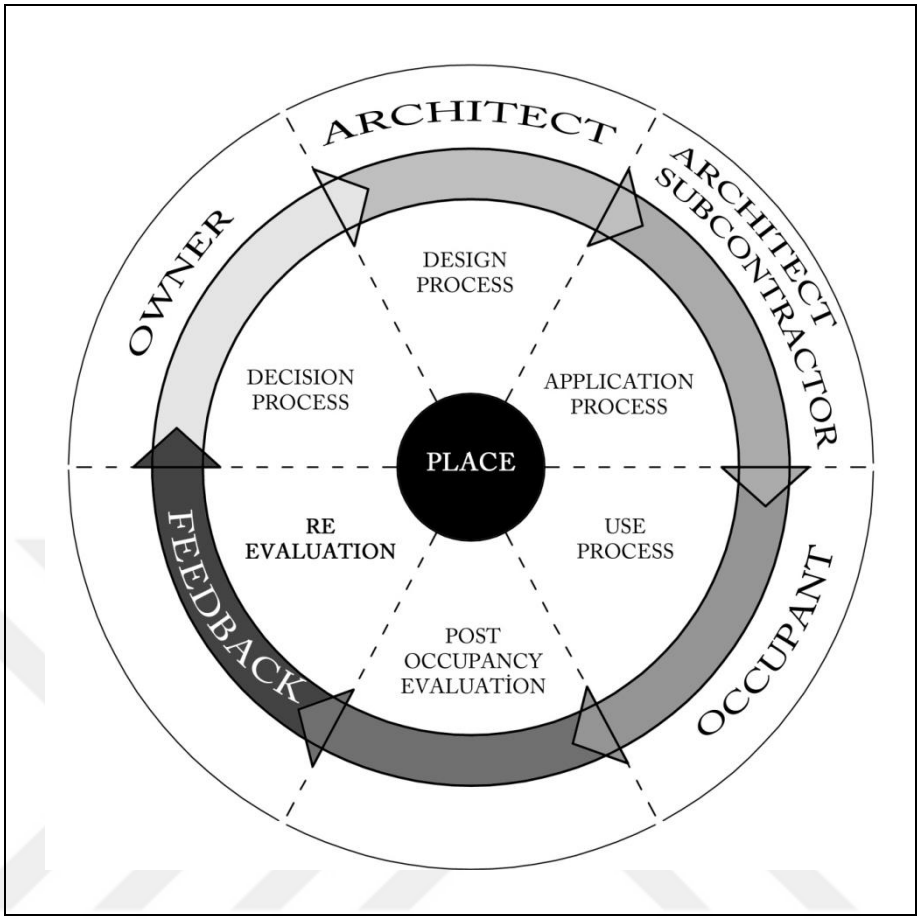

Figure 3.2. The relation between actors that play role in the construction of the building and the occupation period, and reaching the active occupants based on the result of this relation.

Post Occupancy Evaluation basically focuses on the impact of design on the occupants; but, this does not mean that the evaluations on the other side of design process such as energy performance, indoor air quality, operation and maintenance of structural mechanic systems are neglected.

Some early definitions of POE aim to make occupants comprehend the performance of the building; lately, POE regards the comprehension of the expected impacts of designs and the examination of designs that are completed as part of the practices that aim to support structure activities and building management. Moreover, POE serves to environmental psychology and planning and environment-behavior studies such as architecture.

Zimring and Reizenstein classified the benefits of architecture in regards to POE into three categories both by studies they conducted and by interviews with various designers.

- Evaluations provide information to support creativity and design development.
- Evaluations increase and explain the value of planning.
- Evaluations increase and enforce design-customer relationship [66].

Zimring and Reizenstein qualified POE which specifically has a couple of both practical and theoretical values:

- Post Occupancy Evaluation tends to focus on designed environments such as single type buildings or residences, offices, schools or bazaars.
- Those that make the evaluations tend more to define an environment instead of manipulating it.
- This study is conducted almost every time in real environments rather than laboratories [67].

Since POE emerged as a definable research discipline in 1960s, different definitions have been suggested to reflect the inter-disciplinary structure of tendencies and evaluations of researches and practices in the structured environment. Although most of the definitions and approaches are conducted by different investigators at different fields, they have similar facts. Four approaches emerge when we classify these studies that were formerly conducted:

- Sociological Approach
- Rationalist Approach
- Operational Perspective - from the eye of a Pragmatist
- Organizational Approach [68]

Sociological Approach: It focuses on occupant satisfaction. This approach has emerged as a reaction to failures in environments designed at large-scale in the previous decade generally in academic researches by the end of 1960s. One of the biggest failures in the structured environment is the noncompliance between the responses of the occupant and the intention of the designer. Following the occupation of the building, the occupant reveals its reaction by whether manipulating the areas he/she wants to change in a building or by not using the building at all. One of the most striking examples of this is the Le Corbusier's Pessac houses and Minoru Yamusaki's Pruit Igoe blocks which were collapsed at the beginnings of 1970s after receiving design award in 1950s.

Rationalist Approach: It considers the connection between POE and the decision process. Accordingly, information gathered through the reflection of previous designs as the actualized performance is shared with those that are included to the decision-making process. Thus, the information that will be gathered after the evaluation is used in decision-making process in the latter designs. Here, one may argue that evaluation is a two-step process that includes making the evaluation and sharing the evaluation results within the structural form to decision-makers [69].

Definition of POE in the eye of a Pragmatist - Operational Perspective: POE is a technique used to identify how an environment is used by its occupants for the architect or investigator and to evaluate the design targets. In this regard, design decisions and environmental performance are related to POE.

Organizational Approach: The emergence of building management clearly revealed the need for POE concept. In this context, POE has become a decision-making tool that organizations used to meticulously manage the assets. This fact emphasizes that environments do not only form an order for the activities of the organizations, but also reflect the organizational structure, address the organizational images and support or block the actualization of organizational targets [68].

Buildings are a whole that encompass emotions and opinions for the spaces the occupants are in relation with and the works they do in that space. In order to be aware of which structured style will be used in fulfilling occupant needs, various stages of design process should be evaluated. In this context, Post Occupancy Evaluation approach can be regarded as a design tool [70].

The first studies of POE approach started at the end of 1960s and continued in 1970s and 1980s. Early POE study focused on residential environments constructed quickly as housing design for low-income groups after 2nd World War. New cities were constructed in the frame of urban renewal projects in North America and West Europe. However, when houses were constructed, they were completed without obtaining information about the needs, expectations, behaviors and lifestyles of people. Many social and architectural problems were systematically on the focus of interest of physical environment evaluation. In the following periods, POE has been the subject of hospitals, jails and other public

buildings. Studies conducted in hospitals, jails and military posts aim designers to return to design stage and review the positive and negative aspects [63].

In addition to such type of buildings, there are POE studies available that focus on residences. For instance, Oscar Newman who investigated the reasons for crime factors that are densely experienced in collective housing in which low and mid-income groups live observed occupant behaviors by examining the relation between crime factors and areas out of these houses. Emphasizing the necessity of controlling not only their own houses for those living in this collective housing but also of the outdoor spaces around these houses, this study widely influenced the residence design principles and is one of the first studies that apply POE on houses using a systematic observation method [71].

Becker's study on residences is another attractive study that applied POE and contributed to the identification of POE methods that will be applied on these areas. Methods used in this study include occupant surveys and interviews, systematic occupant observations, gathering archive data and identification through photography [72].

Educational buildings, just like the residences, are frequently examined in POE studies. In a study conducted in Columbia and Indiana of the U.S., four school buildings are examined in detail in regards to their technical, functional aspects and behaviors of occupants [73].

A similar study was conducted in North Carolina. These studies are crucial as they identify evaluation techniques that should be applied in school buildings and as they explain how an educational environment should be. Another important publication that includes POE in educational buildings is a guide published by the U.S. Council of Educational Facility Planners in order to establish a standard for evaluating educational buildings [74].

The frequent use of POE studies especially in office buildings begins in 1980s. In a study conducted to increase the efficiency of office employees, a survey was conducted in addition to physical measurements [75].

Another study examined the relation between the noise in office buildings and performance, working environment and employee satisfaction. In time, these survey studies become widely common in private sector [76].

POEs are conducted by academicians in buildings such as dormitories, senior centers and kindergartens [77].

Students and academicians from the Department of Architecture at Wisconsin University conducted POE studies in buildings such as senior centers, Alzheimer treatment centers, museums for children and nursery houses for children, and under the audit of Wolfgang F.E. Preiser, they conducted these studies at Mexico University in spaces such as senior centers, family nursing homes and campus areas. Again, studies conducted by students and academicians are performed in University of Illinois (Champagne, Urbana), University of California, University of Arizona, Utah University, State University of New York, University of Maryland, University of Illinois (Chicago), New Jersey Institute of Technology, University of North Carolina [78].

3.1.2. Performance Levels of POE

Post Occupancy Evaluation method is classified into three in regards to performance evaluation:

- Technical performance
- Functional performance
- Behavioral performance

“Figure 3.3.” shows how to reach Technical, Functional and Behavioral performances.

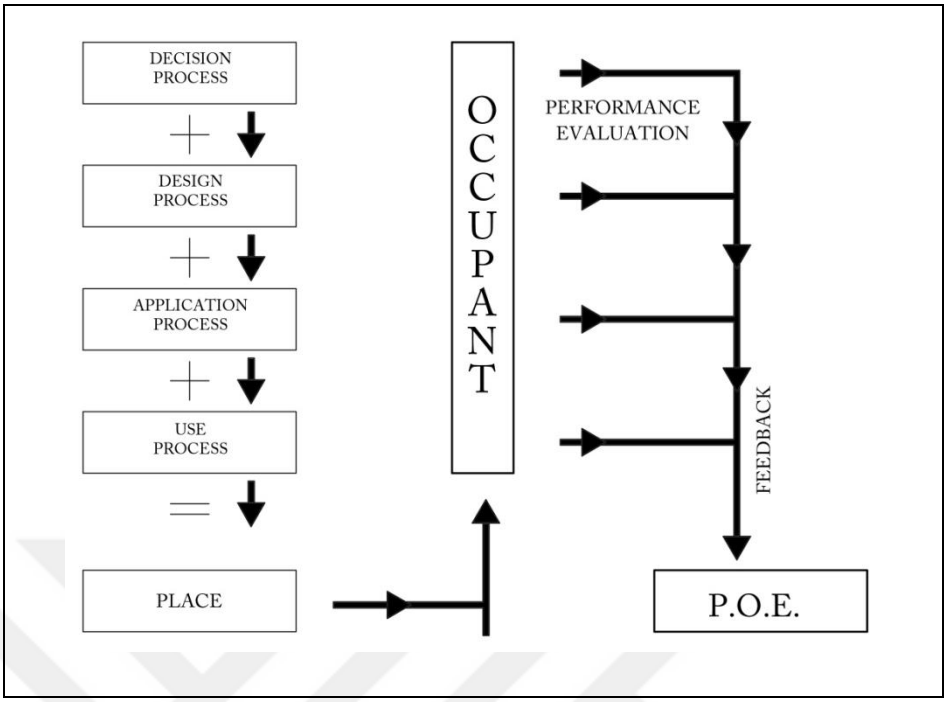

Figure 3.3. Performance evaluation relation between active occupants and the Space.

Technical Performance:

Technical Factors

There are some least qualifications for a building to survive. These qualifications include ventilation, sanitation, fire safety, etc. Technical factors provide the most suitable occupant environment based on the results of different attempts, measurements and calculations. Technical factors can be measured via equipment, so the conditions that will keep occupant comfort at optimum level can be defined easily [79].

This section examines the technical factors that should be taken into consideration while planning an office space.

Noise

According to the definition of Turkish Language Institution, noise means irregular sounds with no harmony in between. It is one of the key factors that should be taken into consideration in planning an office space. We may gather the sources of noise that should be taken into consideration in an open office or planned office under four topics:

i. Noise of external resources

ii. Noise of industrial resources at proximity
iii. Noise of equipment in the office
iv. Noise of mechanical services

The primary noise that should be taken into consideration to prevent any noise in order not to decrease employee performance is the sound insulation. Splits used in between groups and sections, ceiling and upholstery materials should be selected among those that offer noise emitting properties. As a result, anti-static fabric, carpet, laminate, wood covered flakeboard, glass and Plexiglas materials are used in indoor panels. Furniture materials are important too. For high-level ceilings, suspended ceiling systems are used to prevent noise coming from the upper storey and to cover noise without ruining the scene which ventilation and mechanic systems may create. For upholstery, carpets and similar coverings are used due to their noise emitting characteristics [80].

In order to regulate noise in office structures, one should protect the building from noise of external resources, to provide adequate vertical and horizontal sound insulation between each volume, and to obtain the noise level desirable in office spaces [81].

The key requirements in acoustic designing of open-plan offices are given below:

- To design working areas with maximum closeness that block direct noise pass,
- To use divider panels at adequate height or movable walls at full storey height which provide privacy and control team noise when open-plan working areas and team working areas are together at one place,
- The distribution of machines and phones used in the office should be uniform and their noise should not come out of the working area.
- In order to increase conversation privacy and to decrease attention deficit, work stations should be as large as possible to benefit from the decreasing effect of the sound with distance.
- Work stations should be designed to protect occupants from noise resources.
- Tools that will neutralize noise should be used on surfaces that form work stations.
- When using divider panels in open-plan offices, one should take into account not only the noises that break due to these panels but also the noises that directly reach the ceilings and reflect.

- Noises that reflect from the surface of the ceiling spread to the office again. Thus, one should use sound-neutralizing tools on the surface of ceilings to prevent noise reflection.
- Tools used in blocking surfaces are crucial in preventing reflections in the office. So, it is better to cover up blocking surfaces with sound-neutralizing tools [81].

While open-plan offices offer more functional, physical, aesthetic, environmental and economic benefits, it is not easy to obtain a satisfactory conversation privacy and conversational communication when compared to traditionally divided, cell-type office structures. For this reason, sound masking plays a significant role in open office areas. Sound masking is defined as a stable, broadband, low sound level that masks speech disturbances and noise [82].

For background noise to create a fine acoustics in open-plan offices, the range that should be at each frequency provides the suitable and desired characteristics of sound. The noise of air-conditioning system should be at a modest level but should not be too silent. This is because open-plan offices need noise levels that provide high level masking [81].

This section examines the noise concept that should be taken into consideration when planning office spaces: These are given below:

- Acoustics of space (sound distribution in a space)
- Noise that comes from inside in a space
- Noise that comes from outside in a space

Lighting

Lighting is to apply light on certain objects and surfaces in a most suitable way for visual perception. The aim of lighting is to make visible objects and surroundings of this light source rather than the light source itself.

A good technical lighting is known to increase success at schools and efficiency in manufacturing centers and offices and to decrease occupational and traffic accidents, fault production and miss-judgments. Moreover, the basic truths about lighting such as elimination of unnecessary exhaustion, headaches and eye pain and irritation and creation

of a more elegant, more efficient and healthier environment in offices are already understood and applied in improved countries [83].

In open-plan offices, it is impossible to create daylight everywhere as the volume depth is high. Thus, in addition to natural lighting, artificial lighting system is used in these spaces. Lighting is very crucial especially in spacious working areas. Two types of lighting in open offices are the “direct” lighting applied on desks and “indirect” lighting applied on ceiling or in between dividers. Moreover, lighting that is mounted on suspended ceiling applications by using multiple small elements is used as general lighting in open office designs [84].

In open office plans, white-heat light sources are used only in private sections in direct lighting. White-heat light sources draw more electricity compared to fluorescent lamps, are not frequently used in open offices as they get too warm, but rather used in sections that require custom solutions.

General lighting is a method of lighting that provide equal light level in the whole space which is applied to the office in general. As everywhere is illuminated with equal light level in office spaces that are designed for such type of lighting, any change in space furnishing will not change the order of lighting. General lighting should be applied in open-plan offices by avoiding direct light on the occupant by reverting the lamps put at the center of working groups. Light should be reflected on ceiling and then to occupant [85].

In order to eliminate any differences from the outer view of the building, fluorescent lamps are generally preferred. Fluorescent lamps have both warm and cool color options, which is preferred.

The color of the lighting tool used is important as it affects the colors of furniture and materials used in the space. An average of 10 fluorescent lamps can be used in a panel which is situated at the center of electric wiring. Separate keys are used for each panel in open-office spaces and corridors. Moreover, automatic systems offer various options for very large m² areas. Automatic systems consist of sensors sensitive to daylight or with time adjustment. In systems sensitive to daylight, lighting becomes active when light coming from outside decreases, in systems with time adjustment, the light is automatically shut down after a certain hour.

Computer screens offer an additional lighting. One does not need an extra lighting to see the computer screens. As normal office lighting may provide a glaring and shiny effect for computer screens, end-to-end lighting should be applied generally at low levels. However, this method of lighting will not also create a comfortable environment for an occupant who has to work in detail on a desk. As a result, different solutions may be obtained through different designs instead of a lamp to be used on a desk.

This section examines the lighting techniques that should be taken into consideration when planning office spaces: These are given below:

- Natural lighting of the space (daylight)
- Artificial lighting of the space
- Lighting quality to prevent problems such as glitter and reflection on computers, projectors, etc.
- Lighting color

Ventilation

Thermal comfort in office buildings depends on the heat exchange between the shell that surrounds the structure and the air limited by this shell and the human body. In this exchange, the effective parameters are the interior surface temperature of shell, air temperature, relative humidity and air mobility [86].

The office area is preserved at the desired temperature with the motion of heated or cooled air. The two methods of disseminating this air is to use diffuser from the ceiling and convector or “fan coil” in the environment. For ceiling diffusion, air that is inside of the building or on the ground that is heated or cooled in the central equipment is sent via galvanized steel pipe systems, vent-holes on the ceilings or holes in its surroundings. After circulating in the area, air comes back to ceiling voids through the grills on the ceiling or light equipment.

Here, air is humidified, filtered and mixed with the external air. Office buildings are typically classified into heating, ventilation and cooling zones. Each zone is controlled by a thermostat. Each thermostat regulates the amount of air temperature (by adjusting the yield of mixer boxes available in ceiling void). In open offices, heating or cooling occurs whether by convector or fan coil units available on the windows. Pipes carry hot or cold

water to these units. Air passing through the pipes are heated or cooled respectively, and then circulates in the room (through fans in the fan coil unit or through natural heat dispersion). Units are generally under the windows to prevent any impact from outside.

According to energy protection policies applied as a result of the oil crisis in 1970s, thermostats have to be increased in summers and decreased in winters. As a result of these policies, buildings with less air permeability are constructed. One of the results is the lack of ventilation, which ruins the indoor air quality or causes a disease known as "sick building syndrome" among office employees. One solution is to let more fresh air in.

Computers are susceptible to air temperature. Big computer systems may require 24-hour cooling compared to separated systems that can be used alone [87].

As ventilation systems which are one of the technical factors which require particular attention in open-plan and multi-storey buildings may negatively impact employees, one should pay utmost importance to these systems.

This section examines the ventilation techniques that should be taken into consideration when planning office spaces: These are given below:

- Air quality of a space (purity & pollution ratio)
- Thermal comfort of a space
- Humidity ratio in a space
- Smell of a space

Safety

The chain of precautions that should be taken against negative events such as threats, abuses, sabotage that are internal or external for individuals, institutions and organization is called safety. The safety concept which can be examined in different sub-topics such as physical safety, human safety, informatics safety, intelligence safety is a crucial factor to increase the efficiency of office employee.

People should feel safe while working at office buildings. Thus, entrance and exit to buildings should be controlled; the safety level should be increased through cameras and alarm systems situated in buildings. Today, entrance and exit to buildings is through card systems; even there are private safety areas with special cards available in addition to

private building entrances and exits. In open office buildings, there should be locked drawers and cabinets for employees to feel safe [86].

Precautions should be taken against stealing of archives and stored information that are important for office structures. First of all, archive and store areas should be locked and accessed only through private passwords. Away from the basic precautions that should be taken, various different systems made of state-of-the-art technology are used. Some of them are as follows: alarm system, card pass system, turnstile system, parking automation system, license plate recognition system, cash registry pos system, CCTV camera system, barrier system, biometric pass system, fingerprint recognition, iris recognition, vein recognition, face recognition system.

This section examines the safety concept that should be taken into consideration when planning office spaces: These are given below:

- Physical safety (safety for fire, earthquake, etc.)
- Human safety
- Informatics safety
- Intelligence safety

Functional Performance:

Functional performance that impacts performance of a building is directly related to the activities done by the occupants of that building. The key factors of functional performance are ergonomics, flexibility, communication and storage [86].

Ergonomics

Ergonomics is a discipline that enables harmony between vehicles, work flow and human relations and that blocks any disturbances on the body. The subject of ergonomics includes both psychology and physiology, and examines the tools individuals use when working in a physical environment and the factors that influence performance. Ergonomics handles individuals as occupants in addition to several fundamental components that include the layout and design of lighting, heating-ventilation and work units. As a result of misuse of these critical areas, occupants suffer with increased stress level which negatively impacts their efficiency at work.

Ergonomics is a method of approach on issues individuals encounter in working at the intersection point of methods gathered from technology, biology and social sciences. Ergonomics includes a research and action program to adopt work into individuals. Ergonomics is to look for solutions at simple or complex scales to relations at human-machine relationship.

With the introduction of ergonomics into offices, in addition to mechanic, electronic devices and equipment necessary in modern offices, the employees that will use these elements should be taken into consideration as well. Modular office furniture has great importance in providing a comfortable environment for employees in office spaces where they spend most of their time [84].

As a result of researches done on work units, it is confirmed that more than 75 percent of employees working in current offices use computers. Even at home, many people use computers even only for connecting to Internet. Thus, in present conditions in which computers are densely used, work stations designed with an ergonomic approach for eye health are very important.

Work units should be arranged with furniture produced for working with computer systems. Today, furniture manufacturers produce standardized furniture systems that are flexible to organizational and technical developments in offices. The biggest advantage of furniture systems is that they are both ergonomic and dynamic. Physical and visual problems of individuals are also on the rise with the dense utilization of computers in office spaces. The dynamism of furniture offers ergonomics in work units depending on individual's anthropometry and job [88].

Various factors from work units to environmental conditions impact ergonomics. The key point is to offer occupant comfort both physically and psychologically and to create the necessary factors in open-plan office buildings as a whole.

This section examines the concept of ergonomics that should be taken into consideration when planning office spaces: These are given below:

- The dimension of a space,
- The number and dimension of the equipment in a space,

- Installation system necessary for equipment used in a space (the number of socket outlet, etc.)

Flexibility

Flexibility is a management subject that should be considered at design stage. It depends on re-arranging the office space against any change that is functional. Flexibility can be obtained through different methods. The most striking example to flexibility can be the free address concept. Free address concept is a way of working which enables employee to work wherever they are and however they want to via virtual network. To be able to connect to Internet is adequate for individuals to start working.

From a different point of view, flexibility is to have the advantages of comfort while restructuring a modular system, an open office system. Every organizational change results in new space arrangement. It is to minimize dependence to modular structures and changes made on ceilings, lighting and electric wiring [87].

It is one of the key advantages of open office designs. The design type which adopts very fast to changes in regards to the number of employees or organizational changes of office occupants and passes on to the new format is the open offices [89].

This section examines the flexibility concept that should be taken into consideration when planning office spaces: These are given below:

- Distribution and level of furniture and equipment used in a space

Communication

Open office designs enable easy communication between office employees, speed up exchange of information among employees and strengthens production and design stages [89].

Today, communication between employees has become wireless thanks to the wireless technology. Based on this network system, information can be easily carried and shared. New protector systems are constantly developed for this system that causes safety issues as well. On the condition of connecting to a central network, it is possible to transform

information using personal laptops, PDAs (Personal Digital Assistant) or GPRS (General Pocket Radio Service) and mobile phones [90].

Facilitating the communication is one of the key objectives in an office and the responsibility of an architect is to improve this communication process. Open office designs increase the power of communication between employees. However, the design should be completed by taking all factors into consideration, otherwise the strengthening in communication may have negative results.

Conference halls, work areas, the surroundings of coffee and water machine are the preliminary areas where office employees establish personal communication. Office designs may support communication, but also may hinder communication; because it can be a positive factor aimed to contribute to organizational targets or can be perceived as disturbing and unpleasant as it encourages privacy. Individuals whose working areas are too close to the main circulation area may find it hard to concentrate on their works, while the isolated ones may feel that they are isolated from their colleagues. This may complicate communication, making it a dissuasive factor [87].

This section examines the flexibility concept that should be taken into consideration when planning office spaces. These are given below:

- The suitability of a space to group work,
- Inter-space social relations and communication level.

Behavioral Performance:

The comfort expectations of occupants increase as a result of the impacts of social change and technology on social life. In addition to functional and technical factors, occupants also require psycho-social factors. While planning new office spaces, principles that are important in regards to work psychology are equivalent to organizational principles.

Privacy

Privacy is another subject of management. The decisions should be made regarding which employees will work in private offices, which employees will work in joint offices and which employees will work in open offices. This is, sometimes, a result of programming stage or sometimes design approach of an architect.

For instance, privacy in open office systems which become a tradition in Private Banking exists either at very low levels or does not exist at all. This results in an intimate and honest image in regards to customer satisfaction.

Custom design offices are a symbol of statue. It is the symbol of success in many organizations. The dimensions, location and design of open-plan offices will give various information about the management style and company culture of an organization.

In open-plan offices, the main advantage of sections private for senior-level managers is the acoustic privacy. Personnel managers and those who deal with the problems of employees demand and require acoustic privacy. The main complaint about open-plan office systems is the lack of this requirement. Privacy is obtained through separator elements in open-plan offices.

Giving identity to private offices is another form of privacy. This lies in the demand of employees who wish their offices belong only to them. This is a very thin line. Exceeding this line may result in a chaos. This is an important decision an architect gives during the stage of designing.

Sense of belonging

According to the definition by Turkish Language Institution, the sense of belonging means a feeling or awareness of attachment to a group, a part of the society or a social group. As can be derived from this definition, sense of belonging which is a psycho-social factor plays a crucial role in planning elements of open plan offices.

In open plan and multi-storey office structures, designs should be made bearing in mind that employees are social individuals. Several studies are conducted to hinder some psychological results that may rise due to high number of employees. One should provide not only a personal working area for a single employee but also an environment where this employee feels he/she is a part of the team by using working units and separator elements that separate these units from each other. We may examine this spatial behavior of employees under a few sub-topics:

Domination Area

The concept of domination area can be regarded as forming different spaces for employees working at different administrative levels in an open-plan type office area or as forming areas for employees within working areas which belong to them. Forming different spaces based on administrative levels of employees is obtained through eliminating transparency between separator elements in open-plan offices. For instance, while senior level employees are separated by other employees via transparent panels such as glass, these working areas may become more private by using elements such as blinds in special occasions.

The level of efficiency increases in a company which relies on the principle of employee equality as a philosophy; and this principle has a positive impact on the general environment as well.

There are different separator systems such as low, mid or high-level panels in open-plan offices to fulfill different demands such as communication, acoustics or visual privacy. The limits of privacy may be defined with lines, signs, cabinets or plants instead of these panels in open-plan offices.

We may classify the borders of working area into different areas at arm's length. The area to which maximum arm's length reaches is the primary working area, then the rest can be considered as secondary working area. While primary working area forms the primary domination area of an employee, the secondary working area forms the joint domination area with other employees or customers. For different working groups, joint occupation areas are formed within the secondary working areas for employees. In addition, screen privacy is another factor occupants demand in regards to working area [91].

Personal Area

It is a known reality that individuals express their individuality or personal interests through different objects or spaces they decorate. This is a way of defining and claiming that space; in other words, it is to take control of that space and putting a personal stamp on it. Letting this happen would help occupants claim the spaces they use and to better use these spaces.

Employees may encounter two different problems within their personal areas in open plan offices such as the perception of their own behaviors and the perception of others' behaviors. Perception of their own behaviors may create pressure and result in psychological disturbance; or else, the perception of others' behaviors may result in attention deficit.

Employees form their personal areas within these working stations by photos or special belongings. In many open plan offices, employees put the photos of their beloved ones on their eye sight. Such styles may result in a natural elevation of efficiency for employees.

Spatial coding

Spatial coding is a frequently seen factor used to define borders in open offices. Occupants define their borders by creating their domination areas within personal ones. Different separator alternatives are used for spatial coding [91].

In open plan offices, it is known that occupants claim the area they work in and work more efficiently with a sense of belonging thanks to this spatial coding [79].

A sense of belonging can be obtained in open-plan offices where independent working areas are formed based on spatial coding or in areas formed to get some water or tea during the day in order to create joint sharing, or in joint cafes and rest area.

3.1.3. Research Techniques used in POE

Methods used in POE studies depend on the scope and complexity level of the project, its duration, cost and the qualifications and quantifications of actors that may play role in evaluation studies [92].

While selecting the suitable technique to gather information, one should take into account the POE plan and its objective. The methods to be used should include evaluation criteria and the objectives should be presented to use information.

As measurements done with a single method in subjective evaluations such as occupant satisfaction can be misleading, statisticians suggest that measurements done with different methods should be compared and used together. After a building that pose various

problems is used, using a single technique in evaluating the result will probably be inefficient. So, some techniques should be used together [93].

As a technique of gathering information in various POE studies, surveys, interviews, photographs and some other physical evaluations which are used more commonly among other POE research techniques can be used together.

The methods used diversify as the POE utilization becomes more common; and standard method packages are formed. Except for a couple of exceptions, the first POEs focused on methods that include surveys, interviews and observations in which comfort and functionality a space provides are evaluated [94]. “Figure 3.4.” shows the general topics on investigation techniques used in POE.

Those that conduct these evaluations should take into account some points while selecting technique to use information. These are as follows:

- A couple of techniques should be used together as each technique for gathering information has some limits.
- It is important to select the techniques that truly evaluate the primary subjects during the evaluation process.
- It is important to choose a technique that is suitable for the target and that have an affordable cost in an evaluation done to improve beneficial and high-qualified information or a single design product that may be used in new building programs, standards or designs.
- Testing the efficacy of information gathering techniques depends on whether they provide the necessary data that reflects the right and reliable definitions for users and whether they have the necessary precision to catch the important problems.
- After selecting and making the preliminary trial of these techniques, these should not be used in prejudice [95].

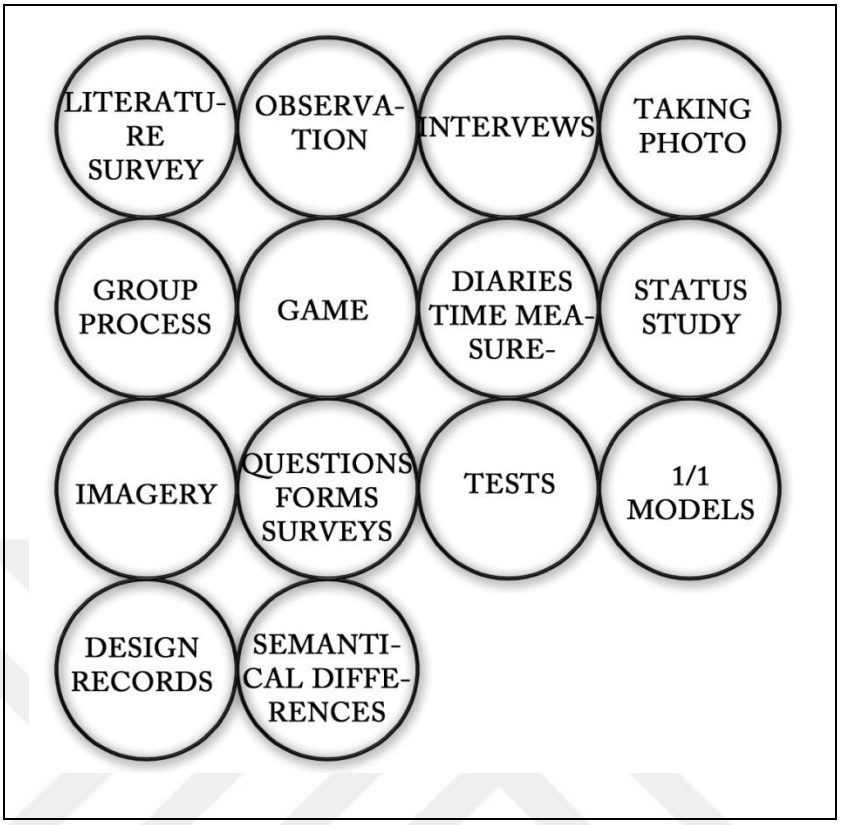

Figure 3.4. General topics on investigation techniques used in POE

Literature Research:

Document archives provide ready and suitable data in addition to environmental behavior (E-B) data from newspapers to corporate records and architectural plans. Researchers who overcome potential problems one may encounter at the entrance may form a complete relation with the data entrance; and reach data such as words, numbers, and nonverbal definitions.

It offers open or closed evaluation criteria. Open criteria are available in publications and reference studies. Closed criteria are available in research articles and conference publications. Closed criteria requires interpretation and examination by the evaluator. This is because the data should be evaluated in regards to its relation with the current context [63].

Observation:

The aim in using the observation technique is to review the original targets of architectural design and to evaluate how the used structural environment meets these targets. “Observation helps occupants’ actions be detected according to the floor plan of that particular area or some recorded sketches.” Based on this technique, three different actions take place including the investigation of occupants’ reactions for the current use of the environment, the detection of evaluation subjects and the formation of research hypothesis [66].

Methods such as direct observation are suitable for cutting the link between the occupant and the evaluator. The advantages of in-situ observation are the smaller number of personnel and the ability to obtain qualified information, while its disadvantage is disorder when observants lack any method [95].

Interviews:

Interviews include making interviews with owners, managers, employees and those passing by. Interviews enable us to reach new information. This is because those who knows best about a particular environment are those who are in one-to-one relation with that building. A person with which one shall interview should have a general and particular knowledge about the building and its surroundings. Thus, the most striking nominees to interview are the architect who designed the building, the organization who runs it and the manager who manages it [66].

Occupants join the evaluations to define portions that support or block the interrogated subject about the building. A crucial principle is that those that join should define the building problems by their own words. One of the important methods used in these studies is the method of monitoring and evaluating these spaces in situ. Thus, one uses spatial experience to encourage people to speak with their own words while defining the buildings. In this method, one should pay attention not to imply or make them realize how they are made to speak their own words.

Participation in small groups is crucial in guaranteeing every participant that they have every opportunity to speak out their own ideas. These interviews form a rich comment-answer range [96].

The advantages of interviews are reaching detailed information, reaching a lot information with less number of people, targeting to special areas and ease of gathering as individuals compared to group gathering; the disadvantages are that the private interviews do not reflect the general, no comparison can be made and it is custom [60].

"Table 3.1," "Table 3.2." and "Table 3.3." show the sample questions and explanations for some question types that may be encountered between the interviewer and the responder. R: Responder, I: Interviewer

Table 3.1. Examples to "reflective question types" created based on Gür [60].

SAMPLE	***EXPLANATION***
R* *What I love most is its location*	*A general answer*
I* *Its location?*	***Reflective question type - Repeating the sentence***
R *Yes, as you may know, it is close to both bus stations*	*A focused response defining the stimulant*
I *What did the architect think about when she/he put those large windows here?*	*It is obvious that R wants some clarity from I*
R *So you say, the architect did not know actually he/she put those windows here?*	***Reflective question type - Responding the why question with another question***
I *Are there any activity you repeat every day in this building?*	*A general question.*
R *While everybody is busy, I go out to balcony. And take some fresh air for a couple of minutes.*	*A descriptive explanation of a personal routine*
I *So, don't you like anybody seeing you while you are out.*	*Reflective question type - Listening carefully and silently.*

Table 3.2. An example to “status indicator question type” created based on Gür [60]

	SAMPLE	***EXPLANATION***
I*	*Which is your favorite place in this playground?*	*A general question*
R*	*Almost everywhere*	*A general answer*
I	*Where do you play the most*	***Status Indicator Question***

Table 3.3. “An example to “emotional question type” created based on Gür [60]

	SAMPLE	***EXPLANATION***
R*	*I am afraid of the young people in the new campus*	*A general reaction*
I*	*What do you mean when you say you are afraid?*	***Emotional question***
R	*They are very tough and rude. They may hurt us, the elders.*	*A descriptive response.*

Photography:

Photographs of physical traces taken at the beginning of a research project can provide a general baseline image for the object types that may be available for all parties who work on these traces. Photographs taken can be used for comparison in the research. For instance, an evaluation can be demanded from an occupant using this photography technique to compare social spaces of different schools. The comment of occupants can be obtained by adjective comparisons such as interesting - boring, dynamic - static, repellent - inviting, new - general, unpleasant - pleasant, friendly - unfriendly, good - bad, etc. [97].

Group Processes:

Group interviews are a good approach used to understand the scope of definitions that may be revealed in regards to a subject or place. A small-sized room, gathering around a desk or forming a ring are the necessary properties.

Its advantage is that one spends less time to management compared to time spent for preparing questions, one may deal with private questions; sometimes a sentence of a single person in the group may cause others to give very clear and violent responses. Its disadvantage is that the need for an expert or sometimes a person in a group silences the others although he/she does not act deliberately; and that it is not anonymous [60].

Play:

There are many plays developed in which some dependent preferences are done and subjects share their views. Among them, one of the oldest is the Wilson's district unit play technique. Several physical qualifications of neighboring unit and health services are offered to the subject in return for a price. The subject has to make some preferences between them as he/she has to make some spending, because he/she cannot afford them all. Thus, the investigator gathers information regarding the preferences of this subject [60].

Diaries and time measurements:

Action systems, flows and the whole will be captured when actions are recorded at certain time intervals.

Case study:

Investigators use case studies to define and specify complex objects. They draw a draft of the borders of an object; relations between elements examine the development of the object and contextual impacts, etc. A case study is suitable when the investigator deals with the information of a certain study object and of its context instead of a general information on a wide population. In case studies, multi-investigation techniques are necessary especially in participant observation when investigators obtain an efficient amount of data about the different appearances of an object.

For instance: Investigators from Oxford examined the physical traces by living a couple of days in a line of buildings where they made records, investigated and planned the

occupants and the personnel; then they analyzed their health records, made an interview with all occupants one by one and tested the suggested room arrangements. In these comparisons, they started to understand which are more important for occupants' daily lives. They obtained good amount of data in regards to meal times, insomnia problems, sense of trust and social isolation. As a result, a great amount of design decisions should be for increasing occupants' control over their surroundings and to increase self-confidence by respect [97].

Similarities:

Performance criteria should be investigated when programming and designing a building that does not exist before. In such conditions, the most frequently used method in obtaining performance criteria is to use area types that are similar but not exactly the same according referencing criteria which is called the similarities. For instance, while new centers were designed for cancer treatment back in 1980s; they discussed whether these buildings should be separate or integrated into bigger hospitals. Moreover, they searched for answers whether they should be scaled as a home or have the coldness of an institution. These questions opened a pathway of a design form which has a modest scale formed by a more empathetic environment which was away from a corporate appearance in order to distress cancer patients and their relatives. Similarly, while making the first constructions for Alzheimer patients who were hospitalized or received outpatient treatment, there was not much information on the evaluation criteria suitable for patients at different stages. Throughout the design investigation, there were many admissions regarding patient requirements and after testing these requirements, a new path was found for designing [63].

Question Forms and Surveys:

As the aim of surveys is to measure the reactions of individuals who interact in a certain environment to that environment, it is important to reach and get the opinions of a possibly wider group who are influenced by this environment. Methods such as surveys are effective in obtaining wide amount of information.

Question paper method is a method based on sociology which detects meanings, attitudes and behaviors. This determines responses given routinely to the same question groups by different person groups. Standardized question papers can be submitted whether via mail

or phone call; and sometimes applied by experienced interviewers. “Table 3.4.” shows “Likert Scale” used in Environment - Behavior studies through the sample scale and questions in attitude evaluations. Some coding categories work not only as response forms but as rating processes as well. While a group of questions is submitted to the evaluator for approval or denial in density, each location to be signed has a secret and obfuscatory value [97].

Table 3.4. Likert scale example [97]

	Absolutely Agree	**Agree**	**In Doubt**	**Disagree**	**Absolutely Disagree**
Rules are not fair in this facility.	**1**	**2**	**3**	**4**	**5**
The management is very supportive in wok related training.	**1**	**2**	**3**	**4**	**5**
The work areas we have can absolutely be better.	**1**	**2**	**3**	**4**	**5**

The advantages of survey studies are that they are objective, they enable performance comparison, offer a wide opinion, do not reveal the identity of the participant or do not let comparison; the disadvantages are that they should be organized well, should guarantee response, they require time of the participant and technical know-how and expertise for analysis.

Semantic Differential (Lexical Differentiation):

The most known and frequently applied subjective evaluation technique used in Human - Environment studies is the semantic difference. The original text of semantic differential has been written by Osgood, Suci and Tannenbaum in 1958. Semantic measurements is a systematic method used to obtain verbal responses. Semantic differential is used in measuring the aesthetic qualification and perception of the environment. Its biggest challenge is to find the most appropriate adjectives. It is suitable to use 5 and 7-point scales in this method. “Table 3.5.” shows the evaluation of a chair to be assessed according to the adjective range defined in 7-point scale [98].

Table 3.5. An exemplary semantic differentiation table [97]

				Your Chair is				
	Very	**Quite**	**A little**	**Somewhat**	**A little**	**Quite**	**Very**	
Wide		**x**						**Narrow**
Modern			**x**					**Traditional**
Functional			**x**					**Nonfunctional**
Tasteful		**x**						**Tasteless**
Fresh			**x**					**Gloomy**
Neat				**x**				**Untidy**
Special				**x**				**Public**
Shiny					**x**			**Pale**

Experiments:

Investigator uses an experimental approach when he/she wants to measure the results of an action in a special condition. It looks for an answer to the question: "What kind of a difference can an experiment create?" For instance, what kind of a difference does general structure participation create when taking management decisions? In experiments, investigators organize actions that can control different factors. For instance, an investigator has to examine the conditions before and after the action in order to measure the changes an action they reveal creates. This brings in the act of comparison. Crap made an assessment between those that are admitted to Victori Plaza designed for the elderly in Texas and those that are not admitted; and obtained an opportunity to compare the changes they go through and to learn if they experienced an important change or not following the first interview. As a result of this examination, Crap reached differential data such as need for medical services, the desire to buy furniture, a sense of pride for the environment one lives in and money issues among those that were settled and those that were not [97].

1/1 Models:

Model evaluation can be done by establishing 1/1 models to guarantee the right investments for special spaces.

Design Records:

Explanatory diagrams, plans (furnishing settlement, comments, symbols), notes, drawings, observation of traces are among design records.

3.1.4. The Level and Process of Applying POE

POE studies and procedures are divided into three stages as shown in "Figure 3.5." by Presier et.al.

- Demonstrate / Indicator POE
- Researcher POE
- Diagnostic, identifiable POE

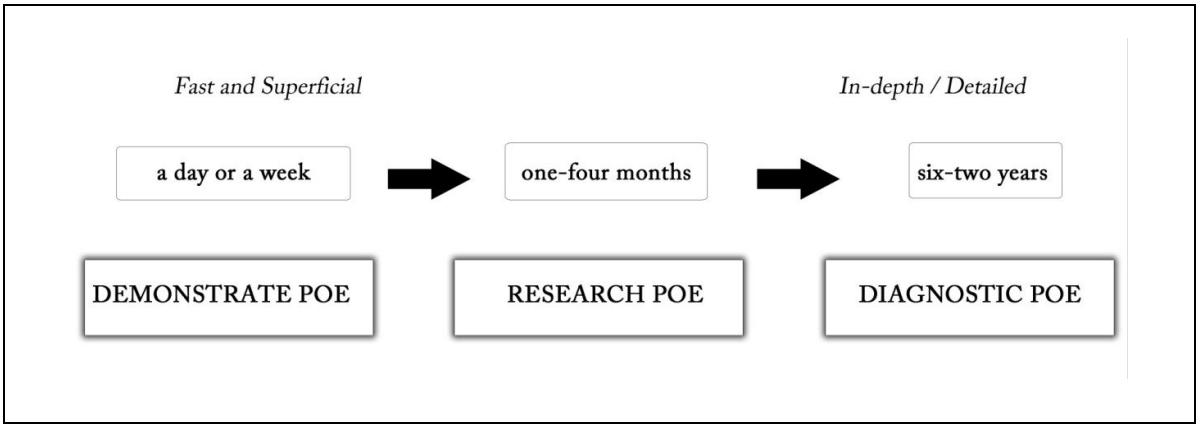

Figure 3.5. P.O.E. The level of applying process model [8]

Level 1: Demonstrate / Indicator POE: They do not take much time; 2-3 hours at least, 1-2 days at most. Simply, this step defines the successful and weak points of a building. There are four types of gathering information:

- Evaluation based on archives and documents
- Gathering information by asking questions on building evaluation
- Gathering information by taking photographs and sightseeing
- Gathering information through meetings and interviews

Level 2: Researcher POE: According to Presier, different from indicator POE method, this requires more time and resource, and it is more complex. It not only compares the existing condition with similar buildings, but also summarizes the existing literature. Both of them reveal the thinking stage and suggestions for change. Even lighting, image, safety, acoustics, energy and air conditions are taken into granted. More reliable results obtained.

Level 3: Diagnostic / Identifiable POE: It includes multi-method tactics such as research, observation and physical measurement. Generally, it is used in big institutions that have very precious structures or very big facilities, in short in large-scale projects. An investigation of such level requires six months to one or two years time. Improved data gathering and analysis techniques are used. Expert consultants are also work in the research team. The number of subjects used for gathering data increased [8].

3.1.5. Stages of POE

Every POE is made of the following stages:

- Planning,
- Management and
- Application [8].

POE Planning Stage: In the planning stage of POE, investigators define the scope and level of the study; review plans related to the structure; detect organizational structure and obtain previously gathered information; perform a small-scale literature research; define gathering data suitable for the study, analysis methods and equipment; establish criteria; identify the personnel to participate in the study; assign the structures of job definitions and costs; conduct process planning; and review all of them before moving to management stage in order to keep the quality of the study high. This is dealt in 3 main topics [95]:

- Exploration and Feasibility
- Resource Planning
- Study Planning

POE Management Stage: At this stage, investigators gather data on site, inform the personnel about the application and procedure, monitor and manage data gathering, analyze this data, and structure the results according to the objectives. This consists of 3 main steps [104]:

- Gathering Data on Site
- Monitoring and Management of Data Gathering
- Analyzing the Total Data

POE Application Stage: In the application stage of POE, investigators prepare an eligible written document out of these results according to certain objectives such as the definition of positive and negative characteristics of the building, the identification and annihilation of problems, and creating data for new buildings; they generally define and interpret these results, explain the performance of the building and offer solutions.

This consists of 3 main steps [95]:

- Explanation of Findings
- Suggesting the Solutions
- Reviewing the Results

We may list the questions that manage the stages of POE as follows [99]:

- Who started the idea to measure?
- What is the motivation behind the desire to measure?
- Who will give authorization to POE?
- What are the preliminary subjects?
- What are the expected benefits?
- What kind of information is necessary?
- Who will manage POE process?
- What is the target of this process?
- Which method will be used?
- What are the limitations?
- Which resources will be needed?
- Can the evaluation plans be approved?
- Which technique will be applied to gather data?
- Which data are necessary?
- What kind of information will be gathered from data analyses?
- Does the obtained information fulfill key subjects?
- How will the results be related to each other?
- How will the evaluation results be discussed?
- Who will authorize the application?
- Which applications will become active?

3.2. SAMPLES OF POST OCCUPANCY EVALUATION IN THE GLOBAL LITERATURE

The design and management of buildings are complex processes. Each have great number of occupants who have different preferences and interests [100]. Meetings, intuitions and

emotions between occupants may help improve a design and minimize risks. Post occupancy arrangements are key tools to gather information about the performance of working environments from the occupant perspective. This is relevant especially when organizations desire to convert the new settlement styles into new work environments [101].

In the mids of 1990s, some Holland institutions including Interpolis Insurance Company, ABN AMRO Bank and Public Buildings Agency started to perform studies on new office strategies and innovative "flexible" concept. A similar trend continued in the world. They thought that the studies of human beings would make this world a more efficient and joyful place: Open work areas for communication, cockpits for jobs that require concentration, meeting areas for official consultations, clubs and places to sit for unofficial consultations, etc. The expectations were to benefit from glass materials, improve communication through possibly less number of walls, and faster flow of information. In addition, the aim was to fulfill globally humanistic requirements such as providing privacy, identity, statue and the ability for an individual to arrange its own work environment [102].

The WODI Toolkit:

This method is a research method developed specially for measuring how good a physical work environment operates. "Work Environment Diagnosis Instrument" (WODI) which is a new evaluation method applied in "Post Occupancy Evaluation" method can be examined under four main headings. These are:

i. WODI classic; a method used to support diagnostic POE,
ii. WODI light; a fast tool used in POE as an indicator,
iii. WODI key; is used to compare buildings in regards to employee satisfaction and dissatisfaction, and
iv. It is a method used to measure data on satisfaction rates [8].

WODI key performance indicators on satisfaction and dissatisfaction

i. Organization Management, salary, colleagues, team spirit, job security, social engagements and freedom of work
ii. Content of the work Content and complexity of the work

iii. Functionality Space for official meetings, space for informal meetings, zoning, activity-based workplace use and orientation

iv. Ergonomics Dimensions of the workplace, dimensions of furniture, comfort of furniture, flexibility of furniture and adaptability of the workplace

v. Aesthetics Use of materials, use of colour, furnishing and architecture

vi. Transparency and inspiration Level of transparency, inspiring interior

vii. Psychological aspects Not being seen, heard or disturbed, distinction of status, space for personal attributes, confidentially and freedom in work

viii. Appearance of the work environment Contribution of the work environment to well being, being proud, and media attention, the workplace being attractive, inviting, a front piece and nice atmosphere

ix. Communication Communication with colleagues, informal and formal consultation, contact ability, exchange of knowledge and experience and environment stimulates communication

x. Concentration Being able to work concentrated, not being distracted, satisfaction about concentrated activities

xi. Archive User friendliness of the archives, central archive, personal archive, way of filing and satisfaction about filing

xii. IT Computers, network, copier, fax, software and assistance of help desk

xiii. Facility management Reception, mail delivery, opening hours, satisfaction helpdesk, lunch room, coffee and tea, cleaning, security, support during meetings and making reservations

xiv. Indoor climate Temperature, ventilation, air quality, acoustics, artificial lighting, day light, personal control of lighting and heating and noise of climate installation

- Indoor climate Temperature, ventilation, air quality and personal control of heating
- Lightning Artificial lighting, day light personal control of lighting
- Acoustics Acoustics, noise of climate installation

xv. Perceived productivity The work environment being supportive to concentration, communication, desk work, telephoning, meeting, archiving and administrating, stimulation of high-standard work and being productive and providing a nice workplace.

The Building Use Studies (BUS):

The method was developed during the PROBE building performance evaluation work financed by the government in 1990s. The BUS methodology is a powerful tool in the development of user-centered building design. It is a method retrofitted to the "Post Occupancy Evaluation" (POE) method that was developed to help to create satisfying residences for the building occupants. This method is a survey method that has statistical data applied on almost 10.000 buildings. BUS methodology in general has been applied on each project separately.

Center for the Built Environment (CBE):

Center for the Built Environment (CBE) has developed methods to evaluate the performance of buildings in terms of occupant comfort and productivity, and energy efficiency. For instance, CBE's web-based Occupant IEQ survey measures how a building performs in perspective of that building occupants. This provides a feedback for the building's owners and occupants and helps the architects and engineers in design of buildings in the future.

Occupant IEQ survey was developed by the University of California at Berkeley (CBE) and consists of a core section that includes questions about the satisfaction of workplace environment and an additional section about psycho-social experience. The questions are about the general properties (sunlight, light amount, air quality, thermal comfort, acoustics, furniture) of the building and workplace environment. Psycho-social modules focus on the following fields: User attention, intellectual theft and communication, acoustic functionality and satisfaction.

The following graphic "Figure 3.6." shows a general summary of the answers to the survey about Merrill Center building. As it can be seen, in order to measure the quality of acoustics a negative and positive point system that uses a seven point scale changing between -3 and +3 is used. The highest degrees are intended for general building, workplace, office furniture and air quality. The average on all these categories are over 2.0. The other highly evaluated features are lighting and appearance.

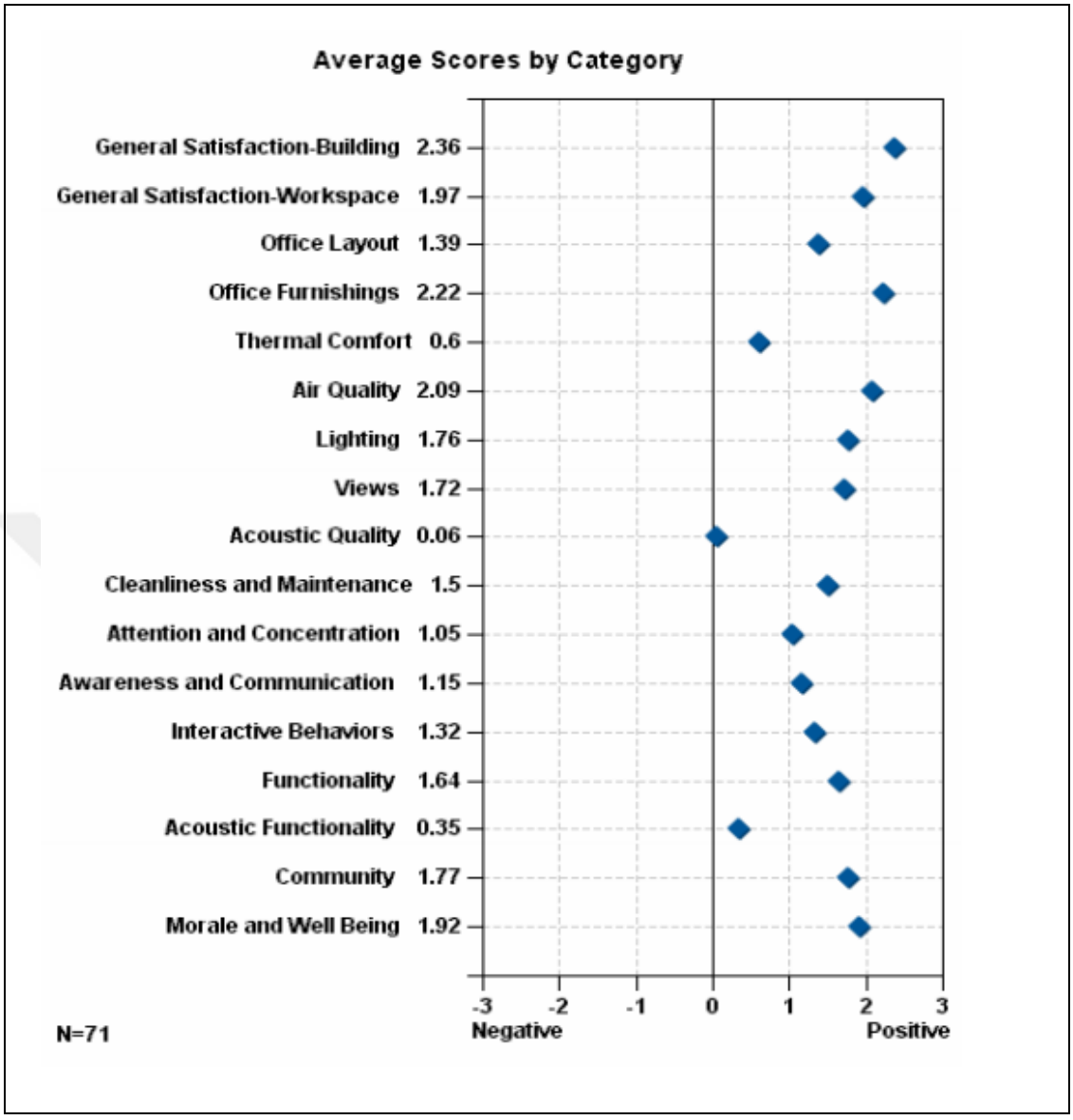

Figure 3.6. The survey results of Merrill Center building

3.3. POE IN OFFICE BUILDINGS

The word office has meaning like “bureau” in French or in “mektep” in Arabic. When we look in the dictionary meanings of “office” and “bureau”, according to the Turkish Language Institution the word “bureau” means 1. Study room, desk, 2. Work location for information desk and editorial department, 3. Department, branch, 4. Writing desk. Its root is French “Bureau.” The meaning of the word office comes again from French “Office” which means workplace, department, bureau. In Turkish language office and bureau are

used as synonyms. The meaning of the office is mainly a service. Afterwards a room or a building of an organization where this service is given comes to mind. Therefore, to accept the meaning of office as a place is a mistake. Nevertheless, performing a service requires protection from natural factors, a location to reside and storage space, i.e. an office [103].

Sahin Naghavi defined the main factors that affect the internal design of offices as:

- Business needs
- Organizational needs
- Personal needs [104].

It is very difficult to satisfy all these three factors in office spaces. To optimize these three factors is the main objective for an ideal work environment. POE in this study is a method to measure the sufficiency and efficiency of these factors.

It can be easily observed that the transformation and development that occurred in the business world due to technology advancement led to changes in occupant profile and to structural and functional changes in structures. The office planning approaches that came along with these functional changes can be listed as:

- Open design plan type
- Close design plan type
- Mixed design plan type

The main difference between these office plans is the alternate design of planning elements such as the core and corridors [105].

Open-Plan Office Type:

The work in the office can be done by individuals or by the teams. While conversation and interaction between people in open offices happen effectively, it also eases the communication. However, it is needed to make the place more suitable for individual work. The employees and teams can be separated with things like plants, movable cabinets, devices, lighting devices that can both serve the needs of the office as well as a portable separation panels. The separate sections in different sizes for the management and upper level employees can be provided with portable panels [80].

“Figure 3.7” shows an example of an open office design in the West Group building.

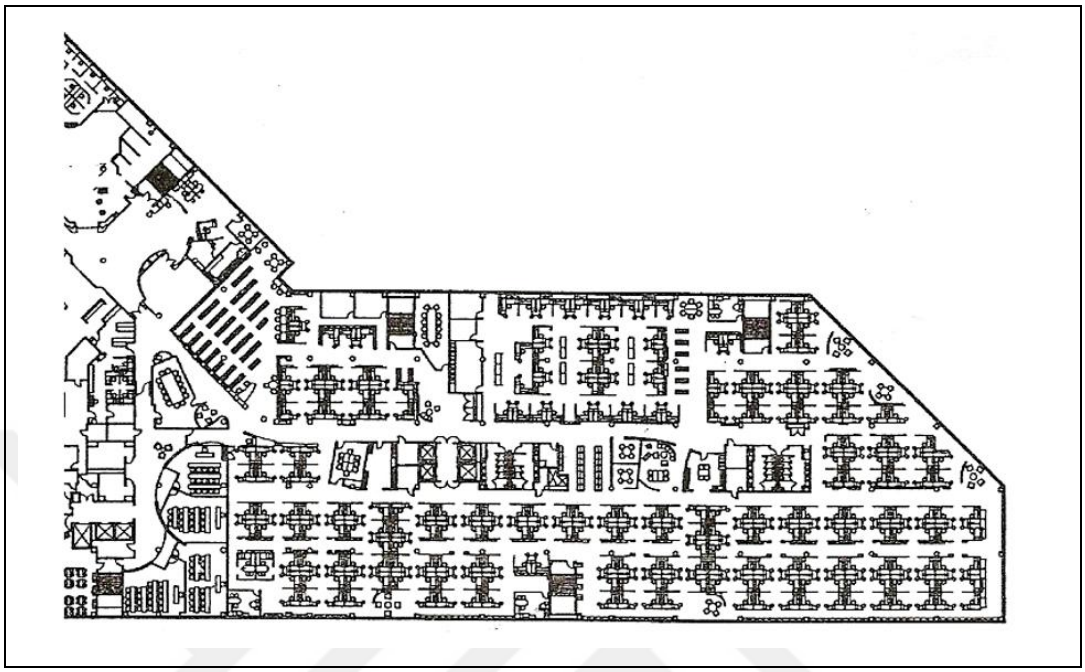

Figure 3.7. Open office plan example, West Group Building [80]

A figure formed by hierarchically placed tables in office buildings; it is used in the middle floor of the Larkin Building “Figure 3.8” which was designed by Frank Lloyd Wright for “Larkin Mail Order Company” in 1904 and this design was used a model for many office space planning until 1960s. The open office with low separating walls concept was totally changed when we came to 1960s [106, 107].

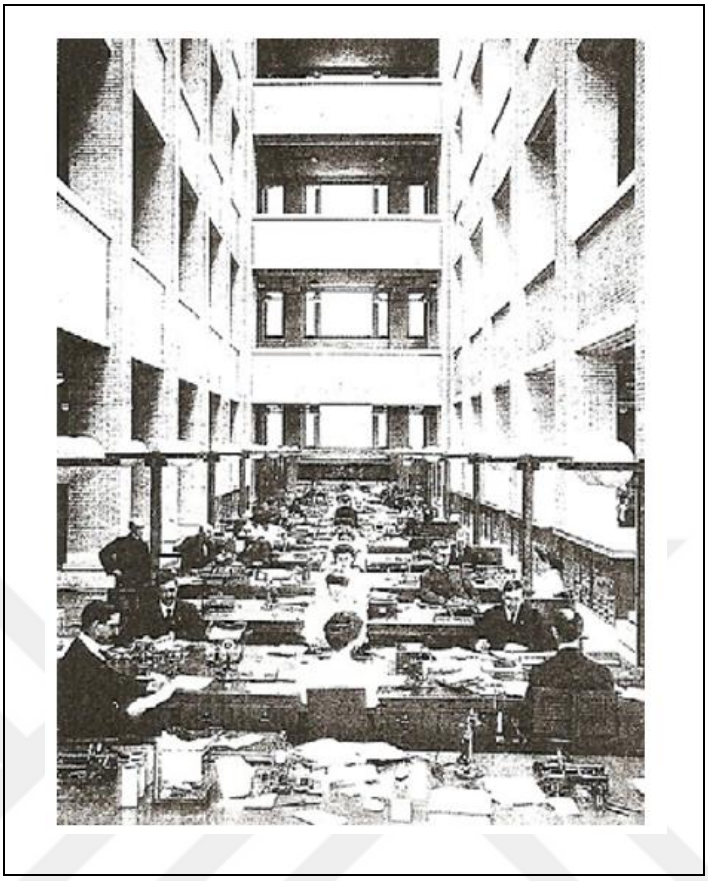

Figure 3.8. Internal space photograph in Larkin Building [107]

This model that came around early 1960s with technological developments that eliminated ventilation and lightning problems. It created positive outcomes in terms of easing of communication, keeping the employees in contact with each other and the outside world and making members of teams feel belonging to the organization [108].

In structural and service terms office buildings project open office plan systems; however, personal privacy concerns should be kept in mind [109].

In Herman Miller's first open office experience which he named as "Action Office" especially new office furniture were used as separators between employees. It is shown in "Figure 3.9." The new concept that started to be used was developed later on by Robert Probst who worked for Miller in 1964. The only problem with the open office layouts was that it caused employees to get tired of the monotony caused by the modular system and this led to new office furniture designs [110].

Figure 3.9. “Action Office”, Herman Miller [110]

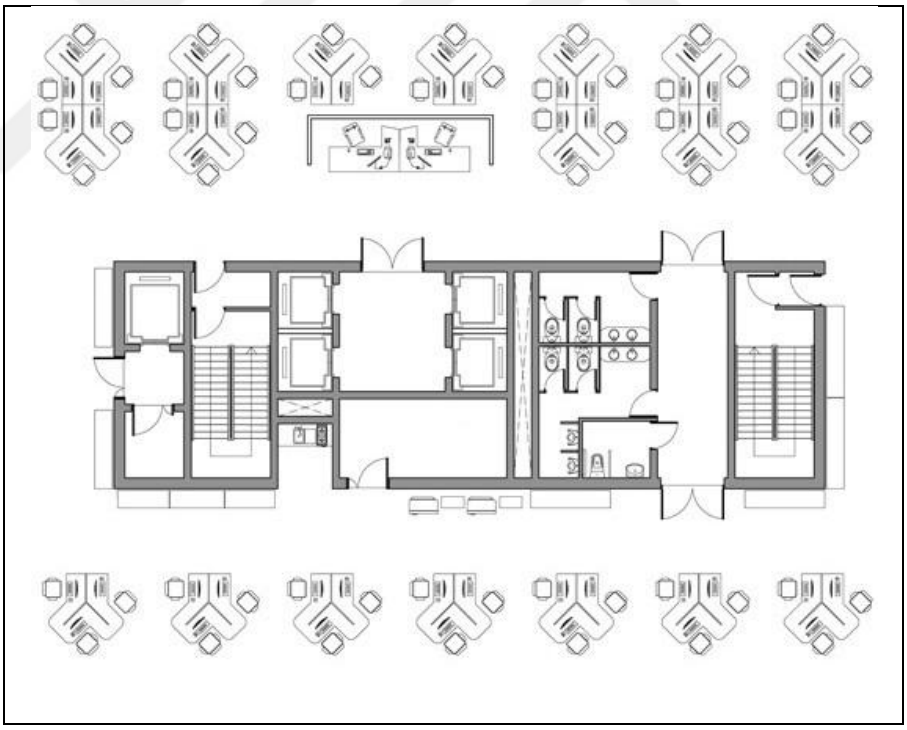

Figure 3.10. Central Beher, Herman Herztberger [111]

Another early example of open system office buildings was “Central Beheer” building in the Netherlands designed by Herman Herztberger and completed in 1972. It can be seen in “Figure 3.10.” City’s characteristics were used in the interior building design with a grid system [111].

As time passed depending on the organization type and technological developments, open system floor plans were separated into two groups: linear designed open office and freely designed office formed by scattered layout. They can be seen in “Figure 3.11.”

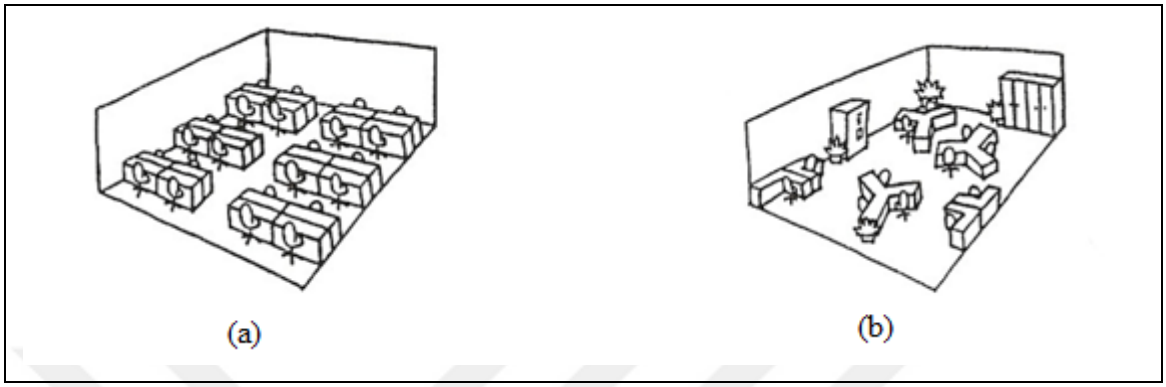

Figure 3.11. Office types (a) open office type, (b) freely designed office type. [112]

The most important aspect of open office system plan types is modular sections. The modular units that form the characteristics of plan type are separated from each other with standardized panels or boards at the height of 140-220 cm. However, in some office buildings these panels are not only used as separator but also as storage units which provide convenience and increase usable space [84].

Close Plan Office Type:

Named also as traditional office space, closed office plan type is the oldest know office type and its used goes back to medieval times. Known as the first office building and designed by Giorgio Vasari, the Uffizzi Building in Florance “Figure 3.12.” was composed of cellular spaces around a square that did not include service sites. These buildings constructed in those periods form the foundation of the plan type known as the close office [112].

Since centralization was the accepted concept until the application of technological developments on organizations in early 20th century, traditional office plan type was used until then [107].

Figure 3.12. The Uffizzi Building which is known as the first office building [112]

Mixed Office Plan Type:

The floor plan type that uses close (traditional) and open plan type together, as closed type for mostly upper management, and open plan type for employees, is called mixed plan office. The office spaces can be average or big in size. By decreasing the number of separators several teams can be enabled to work together. As closed sections can be connected to open sections directly, they can also be connected to aisles [113]. In "Figure 3.13." an example for a mixed office floor plan can be seen.

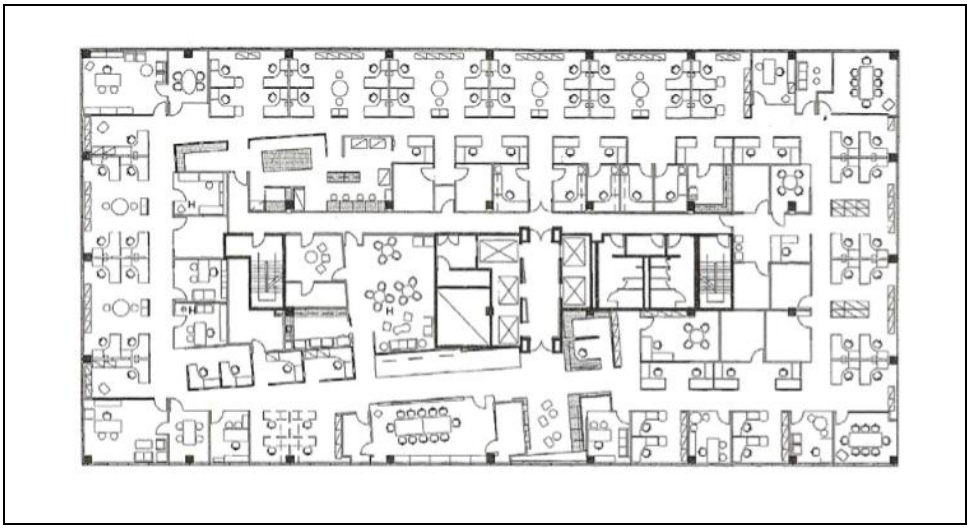

Figure 3.13. An example for a mixed office floor plan, Campbell-Ewald West Building [113]

3.4. THE OBJECTIVES AND BENEFITS OF POE IN OFFICE BUILDINGS

In order to understand the importance and benefits of POE studies, it is important to follow the application process and to define the possible problems that can emerge. According to Presier, the fundamental problems pertaining to the environmental problems due to POE applications can be listed as follows:

- Health, security and safety problems
- Comfort problems
- Aesthetics problems
- Maintenance problems of facets
- Waste of energy
- Poor imagination and direction-finding problem
- Leak problem

The application process and magnitude of the benefits that come from the application of POE can be discussed in three stages:

- Short-term benefits,
- Mid-term benefits,
- Long-term benefits.

Short-term benefits include benefits that can appear immediately; mid-term benefits include adjustments that can appear in three to five years; long-term benefits include the changes and improvements that can occur in ten to fifteen years [8].

Short-term benefits can be listed as:

- Determining the problem related to usage in office and solving it,
- Review of the factors that will increase the productivity of office employees, and ensure that the office is used effectively,
- Evaluating the views of the users that actively enrolled in the evaluation process,
- To ensure decision making is based on data and to understand the results of the design,
- To relate the limitations of the budget and performance.

Mid-term benefits can be listed as:

- To reduce the costs related to office construction, usage and maintenance,
- To ensure that designers take part in evaluation process of the building's performance.
- To ensure the adaptation of the suitable functions to the building for the possible changes that occur in time.

Long-term benefits can be listed as:

- To produce measurements to improve building design and construction quality,
- To prepare a cost plan for the long-term,
- To create a database, standards, criteria and published guides and to improve the already existing ones [8].

4. EXAMINATION OF ANEL PLAZA EXAMPLE IN THE CONTEXT OF POE

In this section, we cover field study that was made in the Anel Plaza office building. Anel Plaza building was taken into evaluation by using POE approach in the context of open-close plan office types. The evaluation study; office building occupant satisfaction data were obtained through the analysis of three areas;

i. Technical performance issues (technical)
ii. Issues related to the use of the place (functional)
iii. The issues related to the connection between the place and the emotions of its users (behavioral)

In this part before passing to the evaluation stage we will provide some information about the subject building. The internal design of the companies that occupy the building will be explained in detail and their above mentioned technical, functional and behavioral performances will be evaluated within the context of POE. After the information about the building is given, the context of the study will be expressed with a model.

Creating the model, the formation of methods and how POE can be in collaboration with architectural design are conceptualized in the analyses that exist in the studies focusing on human and environment interaction.

As part of the model, Anel Business Center was evaluated in the context of occupant satisfaction using analysis based on survey and on the premises observation.

After the model of the study is formed, an analysis and interpretation of the survey and on the premises is provided.

4.1. DEFINING THE FIELD STUDY IN TERMS OF BUILDING TYPE AND PHYSICAL DATA

Anel Business Center is located at one of the central points of Anatolian side of Istanbul, at a section with a lot of new buildings in Umraniye, very close to two expressways. A

technology building was constructed using the newest technology. The building which was started in 2007 was completed in 2009 [114].

Anel Business Center supplies the energy need for its first floor and some of its overall energy with solar panels on its roof and terrace. The 11.67 kWp (kilowatt peak) and 14.82 kWp monocrystalline solar panels on the terrace and roof respectively supplies the first-floor common area lighting [114].

Anel Business Center, which is composed of 19 floors with a total 61.473 m^2 with the basement floors, is surrounded by winter gardens and while some floors are used by the Anel Group, the remaining floors are occupied by the headquarters of several companies.

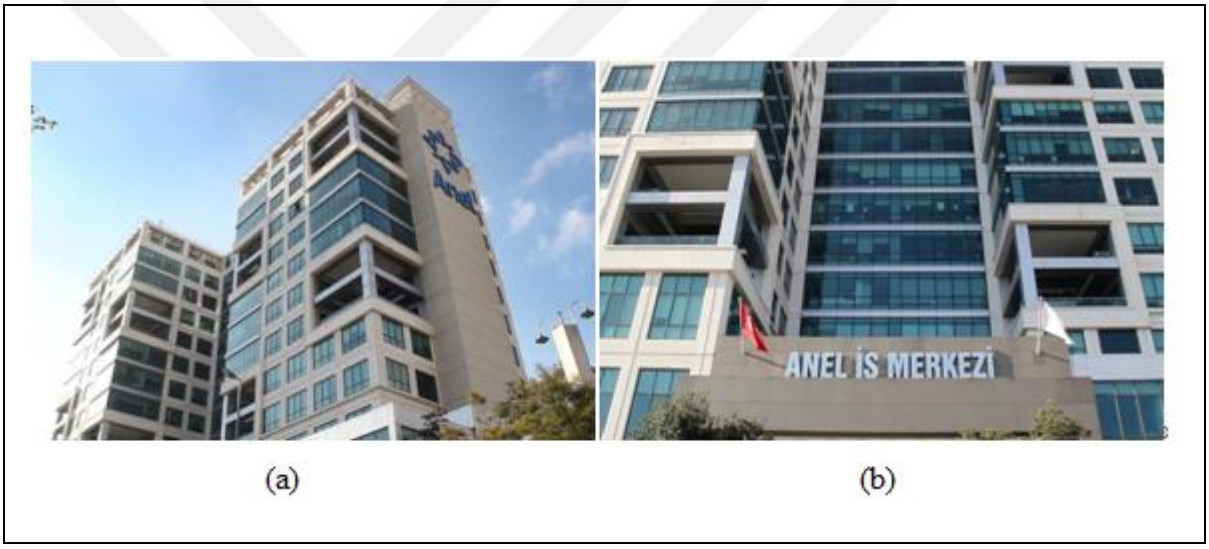

Figure 4.1. A Photo of Anel Plaza (a) a photo of Anel Plaza from side view, (b) a photo of Anel Plaza from front view

Energy Friendly:

By choosing the heat and light conductivity coefficients in the facade woodwork of Anel Business Center properly, maximum benefits using the minimum energy was achieved. The facade elements other than woodwork was projected to minimize the heat loss. In order to prevent generators from working idle and wearing down when the building is not occupied, and in order to save from the operation time, installation of two pieces of 1100 kVa (kiloVolt-amps) generators was preferred. Anel Building is a building with high technology that supplies some of its energy need with solar panels formed by photo voltaic (PV) cells covering its outside facade [114].

Figure 4.2. The solar panels on the facade of the Anel Building.

Energy Supply and Backup Energy:

The energy supply of Anel Business Center is provided from the medium voltage system. The total power of its own transformer which does not serve any other client was chosen as 2000 kVa, taking the future energy need in consideration as well. In case of power interruption from the grid, continues power is provided for adequate period when the generators get into action [114].

Energy Distribution:

Anel Business Center's energy distribution is delivered by busbar vertically and cable canals horizontally. In accordance with the "Fire Protection Regulations" and the "General Technical Specifications for Electrically Power Current Facilities", the cables made of halogen that does not release any toxic gases during a fire and in devices that should be in operation in case of a fire cables that are durable against fire for two hours are preferred. In case that generators do not kick in a power-loss situation, 10 lux emergency exit security lightings are used. This system prevents total darkness of environment during the 15-20 seconds between the power loss from the grid and the generators' kicking in as a backup, while it is also used as security lightning after working hours. In addition, in all areas battery power emergency exit armatures are used. All of the high-power distribution systems were planned in accordance with Electricity Facility High Current Regulation and Power Distribution Facility General Technical Specifications. In the cases where these

specifications did not apply, the internationally agreed standards like BS, IEC, NEC were used. All the leased areas in the building were considered as independent from each other. So that, all occupants are provided with the flexibility of designing the areas they use according to their needs. Lighting and outlet plumbing are also done according to occupant request and needs. In order to provide convenience in plumbing, 16 cm high raised flooring is used in leased office spaces. Places are provided for distributional panels in electricity rooms which are located in each floor [114].

Telephone-Data System:

Anel Business Center is equipped with 1 GBIT Metro Ethernet infrastructure and each office is provided with Internet connection with a Fiber Optic Data Link that is scalable from 5 MBIT to 100 MBIT. Besides, in common areas private wireless Internet connection is provided for visitors. ISDN PRI telephone infrastructure is also installed with advanced features such as multiple subscriber number, direct calling, sub-addressing, subscriber-to-subscriber messaging [114].

Emergency Announcement and Speaker System:

The speaker system in Anel Business Center provides music broadcast in common areas. Using this system in case of need warning or directive announcements can be made in the whole building. Using the regional adjustment panels installed in every space, the level of audio can be adjusted by the occupants. During an announcement, even deactivated adjustment panels can be reactivated and announcement from a chosen area or all building can be made [114].

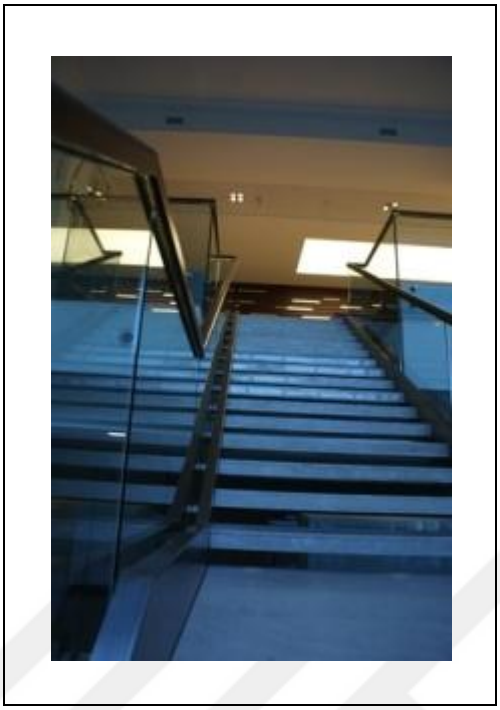

Figure 4.3. Anel Building aisle internal area photograph

CCTV System for Security:

Anel Business Center CCTV System enables to watch any intervention happening both inside or outside of the building. In support to the security card entry system, this system watches and records the human motions in the common areas (office entrances, circulation areas, stairways, elevators, parking lot entrances, information desk areas) and surroundings of the building [114].

Card Entry System for Security:

The card entry system of Anel Business Center seeks to prevent any unauthorized entrances to all areas that need authorization, to record of all authorized entrances and exits and to examine them retroactively, to observe the time period spent inside and to keep all areas under control by the security personnel using a computer installed in the security center. Visitors who are allowed in by the main entrance can enter the building only with the cards they are given after they present their IDs. Occupants of the building can only entered to the areas they are authorized to [114].

Fire Security:

The fire warning system of Anel Business Center is designed according to the current regulations and NFPA standard which is accepted and used worldwide. All the system elements that are required to be in operation during fire (hydrophore system, engine powered fire dampers, exhaust fans, fire evacuation gates, etc.) are supplied with fireproof cables. The integration of the fire systems installed by leasers based on their specific needs into the building's system is administered by installing an addressing module in every leased space. Fire warning central is located in the weak current room on the third floor and is constantly monitored. The architectural planning of Anel Business Center was predicated on the new Fire Regulation dated 19.12.2007 [114].

Earthquake Security:

The sizing of Anel Business Center's concrete framework support system was predicated on the Earthquake Regulations dated 03.05.2007 and its concrete quality was selected as C 40. In order to secure the building and the surrounding buildings, bored pile and anchorage system was used and ground safety tensions were approved with the samples taken from the excavation base [114].

Parking Lot for Employees:

In order to prevent parking space problem in Anel Business Center, a special parking lot dedicated to the business center was built [114].

Heliport on the Roof:

The heliport located on the roof of the Anel Business Center serves for those who prefer helicopter as a means of transportation.

Other companies that are located inside Anel Plaza are: Celebi Aviation Holding Inc., Kariyer.net, Orange, Redbull, SAP Turkey, Shaya Retailing Inc, Sigortam.net, Techdata and Watsons. In this section, we will cover topics such as the office type, internal space organization, furniture choice, main color used, circulation areas of the companies located inside Anel Plaza in detail [114].

- SAP Turkey Office

SAP Turkey Office is designed in a fashion that features the corporate identity of the international brand, is integrated with technology and elevates occupant interactions to a higher level. The current office that is located in Anel Business Center includes open office areas that use natural light in a comfortably spacious atmosphere as well as alternative working, meeting and resting areas together with social areas planned to withdraw from intensity of work life and stress.

All the manager areas including the CEO are planned as open office, the brand's contemporary and democratic culture was targeted in the design with a transparent way. In internal space design, in order to keep the employee motivation and comfort at the highest levels, employer's all demands were evaluated and its needs were determined one by one and addressed. The areas which existed in the older design and were used inefficiently were converted into alternative and living spaces.

In common areas, as a plain approach is preferred with vivid color, bright material and landscape to keep employee satisfaction of top priority, integration of organization's current brand identity with the place is also accomplished. For employees who have a high working pace to relieve stress and to get motivated, multi-functional areas are designed and a counter table and chairs were placed in front of the scenic view of the front facade. In the common area a coffee corner and mobile counter tables are placed to create a meeting location. The characteristic of the place which changed with the use of natural and bright materials is also supported with interior landscape by replacing artificial plants with new natural ones. Thus, for office celebrations for special days and coffee breaks a comfortable and useful space is created [115].

Figure 4.4. Internal layout of SAP Turkey Office [115]

Imitating several streets in Istanbul with a contemporary touch. the long aisle area created with the theme “Street”, is formed with seating spaces that offer work and interaction in an intimate environment. At the same time, Istanbul theme is emphasized with artistic Istanbul cutouts on the walls. The cubicles that are located on the “street” are named with some of Istanbul's iconic parks such as Gezi, Bebek, Macka, and are designed as special working spaces for one or two people [115].

Figure 4.5. Circulation network scheme of SAP Turkey Office [115]

For the main occupants of the office, software developers, four working spaces named after essential districts of Istanbul, Beyoglu, Kadikoy, Balat, Karakoy are designed. The

main objective of the thematic design was to create proper alternatives to various work needs and to let occupants live Istanbul in a symbolic way and form connection with local values.

With its flexible base and mobile furniture, the project area is designed to give occupants the opportunity to reevaluate and organize their approach, strategy and methods daily. The materials used in the layout are selected from recyclable or local products in accordance with both SAP's and Teknopark's sustainable design specifications [115].

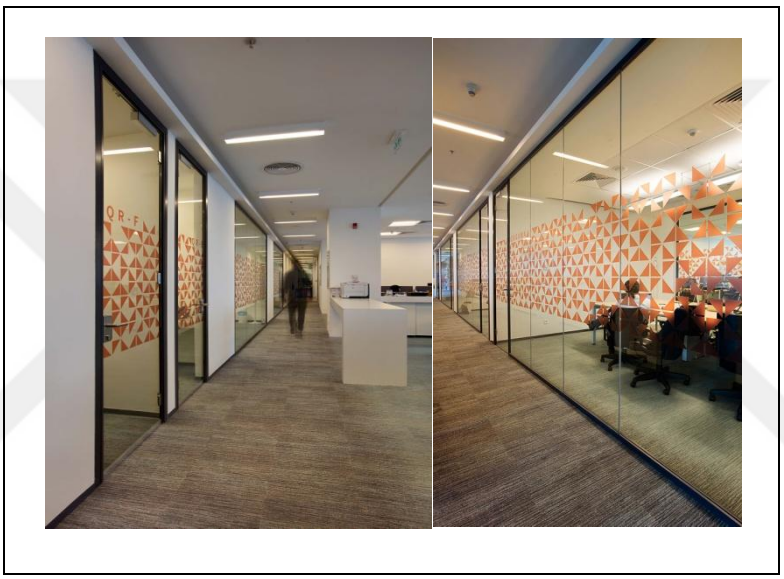

Figure 4.6. Corridor system of SAP Turkey Office [115]

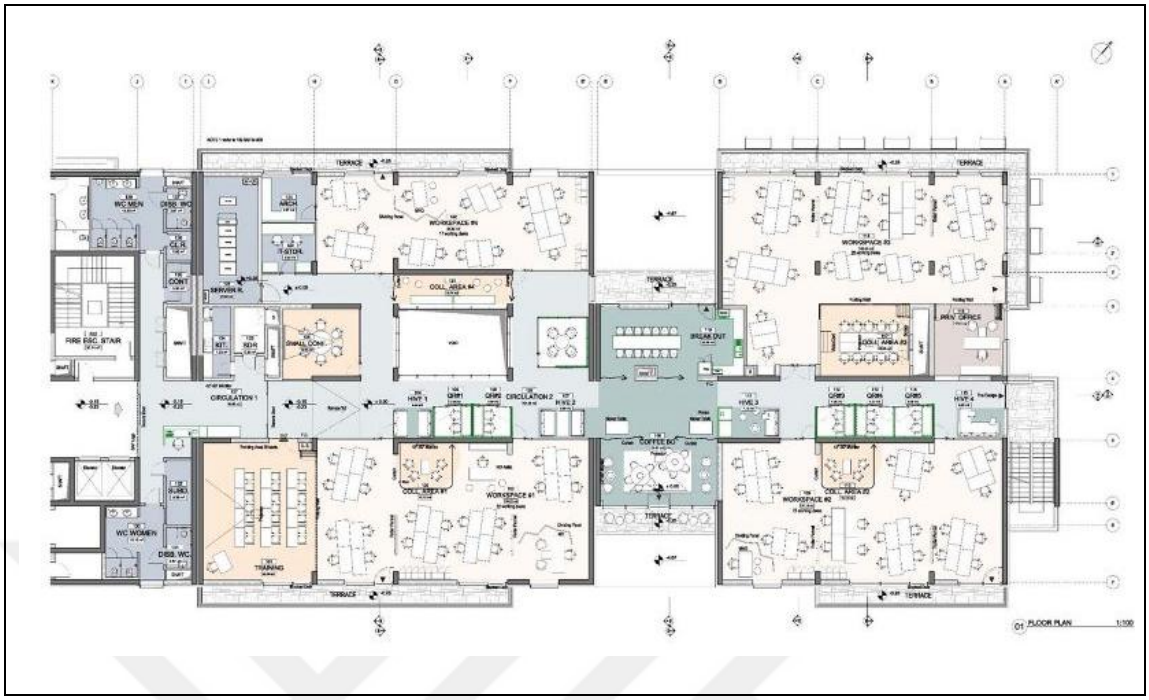

Figure 4.7. Floor plan of SAP Turkey Office [115]

- Red Bull Office

The office that is located on the 12th floor of Anel Plaza in Istanbul Umraniye is designed to have reception, meeting rooms, workshop rooms and resting areas. The architectural design, project and applications was done by KG Architect [116].

Figure 4.8. Red-Bull office open and close offices [116]

Red Bull's young, dynamic, athletic and energetic identity is featured. Office is laid out with totally open and transparent plan that does not prevent employees' interaction with each other.

Figure 4.9. Red-Bull office open and close offices [116]

The elements such as climbing wall, bar, DJ cabin take their place in the layout as elements of Red Bull identity. In the concept for design a plain and brutalist approach is followed and this approach also emphasized the company identity.

Figure 4.10. Internal layout of Red Bull Office [116]

The office is conceived sufficient for meeting, training and seminar activities of employees and visitors and a bar area where occupants can socialize, and resting areas are also included in the design.

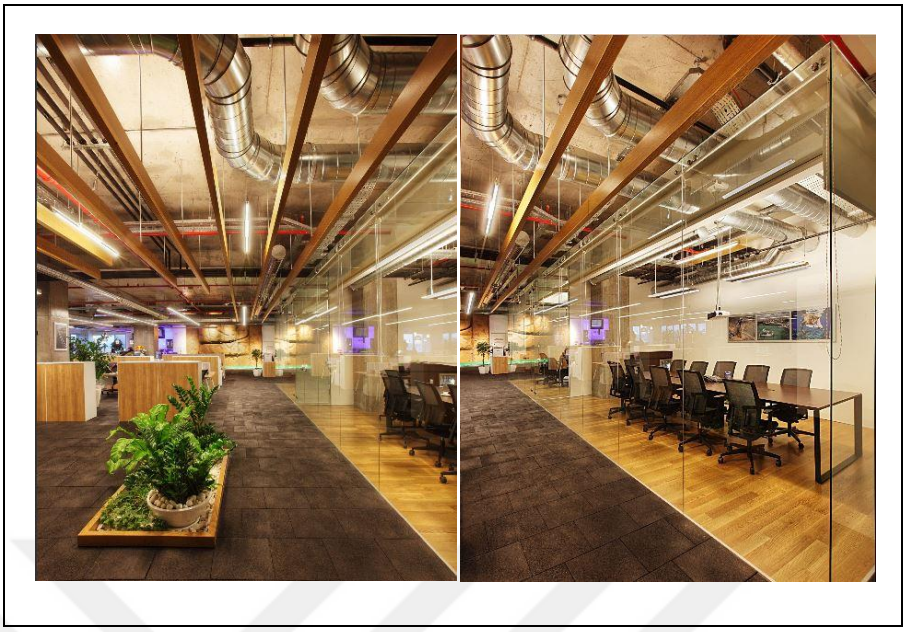

Figure 4.11. Corridor system of Red Bull Office [116]

- Sigortam.net Office

Sigortam.net, facing increasing volume and demand for its services, moved into Anel Plaza on February 07, 2011 and started its service in its new modern office in order to increase its quality of service [117].

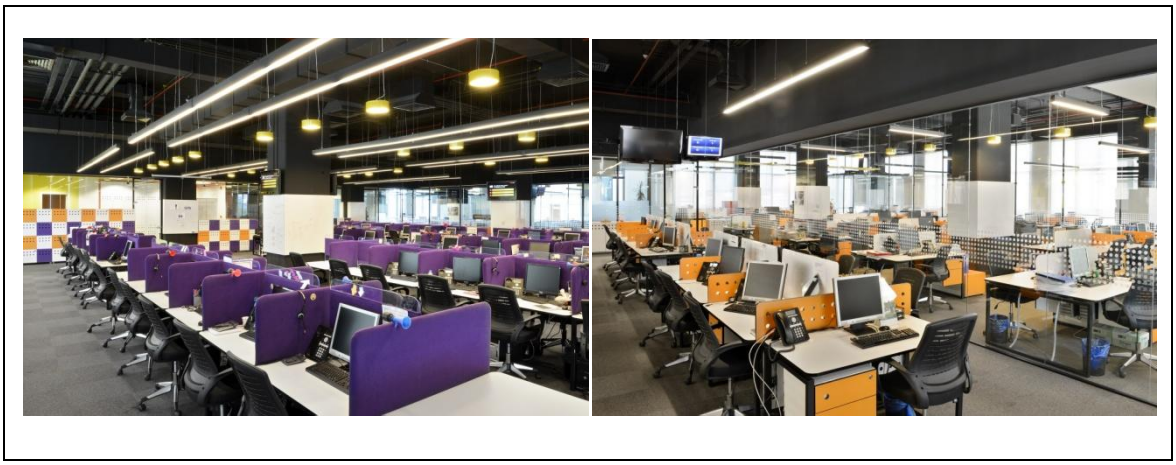

Figure 4.12. Open office system of Sigortam.net [117]

By using separators in sigortam.net open offices it is aimed to let higher number of employees work at the same space. Natural and artificial lighting systems are used together.

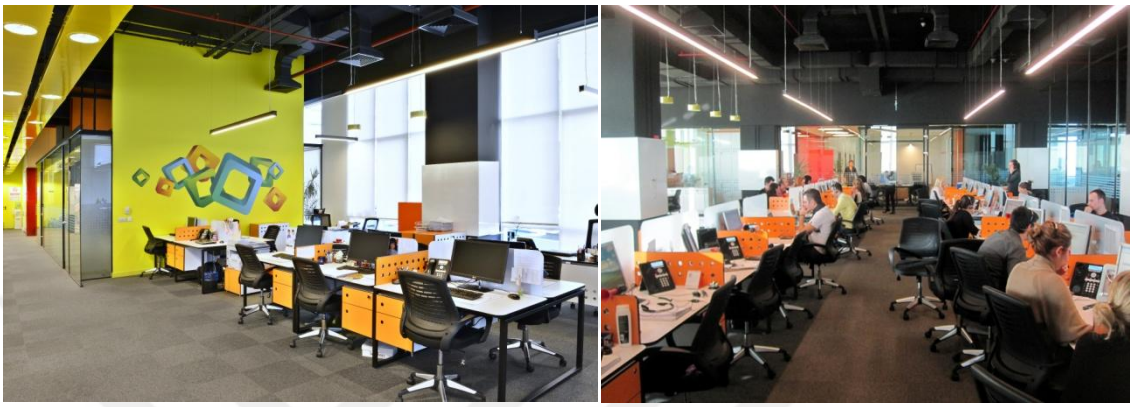

Figure 4.13. Internal layout of Sigortam.net Office [117]

- Kariyer.net R&D Office

In order to comprehend the company identity and space needs, at the end of intense designing meetings with the attendance of Kariyet.net it was agreed on to create a human-centered space that was molded around dynamism, technology and contemporary, the key words reflecting the company's identity.

Beside this, by incorporating the concepts like transparency and semi-transparency, which had been handled by Adort Architect in several of its projects earlier, into the design it was aimed to turn the physical traits of the current building to tangible benefits [118].

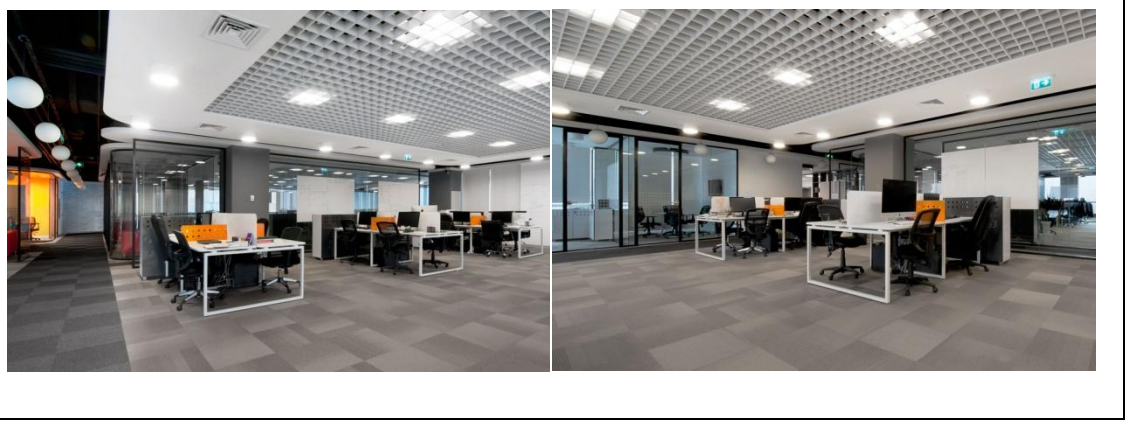

Figure 4.14. Open plan office of Kariyer.net [118]

Taking advantage of the space facilities of the current building's core, a plain and dynamic reception wall that reflect the brand's organizational identity is installed. When entered inside, incorporated waiting and resting areas serve customers and employees together. These semi-transparent bays aim to provide semi-private spaces to the employees. On the other side of these bays there is a common area with gaming elements open to everybody.

By connecting the transparency concept with the open office need, it is aimed to create an environment where the common and working areas can be perceived by a single look from anywhere in the office. In this context, rather than heavy separator walls, transparent separators and translucent panels are used. Colors reflecting the company identity are used in furniture selection and the annular object method aims to increase the dynamic effect of the office. The ceiling allows to hide the technical elements, and lacerations and curvilinear movements in transition areas help create a non-monotone office environment. The lighting elements were treated as items that have similar form dialect with the annular details that can be observed in interior office furniture and also emphasize simple and dynamic office traits like the rest of the office elements.

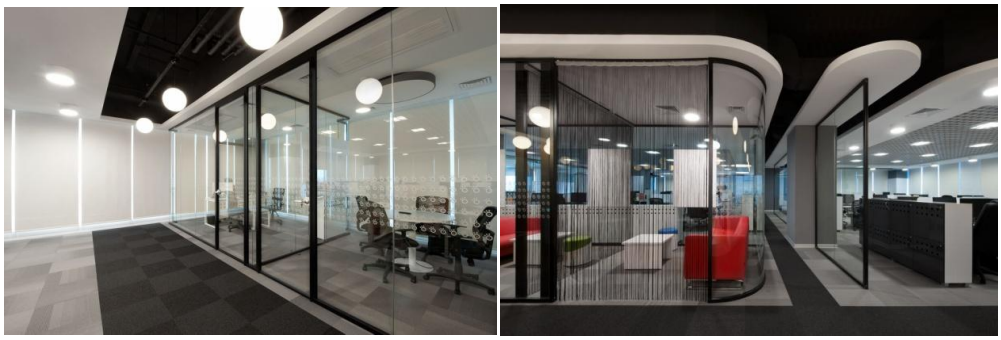

Figure 4.15. Close office of Kariyer.net [118]

- Çelebi Aviation Holding Inc. Office

Çelebi Aviation Inc. Umraniye Anel Plaza Office was designed by Modern Construction in 2010. Open and close offices are used together in a 8000 m^2 area. It can be observed that light colors pervade the space and natural and artificial light are used together in the office that is designed for maximum occupant comfort [119].

Figure 4.16. Çelebi Aviation Inc. Office internal layout

- Shaya Headquarters Office

Shaya Headquarters Office was designed by Dikey Architect. There are open and close offices in this design. The pervading colors in the work environment are selected in light and bright colors. Day light is used in lighting extensively, while artificial lighting is used as supplementary. Using the separator panels in open offices private spaces are created [120].

Figure 4.17. Internal layout of Shaya Office

Figure 4.18. Lighting and transparent separator wall in Shaya Office

- Tech-Data Office

Tech-Date Office is located on the 8th floor of Anel Plaza. It contains both open and close offices. Light colors pervade in the working environment [121].

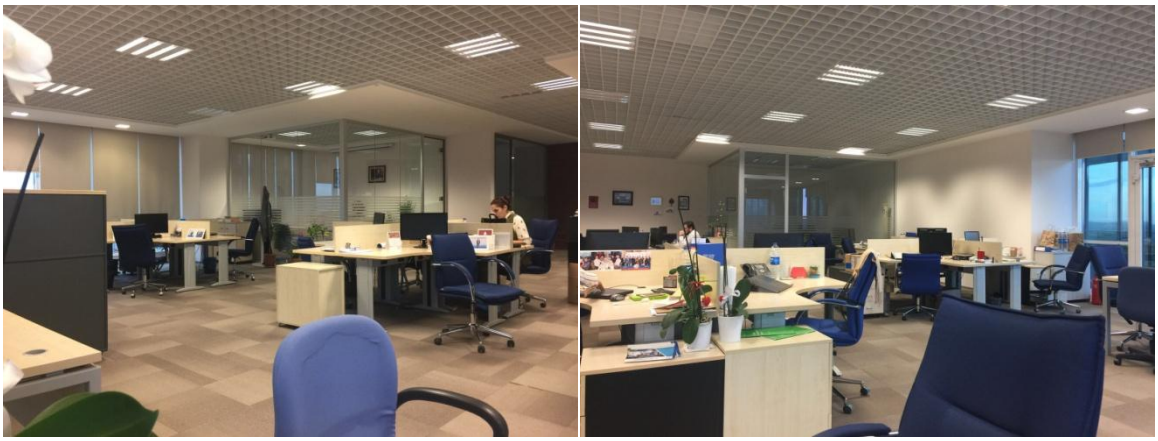

Figure 4.19. Tech-Data open and close office layout

Figure 4.20. Tech-Data office daylight and artificial lighting

Blue and white colors that reflect the company's brand are used in the design. Natural and artificial lighting are used together. In the open office section tables with drawers are preferred for employees' personal belongings [121].

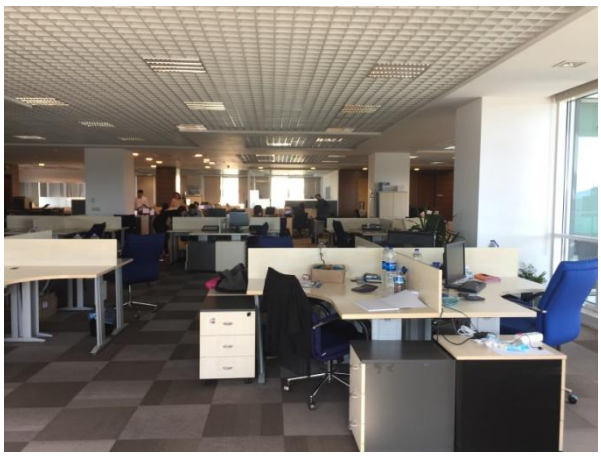

Figure 4.21. The condition of personal belongings at Tech-Data Office

4.2. CONSTITUTING THE SURVEY AND DETERMINATION OF QUESTIONS USED IN THE FIELD STUDY

The field study is carried out with determination and survey forms in various kinds. The survey form is prepared with two types of questions; 1) Five-point Likert scale (intended for satisfaction) 2) Determination Questions (age, gender, etc.) In the determination form the methods used in the current layout (based on the window, view, location of the door or direction of the light) of the office is analyzed.

For the field study interviews were arranged with occupants during a one-month period. The survey forms were sent to the occupants for them to fill. 82 people responded and filled the survey forms. The analysis is made on these 82 survey forms.

The questions in the survey form consist of four categories; (1) the questions to determine the traits of the occupants, (2) the questions related to technical performance, (3) the questions related to the office use and (4) the questions related to the emotional state of occupants. The survey form on the other hand has two sections as general demographic questions, the questions intended to measure the satisfaction with the performance.

In the first part of the survey form it is aimed to have the personal information (age, gender, title, duration of duty, office type) of the participants. (Question number; 1, 2, 3, 4, 5)

In the second part of the form the satisfaction from the technical comfort conditions are covered in the context of thermal comfort, noise, lighting, and ventilation. This was evaluated with five point Likert scale. The thermal comfort is evaluated in three separate categories; the satisfaction with internal temperature when the outside temperature is cold, in sudden seasonal changes in temperatures, and the temperature values at the moment the form is filled. This analysis is made in the 6th question of the survey form. Noise is covered as the noise coming from the adjacent offices, the noise coming from the upper-lower floors and the noise come from the outside when the windows are open. This analysis is made in the 7th question of the survey. In addition, since the work done in the offices academicians use needs high concentration, the effects of noise on the work outcome is also examined. Lighting comfort in offices is analyzed in four categories; the sufficiency of lighting with electric power, the glow or reflection due to artificial lighting, the dominant color in the offices and the level of daylight use in the offices. (Survey form question 8) Ventilation is analyzed in four categories of sufficiency of natural ventilation, the odor that occurs in the office because of carpet and cabinets, humidity and necessity of natural ventilation for the office. (Question 9)

The questions related to the office use are covered under the headlines; spatial comfort, internal activities and their intensity and accessibility of offices to other units. In the context of spatial comfort, the size and adequacy of the offices, in the context of storage, room for personal items and tranquil working environment are analyzed. (Question 10)

The relationship between the office and the emotions of occupants are analyzed in five point Likert scale under the topics of emotional stage while working in the office, tranquility, comfort, safety, feeling like at home, enjoyment, working efficiently, concentration and independence.

The date obtained with the survey and determination forms were statistically analyzed in the computer and interpreted.

4.3. FIELD SURVEY ANALYSIS AND EVALUATION

4.3.1. General Information

Of the 81 participants, 40.7 percent was male, 59.3 percent was female. The ages of the participants ranged from 18 to 45. The age group of 26-45 had the greatest number of employees with 65.4 percent. While the ratio of 36-45 age group was 21.0 percent, the ratio of 18-25 group was 13.6 percent.

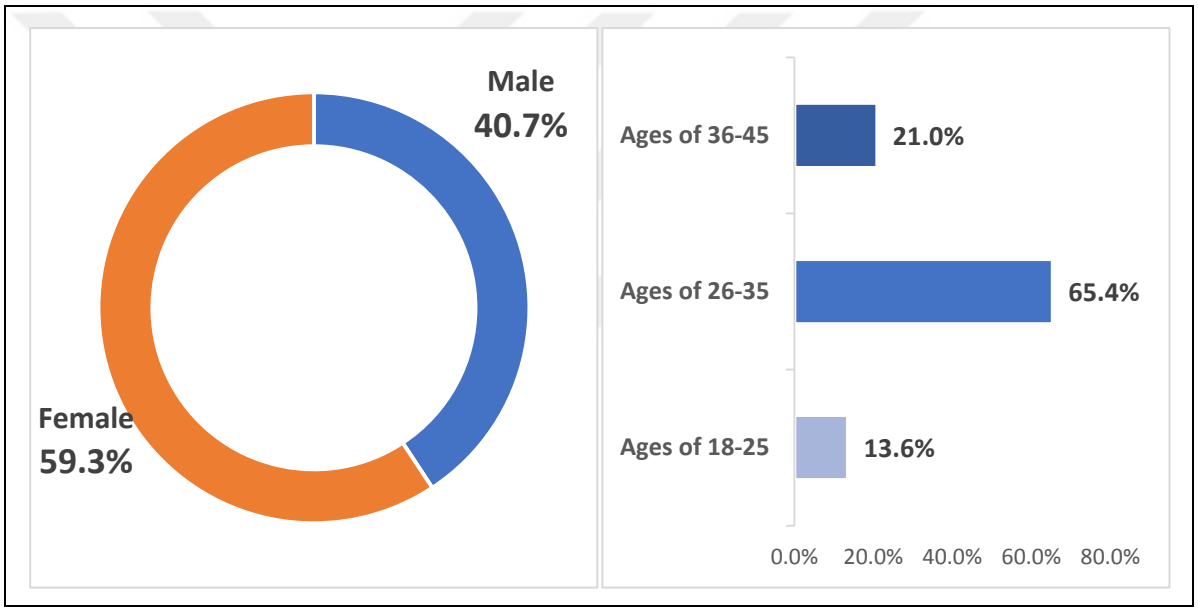

Figure 4.22. Gender and age

The biggest portion of the 81 participants was department personnel with 72.8 percent. Department managers' ratio was 9.9 percent. Only one deputy general manager was interviewed. The ratio of workers who worked between one and five years is 85.2 percent.

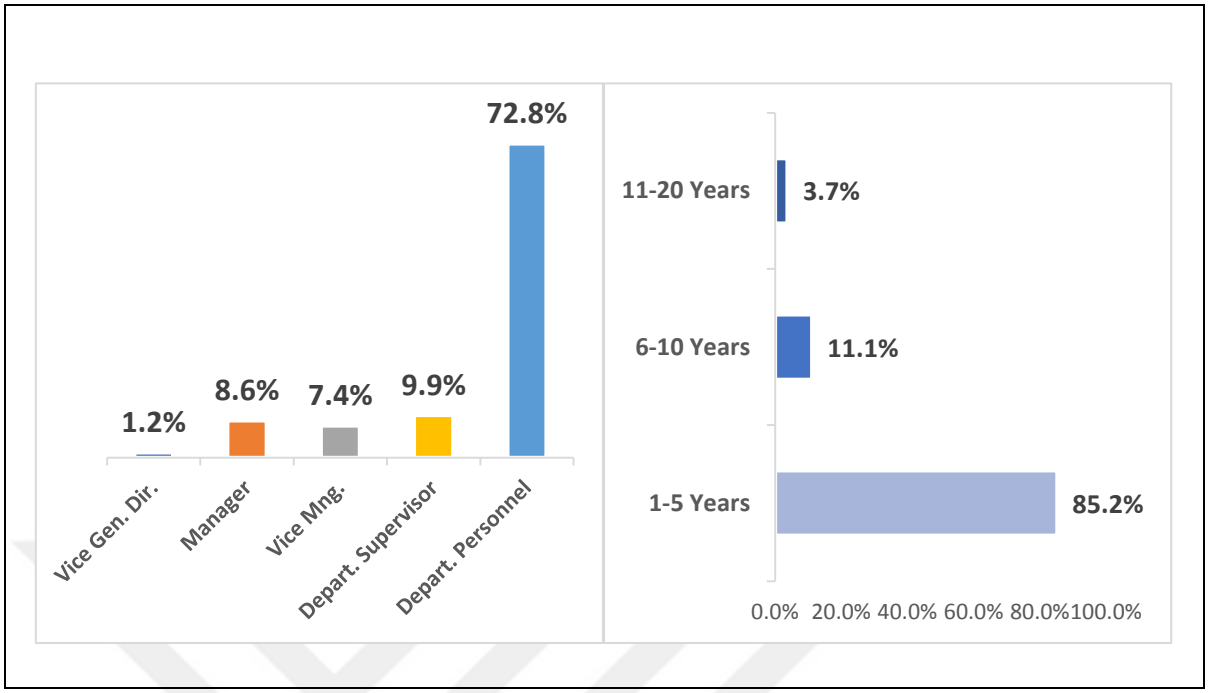

Figure 4.23. Title and length of employment

While 85.2 percent of the participants worked in open offices, only 14.8 percent worked in closed ones.

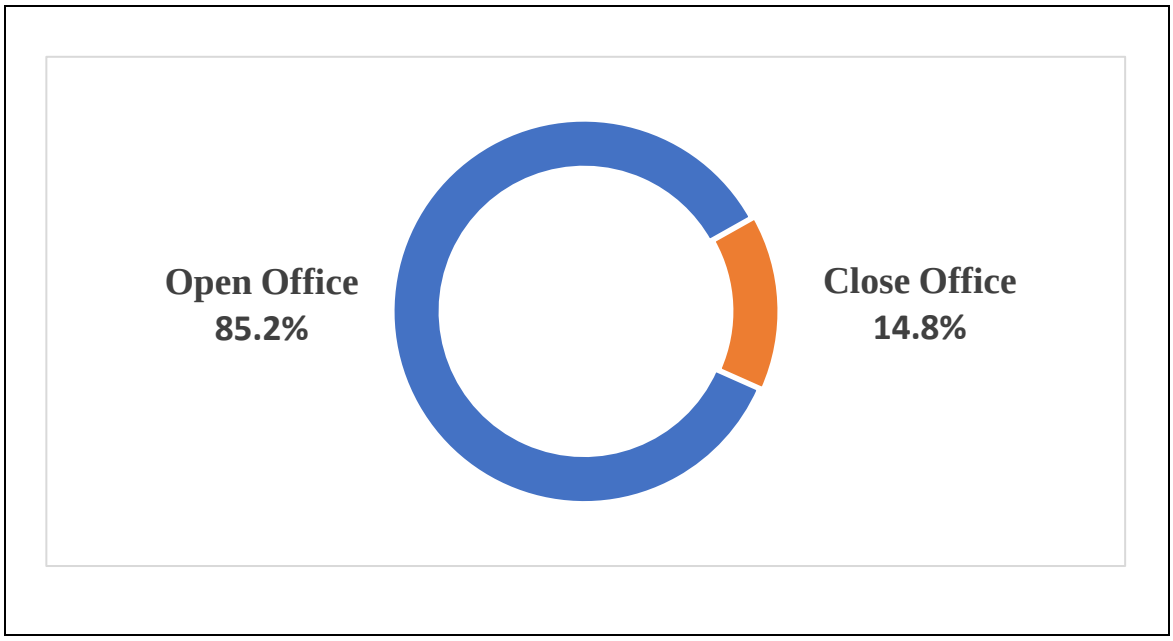

Figure 4.24. Work environment

4.3.2. Satisfaction

In this section, we asked 18 questions to the participants to measure their satisfaction. The first twelve questions were to measure "Technical Comfort" and the rest six questions were to measure "Spatial and Personal Comfort."

4.3.2.1. Technical Comfort

The scale that is used to measure the technical comfort is categorized below:

- Thermal comfort (questions 1-3)
- Aural comfort (questions 4-6)
- Lighting comfort (questions 7-9)
- Ventilation comfort (questions 10-12)

The ratio of people who answered the first three questions about "Thermal Comfort" with "I agree" is relatively high. This ratio is 66.7 percent in the "Temperature Lever Properness" criterion which has an average of 3.63. The ratio of participants who chose to abstain in the "Regulation of Office Internal Temperature" and "Adjustment to the seasonal temperature changes" criteria was 40 percent.

Table 4.1. Thermal comfort criteria

Thermal Comfort	**Frequency**					**Average(%)**	**Standard Deviation**
	Strongly Disagree (%)	Disagree(%)	Neither agree nor disagree(%)	Agree(%)	Strongly Agree(%)		
1. The internal temperature is regulated well when the outside temperature is too cold.	0.0	14.8	39.5	42.0	3.7	3.35	0.78
2. It is compatible with the sudden seasonal temperature changes.	1.2	14.8	42.0	40.7	1.2	3.26	0.77
3. The current temperature adjustment is acceptable.	1.2	8.6	19.8	66.7	3.7	3.63	0.75

The participants states whether the noise coming from adjacent spaces, corridors and upper-lower floors is disturbing or not. The ratio of people who answered the question "The noise coming from the upper or lower levels are not disturbing" with "Strongly Agree" is 51.9 percent. Besides, the average of this criterion is relatively high compared to other criteria.

Table 4.2. Aural comfort criteria

Aural Comfort	**Frequency**					**Average(%)**	**Standard Deviation**
	Strongly Disagree (%)	Disagree(%)	Neither agree nor disagree(%)	Agree(%)	Strongly Agree(%)		
4. The noise coming from the adjacent spaces is not disturbing.	4.9	21.0	24.7	40.7	8.6	3.27	1.05
5. The noise coming from the aisle is not disturbing.	4.9	22.2	18.5	46.9	7.4	3.30	1.05
6. The noise coming from the upper or lower levels is not disturbing.	3.7	9.9	16.0	51.9	18.5	3.72	1.00

The ratio of participants who think that the color that occurs due to the lighting units is acceptable (Strongly Agree + Agree) is 55.5 percent. However, 32.1 percent of participants mentioned negative views (Strongly Disagree + Disagree) about the amount of daylight coming through the windows, while 44.4 percent of them mentioned the same about glow and reflection caused by lighting systems.

Table 4.3. Lighting comfort criteria

Lighting Comfort	**Frequency**					**Average(%)**	**Standard Deviation**
	Strongly Disagree (%)	Disagree(%)	Neither agree nor disagree(%)	Agree(%)	Strongly Agree(%)		
7. The amount of daylight coming through the windows is sufficient.	4.9	27.2	29.6	33.%	4.9	3.06	1.00
8. The pervading color that occurs in the office due to the lighting units is acceptable.	6.2	16.0	22.2	48.1	7.4	3.35	1.04
9. The glow and reflection caused by the lighting elements are not disturbing.	11.1	33.3	21.0	28.4	6.2	2.85	1.14

While the ratio of people who think that natural ventilation is sufficient is 32.6 percent, it is 48.8 percent for people who say the same about the humidity in the office. The ratio of people who think that the fresh air inside is not regulated well with the ventilation system is 46.3 percent.

Table 4.4. Ventilation comfort criteria

Ventilation Comfort	**Frequency**					**Average(%)**	**Standard Deviation**
	Strongly Disagree (%)	Disagree(%)	Neither agree nor disagree(%)	Agree(%)	Strongly Agree(%)		
10. The air inside the office when ventilated naturally is adequate.	6.3	37.5	23.8	31.3	1.3	2.84	0.99
11. The humidity level in the office is proper.	3.8	12.5	35.0	48.8	0.0	3.29	0.83
12. The fresh air inside is regulated well with the ventilation system.	7.5	38.8	27.5	23.8	2.5	2.75	0.99

4.3.2.2. Spatial and Personal Comfort

The scale used to measure the spatial and personal comfort is categorized as follows:

- Spatial comfort (questions 13-15)
- Personal comfort (questions 16-18)

The ratio of people who expressed positive views about the size of the office is 78.8 percent and the ratio of people who expressed the same for finding space for personal belongings is 82.5 percent. The ratio of people who answered "Agree" about the office's usefulness for different activities is 40,0 percent and the ratio of abstained to answer this question is 35.0 percent.

Table 4.5. Spatial comfort criteria

Spatial Comfort	**Frequency**					**Average(%)**	**Standard Deviation**
	Strongly Disagree (%)	Disagree(%)	Neither agree nor disagree(%)	Agree(%)	Strongly Agree(%)		
13. The size of my office space is acceptable.	0.0	2.5	18.8	65.0	13.8	3.90	0.65
14. I have enough space in my office to keep my personal belongings.	0.0	1.3	16.3	65.0	17.5	3.99	0.63
15. My office is useful for different activities.	1.3	13.8	35.0	40.0	10.0	3.44	0.90

4.3.3. Occupant-Office Space Relationship

In this part we interpreted the survey results related to the relationship between occupants and office space.

4.3.3.1. Reliability Factor Analysis

The satisfaction of occupants are interpreted based on the questions that examine the technical aspects of the office space as "Technical Comfort" and the questions that reflect the views about general issues pertaining to the office space as "Spatial and Personal Comfort." In order to determine whether these scales are suitable to be used in this study, we have used reliability and factor analysis. The analyses are applied separately for these

two parts using the data received from the 80 interviews of 82 in which all the questions were answered.

4.3.3.1.1. Technical Comfort

In the Reliability analysis table, we can see that the factor reliability (α=0.842) has a high value.

Table 4.6. Technical comfort reliability analysis

Cronbach Alfa	Cronback Alpha Based on Standard Data	N
0.842	0.842	12

When we look at the values in the Cronbach Alpha column of the Total Data Statistics table, it is observed that when one of the criteria that form the scale is removed there is no increase in the reliability value. Consequently, it can derived that these twelve factors are successful (α=0.842>0.70) in measuring the phenomenon intended to be evaluated.

Inter-group scale relationships are examined in hypotheses. In the example of Office Type – Satisfaction Relationship;

- The office type constitutes two different groups as open and close offices,
- The satisfaction constitutes the fact (scale) that one desires to measure.

Before the analysis, normality and homogeneity tests are applied on the distribution of the fact (scale) within groups. As a result of these tests, if the data distributes normally and homogeneously, then parametric tests are used; on the contrary case, non-parametric tests are used [122].
Afterwards, the number of groups is taken into consideration. If the number of groups is 2, then the following tests are used:

- Independent Samples t-Test (Parametric)
- Mann-Whitney U Test (Non-parametric)

If the number of groups is more than 2, then the following tests are used:

- Anova Test (Parametric)
- Kruskal Wallis Test (Non-parametric)

To summarize, the abovementioned tests that fulfill the necessary conditions are used in order to examine the relationship between groups that belong to a certain fact (samples). Before analyzing the hypotheses, the necessary method of analysis is applied by conducting normality and homogeneity tests [122].

Although different opinions exist in regards to the power of reliability coefficient, if the most frequently used ranges given below are:

- $0.00 \leq \alpha < 0.40$ then the scale is not reliable,
- $0.40 \leq \alpha < 0.60$ then the scale has low reliability level,
- $0.60 \leq \alpha < 0.80$ then the scale is quite reliable,
- $0.80 \leq \alpha < 1.00$ then the scale has very high reliability level.

Table 4.7. Technical comfort total data statistics

	Effect on the Scale Average(%)	**Effect on the Scale Variance(%)**	**Sum of Correlation of Material(%)**	**Multi-correlation of Squares(%)**	**Cronbach Alpha Effect(%)**
1. The internal temperature is regulated well when the outside temperature is too cold.	35.31	43.711	0.381	0.521	**0.839**
2. It is adaptable to the sudden seasonal temperature changes.	35.40	43.053	0.452	0.599	**0.834**
3. The current temperature adjustment is acceptable.	35.03	42.455	0.535	0.576	**0.830**
4. The noise coming from the adjacent spaces is not disturbing.	35.41	41.258	0.444	0.709	**0.835**
5. The noise coming from the aisle is not disturbing.	35.35	42.205	0.362	0.746	**0.842**
6. The noise coming from the upper or lower levels are not disturbing.	34.95	41.390	0.450	0.608	**0.835**
7. The amount of daylight coming through the windows is sufficient.	35.60	40.167	0.551	0.583	**0.827**
8. The pervading color that occurs in the office due to the lightning units is acceptable.	35.30	39.175	0.619	0.630	**0.821**

9. The glow and reflection caused by the lightning elements are not disturbing.	35.83	36.779	0.735	0.736	**0.810**
10. The air inside the office when ventilated naturally is adequate.	35.83	41.108	0.488	0.567	**0.832**
11. The humidity level in the office is proper.	35.38	42.642	0.454	0.460	**0.834**
12. The fresh air inside is regulated well with the ventilation system.	35.91	39.575	0.620	0.647	**0.821**

In order to determine if the Technical Comfort scale can be used as a factor analysis on the 80 interviews performed, KMO value and Bartlett test have been used. We can conclude that since the KMO value is higher than 0.68 (>0.6), the sampling size is big enough, since the chi-square value in the Bartlett test is 497.706 and the degree of freedom is 66 (p=0.00, p<0.05); and when the common variance values of the factors examined, the load of all factors is higher than 0.30, the scale is suitable to apply a factor analysis on it [122].

Table 4.8. Technical comfort KMP and Bartlett's

Kaiser-Meyer-Olkin Sampling Adequacy		**0.681**
Bartlett's Test of Sphericity	Approximate Chi-Square	497,706
	Degree of Freedom	66
	Sig.	0.000

Table 4.9. Technical comfort common loads

	Start	**Deduction**
1. The internal temperature is regulated well when the outside temperature is too cold.	1.000	0.659
2. It is compatible to the sudden seasonal temperature changes.	1.000	0.763
3. The current temperature adjustment is acceptable.	1.000	0.680
4. The noise coming from the adjacent spaces is not disturbing.	1.000	0.779
5. The noise coming from the aisle is not disturbing.	1.000	0.775
6. The noise coming from the upper or lower levels are not disturbing.	1.000	0.731
7. The amount of daylight coming through the windows is sufficient.	1.000	0.620
8. The pervading color that occurs in the office due to the lightning units is	1.000	0.670

acceptable.		
9. The glow and reflection caused by the lightning elements are not disturbing.	1.000	0.737
10. The air inside the office when ventilated naturally is adequate.	1.000	0.632
11. The humidity level in the office is proper.	1.000	0.479
12. The air in the office is regulated well with the ventilation system.	1.000	0.718

When we look at the sum of explained variance, we can see three factors in the scale that have value higher than 1. The first factor (with the value of 4.515) explains 28.0 percent of the variance, while the second factor (with the value 2.219) explains 21.2 percent and the third factor (with the value 1.509) 19.3 percent. As a result, we can say that the scale can explain the Technical Factor satisfaction 68.7 percent with a three-factored model [122].

Table 4.10. The Sum of explained variance in the technical comfort

Component	**The Starting Values**			**Sum of Square Load Deduction**		
	Sum	**Variance (%)**	**Cumulative (%)**	**Sum**	**Variance (%)**	**Cumulative (%)**
1	4.515	37.628	37.628	3.366	28.052	28.052
2	2.219	18.489	56.117	2.551	21.262	49.314
3	1.509	12.577	68.694	2.326	19.380	68.694
4	0.848	7.067	75.761			
5	0.650	5.414	81.175			
6	0.601	5.007	86.182			
7	0.450	3.748	89.931			
8	0.369	3.075	93.006			
9	0.304	2.533	95.539			
10	0.248	2.063	97.602			
11	0.179	1.491	99.093			
12	0.109	0.907	100.000			

Table 4.9: measures whether the materials that form the scale are suitable for the application of factor analysis. If the values in deduction is over 0.30, then the materials can be subjected to factor analysis (it is said to explain the total variant). The values under 0.30 are excluded from the scale to perform factor analysis (a kind of suitability test). In short, one may argue that materials that form the scale generate the scale itself as a whole and are suitable for factor analysis.

Table 4.10: is used to define how much of the variant the scale identifies (in the sample, cumulative percent column – 68.694 percent), and shows the structure of the scale. It identifies at least in how many groups the materials that form the scale explain the variant in addition to explanation degree (and Variant percent column). In this table, the scale consists of a 3-factor structure. Namely, materials that form the scale is divided into 3 different groups. These groups represent the scale as a whole (68.694 percent); each group can be used as if a different scale.

4.3.3.1.2. Spatial and Personal Comfort

In the Reliability analysis table, we can see that the factor reliability (α=0.824) has a high value.

Table 4.11. Spatial and personal comfort reliability analysis

Cronbach Alpha	**Cronback Alpha Based on Standard Data**	**N**
0.824	0.837	6

When we look at the values in the Cronbach Alpha column of the Total Data Statistics table, it is observed that when one of the criteria that form the scale is removed there is no increase in the reliability value. With these results, it can concluded that the six factors can successfully explain (α=0.824>0.70) the measured phenomenon.

Table 4.12. Spatial and personal comfort total data statistics

	Effect on the Scale Average(%)	Effect on the Scale Variance(%)	Sum of Correlation of Material(%)	Multi-correlation of Squares(%)	Cronbach Alpha Effect(%)
13. The size of my office space is acceptable.	18.70	7.428	0.642	0.555	**0.787**
14. I have enough space in my office to keep my personal belongings.	18.61	7.785	0.555	0.503	**0.804**
15. My office is useful for different activities.	19.16	6.214	0.692	0.506	**0.774**
16. I feel safe in my work space.	18.56	7.971	0.578	0.377	**0.802**
17. My office has an aesthetic value.	19.14	6.778	0.514	0.370	**0.823**
18. I am generally satisfied with my office space.	18.83	7.463	0.676	0.477	**0.782**

As a result of KMO value and Bartlett test used in order to determine if the Technical Comfort scale can be used as a factor analysis on the 80 interviews performed; we can conclude that since the KMO value is higher than 0.80 (>0.6), the sampling size is big enough, since the chi-square value in the Bartlett test is 180.208 and the degree of freedom is 15 ($p=0.00$, $p<0.05$); and when the common variance values of the factors examined, the load of all factors is higher than 0.30, the scale is suitable to apply a factor analysis on it.

Table 4.13. Spatial and personal comfort KMO and Barlett's

Kaiser-Meyer-Olkin Sampling Adequacy		**0.799**
Bartlett's Test of Sphericity	Approximate Chi-Square	180.208
	Degree of Freedom	15
	Sig.	0.000

Table 4.14. Common loads of spatial and personal comfort

	Start	Deduction
13. The size of my office space is acceptable.	1.000	0.620
14. I have enough space in my office to keep my personal belongings.	1.000	0.512
15. My office is useful for different activities.	1.000	0.653
16. I feel safe in my work space.	1.000	0.504
17. My office has an aesthetic value.	1.000	0.421
18. I am generally satisfied with my office space.	1.000	0.611

When we look at the sum of explained variance, the value that has a value higher than 1 (value=3.321) explains 55.36 percent of the variance. Consequently, it can be concluded that the scale can explain the Spatial and Personal satisfaction 55.4 percent with a single-factor form.

Table 4.15. Spatial and personal comfort sum of explained variance

Component	The Starting Values			Sum of Square Load Deduction		
	Sum	Variance %	Cumulative %	Sum	Variance %	Cumulative %
1	3.321	55.357	55.357	3.321	55.357	55.357
2	0.927	15.444	70.801			
3	0.658	10.971	81.772			
4	0.420	7.006	88.778			
5	0.393	6.544	95.321			
6	0.281	4.679	100.000			
7	0.450	3.748	89.931			
8	0.369	3.075	93.006			
9	0.304	2.533	95.539			
10	0.248	2.063	97.602			
11	0.179	1.491	99.093			
12	0.109	0.907	100.000			

4.3.3.2. The Results of the Study

The relationship between the occupants and the office space is researched with the following 10 hypothesis using the scales that have been described in the previous sections.

- H1: There is a connection between the "Spatial and Personal Comfort" and the "Technical Comfort" (thermal, aural, lighting, ventilation comfort) the building provides. The occupant who is satisfied with the technical comfort is also satisfied with the spatial and personal comfort.
- H2: There is a connection between the working environment and thermal comfort, lighting comfort, ventilation comfort, spatial comfort and personal comfort. The employees of close offices are more satisfied than open office employees about the building's general characteristics (Technical, Functional, and Behavioral).
- H3: There is a relationship between the level of satisfaction and age. The general level of satisfaction (Technical, Functional, and Behavioral) lowers as age increases.
- H4: There is a relationship between the level of satisfaction and gender. Male employees are more satisfied than female ones about the building's general characteristics (Technical, Functional, and Behavioral).
- H5: There is a relationship between the level of satisfaction and the length of employment. The occupants with longer employment are more satisfied compared to the ones with shorter ones about the building's general characteristics (Technical, Functional, and Behavioral).
- H6: There is a relationship between the technical satisfaction and the general satisfaction. The occupant who is satisfied with thermal (question 1), aural (question 4), lighting (question 7) and ventilation (question 10) comforts is generally satisfied with the office space (question 18).
- H7: There is relationship between the office space and noise problem. Employees of close offices are more satisfied in terms of aural comfort compared to open office employees.
- H8: There is a relationship between the office space and spatial comfort. The employees working in closed offices are more satisfied with the office space compared with the employees working in open offices.

- H9: There is a relationship between the level of satisfaction and feeling safe. The occupants who feel safe in the office space in general (Technical, Functional and Behavioral) is more satisfied with the office space.
- H10: There is no relationship between finding the office aesthetically attractive and technical features of the office. The occupants who view their offices aesthetically positive do not consider the technical features.

Before the hypothesis analyses are performed, a normalcy and homogeneity test is applied on the parameters, and the appropriate (parametric or non-parametric) analysis method is followed based on these tests.

4.3.3.2.1. H1: The Relationship between Spatial and Personal Comfort and Technical Comfort

- $H1_0$: There is no relationship between the "Spatial and Personal Comfort" and the "Technical Comfort" (thermal, aural, lighting, ventilation comfort) the building provides.
- $H1_1$: There is a relationship between the "Spatial and Personal Comfort" and the "Technical Comfort" (thermal, aural, lighting, ventilation comfort) the building provides.

In order to find out if there is a relationship between the "Spatial and Personal Comfort" and the "Technical Comfort" Pearson Correlation analysis is performed. As it is seen in "Table 4.16." there is a positive relationship possibly a strong one between these two satisfaction perception (0.603). In this case we reject $H1_0$ and accept $H1_1$. Therefore, we can say that "the occupant who is satisfied with the technical comfort is also satisfied with the spatial and personal comfort."

Table 4.16. Spatial and personal comfort - technical comfort (Correlation)

Satisfaction Scales	Average	Std. Deviation	N	Correlation Coefficient	Sig.
Technical Comfort	3.22	0.58	80	0.603**	0.000
Spatial and Personal Comfort	3.77	0.53			

** The correlation is meaningful in 0.01 level.

4.3.3.2.2. H2: The Relationship between the Working Environment and the Satisfaction with Building's General Characteristics

- $H2_0$: There is no connection between the working environment and thermal comfort, lighting comfort, ventilation comfort, spatial comfort and personal comfort.
- $H2_1$: There is a connection between the working environment and thermal comfort, lighting comfort, ventilation comfort, spatial comfort and personal comfort.

In order to determine whether there is a relationship between the office space and the satisfaction sub-groups, a independent sample t test is applied. In the light of data in 0 (Sig.>0.05) a relationship could not be observed; therefore, we accept $H2_0$ and reject $H2_1$. As a result, it can be stated that "there is no difference between the close office employees and the open office employees regarding their satisfaction with the building's general characteristics."

Table 4.17. Work environment - satisfaction (Independent sample T-test)

Satisfaction Sub-topics	Average		t	Sig. (2-tailed)
	Open Office (N=68)	Close Office (N=12)		
Thermal Comfort	3.41	3.47	-0.328	0.744
Aural Comfort	3.43	3.39	0.148	0.883
Lighting Comfort	3.06	3.25	-0.669	0.505
Ventilation Comfort	2.98	2.83	0.613	0.542
Spatial Comfort	3.77	3.81	-0.189	0.851
Personal Comfort	3.73	3.92	-1.056	0.294

4.3.3.2.3. H3: The Relationship between Age and General Satisfaction with the Building's Characteristics

- $H3_0$: There is no relationship between the level of satisfaction and age.

- $H3_1$: There is a relationship between the level of satisfaction and age.

In order to determine if there is a relationship between age and general satisfaction, ANOVA test is applied. Since the significance level is 0.008<0.05, it is concluded that there is relationship between age and general satisfaction. We reject $H3_0$ and accept $H3_1$.

Table 4.18. Age - satisfaction (Anova)

Age	N	Average	Std. Deviation	F	Sig.
18-25	11	3.44	0.38	5.201	0.008
26-35	53	3.29	0.49		
36-45	16	3.74	0.53		
General	80	3.40	0.51		

As a result of the Tukey test (0) that is used in order to find out between which age groups the above mentioned relationship exists and its direction we have found that there is no statistically significant relationship between 18-25 age group and other age groups, and the satisfaction difference exists only between 26-35 age group and 36-45 age group. Therefore, it can be stated that regarding the people above 26 years of age, age and satisfaction increase in direct proportion.

Table 4.19. Age - satisfaction comparison (Tukey Test)

Age		Average Difference	Std. Error	Sig.
18-25	26-35	0.151	0.161	0.620
	36-45	-0.295	0.191	0.275
26-35	18-25	-0.151	0.161	0.620
	36-45	-0.446*	0.139	0.005
36-45	18-25	0.295	0.191	0.275
	26-35	-0.446*	0.139	0.005

4.3.3.2.4. H4: The Relationship between Gender and General Satisfaction for Building Characteristics

- $H4_0$: There is no relationship between gender and level of satisfaction.
- $H4_1$: There is a relationship between the level of satisfaction and gender.

After the application of independent sample t-test, it is observed that there is statistically significant relationship (Sig.<0.05) , therefore, we reject $H2_0$ and accept $H1_1$. As we examine the averages, we can state that "Male employees are more satisfied with the building's features compared to female employees."

Table 4.20. Gender - satisfaction (Independent sample t-test)

Gender	Average	Std. Deviation	t	Sig. (2-tailed)
Female	3.30	3.47	-2.357	0.021
Male	3.56	3.39		

4.3.3.2.5. H5: The Relationship between the General Satisfaction with Building's Features and Length of Employment.

- $H5_0$: There is no relationship between the level of satisfaction and the length of employment.
- $H5_1$: There is a relationship between the level of satisfaction and the length of employment.

In order to find out if there is relationship between the level of satisfaction and the length of employment, an independent sample t-test is applied. Prior to the test, since the number of employees with 11-20 years of employment were not enough, this group is merged with 6-10 year of employment group to create "6-20 year" of employment group. As it is seen in 0 (Sig>0.05) a relationship between the length of employment and general satisfaction;

in this case we reject $H2_0$ and accept $H1_1$. As a result, we can state that "The occupants with longer employment history are more satisfied with the building's features.

Table 4.21. Length of employment - satisfaction (Independent sample T-test)

Length of Employment	Average	Std. Deviation	t	Sig. (2-tailed)
1-5 years	3.34	0.50	-2.869	0.005
6-20 years	3.78	0.42		

4.3.3.2.6. H6: The Relationship between Technical Satisfaction and General Satisfaction

- $H6_0$: There is no relationship between the technical satisfaction and the general satisfaction.
- $H6_1$: There is a relationship between the technical satisfaction and the general satisfaction.

In order to determine if there is a relationship between the questions 1, 4, 7, and 10 which aimed to measure the technical satisfaction, and question 18 which aimed to measure the general satisfaction a correlation analysis is performed. While there is no relationship between the Thermal Comfort (Question 1) and the general satisfaction, we found a positive mid-level relationship between the aural comfort (question 4), the lighting comfort (question 7) and the ventilation comfort (question 10). As such we accept $H6_0$ for question 1, and $H6_1$ for the rest of the questions.

Table 4.22. Technical satisfaction - general satisfaction (Correlation)

Technical Satisfaction	Average	Std. Deviation	18. I am generally satisfied with my office space.	
			Correlation Coefficient	Sig.
1. The internal temperature is regulated well when the outside temperature is too cold.	3.35	0.78	0.218	0.05
4. The noise coming from the adjacent spaces is not disturbing.	3.25	1.04	0.327**	0.00
7. The amount of daylight coming through the windows is sufficient.	3.06	1.01	0.491**	0.00
10. The air inside the office when ventilated naturally is adequate.	2.84	0.99	0.293**	0.01

** The correlation is meaningful in 0.01 level.

4.3.3.2.7. H7: The Relationship between Office Space and Aural Comfort

- $H7_0$: There is no relationship between the office space and noise problem.
- $H7_1$: There is a relationship between the office space and noise problem.

An independent sample t-test is performed in order to determine if there is a relationship between the office space and the aural comfort sub-topics. Considering the data in 0 A relationship (Sig>0.05) could not be determined, therefore, for all sub-topics we accept $H7_0$ and reject $H7_1$. As a result, we can state that "There is no difference in terms of aural satisfaction between close office employees and open office employees."

Table 4.23. Work Environment - Aural Comfort (Independent Sample T-Test)

Aural Comfort	Average		t	Sig. (2-tailed)
	Open Office	Close Office		
4. The noise coming from the adjacent spaces is not disturbing.	3.28	3.08	0.601	0.549
5. The noise coming from the corridor is not disturbing.	3.32	3.25	0.222	0.825
6. The noise coming from the upper or lower levels are not disturbing.	3.69	3.83	-0.448	0.656

4.3.3.2.8. H8: The Relationship between Work Environment and Spatial Comfort

- $H8_0$: There is no relationship between work environment and spatial comfort.
- $H8_1$: There is a relationship between work environment and spatial comfort.

An independent sample t-test is performed in order to determine if there is a relationship between work environment and spatial comfort sub-topics. Considering the data in 0 a relationship (Sig>0.05) could not be determined, therefore, for all sub-topics we accept $H8_0$ and reject $H8_1$. As a result, we can state that "there is no difference in terms of spatial comfort satisfaction between close office employees and open office employees."

Table 4.24. Work environment - spatial comfort (Independent sample T-Test)

Spatial Comfort	Average		t	Sig. (2-tailed)
	Open Office	Close Office		
13. The size of my work environment is acceptable.	3.91	3.83	0.384	0.702
14. I have enough space in my office to keep my personal belongings.	3.99	4.00	-0.075	0.941
15. My office is useful for different activities.	3.41	3.58	-0.608	0.545

4.3.3.2.9. H9: The Relationship between Feeling Safe and General Satisfaction

- $H9_0$: There is no relationship between the level of satisfaction and feeling safe.
- $H9_1$: There is a relationship between the level of satisfaction and feeling safe.

The Kruskal Wallis test is performed in order to determine if there is a relationship between the "Feeling Oneself Safe" emotion which was measured in the 16th question "I feel safe in my office" and the general satisfaction. As it is seen in 0 there is a relationship between the two (Sig. <0.05). In this case we reject $H9_0$ and accept $H9_1$.

It is also worth noting that the general satisfaction level of the occupants who replied positively in "Feeling Oneself Safe" question is higher than that of ones who replied negatively. As a result, we can state that "The occupant who feel safe in the office is generally satisfied with the work environment."

Table 4.25. Feeling safe - general satisfaction (Kruskal Wallis)

16. I feel safe in my work space.		**N**	**Average**	**Chi-square**	**Sig.**
General Satisfaction	Disagree	1	2.89	17.456	0.001
	Neither agree nor disagree	8	2.83		
	Agree	58	3.38		
	Strongly Agree	13	3.90		
	Sum	80	3.40		

4.3.3.2.10. H10: The Relationship between Aesthetic Appreciation of a Space and Technical Comfort

- $H10_0$: There is no relationship between finding a aesthetically attractive and technical features of the office.
- $H10_1$: There is a relationship between finding an office aesthetically attractive and technical features of the office.

Anova test is performed in order to determine if there is a relationship between the "Aesthetic Appreciation of a Space" perception which was measured in the 17th question "My work environment has an aesthetically value" and the "Technical Comfort" satisfaction. As it is seen in 0 there is a relationship between the two (Sig. <0.05). In this case we reject $H10_0$ and accept $H10_1$.

The average "Technical Comfort" satisfaction of occupants who replied positively on "Aesthetic Appreciation of an Office" question is higher than that of who replied negatively. As a result, we can state that "The occupants who view the office aesthetically positive consider the technical aspects of the office in their views."

Table 4.26. Aesthetic appreciation - technical comfort (Anova)

17. My office has an aesthetic value.		**N**	**Average**	**Chi-square**	**Sig.**
General Satisfaction	Strongly Disagree	2	2.42	9.501	0.000
	Disagree	9	2.84		
	Neither agree nor disagree	28	3.04		
	Agree	32	3.33		
	Strongly Agree	9	3.96		
	Sum	80	3.22		

Table 4.27. Hypotheses and results

HYPOTHESES	**RESULTS**
H1: An occupant that is satisfied with the technical comfort is satisfied with the spatial and personal comfort as well.	An occupant that is satisfied with the technical comfort is satisfied with the spatial and personal comfort as well.
H2: Close office employees are more satisfied with the general characteristics of a building than open office employees.	There is no difference between close office employees and open office employees in regards to their satisfaction with the general characteristics of a building.
H3: There is a relationship between age and the level of satisfaction. As one gets older, the general satisfaction level (Technical, Functional and Behavioral) decreases.	One may argue that there is a direct proportion between age and level of satisfaction.
H4: Male employees are more satisfied with the general characteristics of a building (Technical, Functional, Behavioral) than female employees.	Male employees are more satisfied with the general characteristics of a building than female employees.

H5: Occupants with longer working hours are more satisfied with the general characteristics of a building (Technical, Functional, Behavioral) than occupants with short working hours.	Occupants with longer working hours are more satisfied with the general characteristics of a building than occupants with short working hours.
H6: Occupants that are satisfied with thermal (question 1), aural (question 4), lighting (question 7) and ventilation (question 10) comforts are also satisfied with the office space in general (question 18).	While there is no relationship between thermal comfort (question 1) and general satisfaction, there is a medium-level positive relation between aural comfort (question 4), lighting comfort (question 7) and ventilation comfort (question 10).
H7: Close office employees are more satisfied with the aural comfort than open office employees.	There is no difference between close office employees and open office employees in regards to their satisfaction with aural comfort.
H8: Close office employees are more satisfied with the office space than open office employees.	There is no difference between close office employees and open office employees in regards to their satisfaction with spatial comfort.
H9: Occupant that feels safe in the office space is satisfied with the space in general as well (Technical, Functional, Behavioral).	Occupant that feels safe in the office space is satisfied with the space in general.

5. CONCLUSIONS

This study is performed in order to look at POE, work environment and the quality of life in office from a different perspective. In this thesis study, the relationship between the quality of life and occupant satisfaction is examined using the Post-Occupancy Evaluation (POE) method. Although until today many studies have been performed related to the work environment, the number of studies that evaluates offices according to technical, functional and behavioral performance criteria is very limited. Therefore, in this study an office structure is examined in terms of occupants' satisfactions under various parameters using Post-Occupancy Evaluation.

In this thesis study, ANEL Business Center which is located in Istanbul Anatolian side and was designed in accordance with green-building criteria but was not certificated is chosen to test the POE survey.

In this study, a POE study is performed within ANEL Business center absorbing the research topics on work environments, post-occupancy evaluation, spatial character parameters and quality of life.

In the study, data that are exclusive to academic platforms are provided for post-occupancy evaluation studies. With this study, quality of life necessities of a work environment are tried to be determined with the survey performed on ANEL Business Center occupants.

In the context of technical performance topics, we can see that there is a relationship between the Spatial and Personal Comfort and the Technical Comfort (thermal, aural, lighting, ventilation comfort) the building provides. It was also observed that the occupants who are satisfied with the technical comfort are also satisfied with the spatial and personal comfort. We conclude that the aural comfort covered in the context of technical performance, did not cause any difference in the satisfaction levels of close office employees and open office employees.

As a result of the analyses regarding the office use (functional), it is determined that the satisfaction with spatial comfort is high. In this context, work environments are found to be functional in terms of size and sufficient space for personal belongings. In addition, no

difference is observed between the close office employees and open office employees regarding the satisfaction with the general building features.

The last analysis in the emotional state (behavioral) in the work environment is about trust, aesthetics and general satisfaction. It is concluded that in the work environments examined the occupants who feel safe are generally satisfied with the office. Moreover, it is observed that occupants who value their office aesthetically positive take the technical characteristics of their office into consideration. Regarding the age in the context of behavioral performance, it can be stated that the changes in the building characteristics are more effective on older occupants' perceptions because of their longer work experience and prior work conditions. In terms of length of employment, it is concluded that the changes in building characteristics are more effective on the perception of occupants with longer employments due to their prior work conditions.

When we look at the building as a whole, we observe that performance requirements are provided. In this study, regarding the POE performance requirements (technical, functional, behavioral) it is seen that occupants' satisfaction level is high in a non-certified office building. The future studies about office buildings can be improved further with occupant-oriented investigations by approaching occupant satisfaction levels in technical and functional aspects.

Post Occupancy Evaluation Approach is the most practical, systematic and effective method in the identification and solution of problems closely related to occupation that may affect the performance of a building due to limitative reasons that are neglected during construction and not recognized during the design process of a building; one encounters these problems after a certain occupation period of the building. This approach enables to gather classifier information including the efficiency of a building, occupant satisfaction, the accuracy of design parameters, whether the planned occupants are the same as the current occupants, and the environmental performance criteria such as comfort, aesthetics and techniques. Positive or negative information are evaluated systematically through POE research techniques based on the opinions of investors, architects, managers, and above all, the occupants of a building. As a result of this evaluation, a report is prepared using short, mid- and long-term results about a construction. In this thesis study, the following results are obtained in the light of the parameters defined for building performance of Anel Business Premises using POE approach:

- POE approach evaluates the relationship of the occupants with the building. As a result of this evaluation, information about the aesthetical, functional and technical performances of a building is gathered. This information is used to identify the success level and accuracy of criteria that are neglected or taken into consideration during design process and construction process. In the office building that is considered as a pilot case study in this thesis, it is observed that the positive values about the harmony between occupant and space are related to the decisions taken during design process when the results are examined.
- The feedback and feed forward aspects of POE study for buildings that will be constructed in future create data for building designs and provide sustainability. As this type of study is a guide for office buildings that will be established in future, this supports POE's ability to provide data for future buildings.
- In a building, the investors, operators, managers and the architects should cooperate. Joint decisions should be made on how to make a building better. Investments done by associations such as Business Premises are huge investments. Following the completion of building construction, the changes caused by the problems during occupation of a building will bring higher costs.

As a result; this study which has a decisive level in its current form constitutes a preliminary research. We may contribute to national economy by conducting a more detailed POE study. There are private companies abroad that conduct several POE studies in addition to universities. As such companies emerge in Turkey, we believe that arrangements related to current building evaluations, occupant satisfaction and work efficiency will be conducted.

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APPENDIX A: SURVEY FORM

İyi günler, "Kullanım Sürecinde Değerlendirme Yaklaşımı İle Ofis Mekanlarında Kullanıcı Memnuniyetinin İrdelenmesi" başlıklı yüksek lisans tezi çalışması kapsamında ofis mekanı bünyesinde, her kademedeki kullanıcının görüşlerini almak üzere anket uygulamaktayız. Bu anketin odak noktası, içinde yaşamakta olduğunuz fiziksel çevrenin nitelikleri ve bu niteliklerin siz değerli kullanıcılara olan uygunluğu, sizlerde yarattığı memnuniyettir. Bu nedenle kişisel değerlendirmeleriniz ve görüşleriniz son derece önemlidir. Anket formunu doldurmak yaklaşık 1-2 dakika kadar sürecektir. Yardımlarınız için teşekkür ederiz.

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YÜKSEK LİSANS ÖĞRENCİSİ)

BÖLÜM I. GENEL BİLGİLER

Cinsiyetiniz? *

- ◯ Kadın
- ◯ Erkek

Yaşınız? *

- ◯ 18-25 Yaş
- ◯ 26-35 Yaş
- ◯ 36-45 Yaş
- ◯ 46-55 Yaş
- ◯ 55 Yaş ve Üzeri

Çalışma durumunuzu öğrenebilir miyiz? *

- ◯ Genel Müdür
- ◯ Genel Müdür Yard.
- ◯ Müdür
- ◯ Müdür Yard.
- ◯ Bölüm Yöneticisi
- ◯ Bölüm Personeli

Ne kadar zamandır kurumda görev yapmaktasınız? *

- ◯ 1-5 Yıl
- ◯ 6-10 Yıl
- ◯ 11-20 Yıl
- ◯ 21 Yıl ve Daha Fazla

Figure A.1. Survey Form (Page1)

Çalışma ortamınız nasıldır? *

◯ Kapalı Ofis

◯ Açık Ofis

BÖLÜM II. MEMNUNİYET

ISI Konforunun size göre memnuniyet düzeyini ifade eden katılım derecenizi 1-5 arası bir puanla puanlandırmanızı rica ediyoruz. *

	Hiç Katılmıyorum	Katılmıyorum	Ne Katılıyorum Ne Katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
1. Dış hava sıcaklığı çok soğuk olduğunda mekan içi sıcaklığı iyi ayarlanmaktadır.	◯	◯	◯	◯	◯
2. Mevsimsel ani ısı değişikliklerine uyumludur.	◯	◯	◯	◯	◯
3. Şu anki ısı ayarı uygundur.	◯	◯	◯	◯	◯

İŞİTSEL Konforun size göre memnuniyet düzeyini ifade eden katılım derecenizi 1-5 arası bir puanla puanlandırmanızı rica ediyoruz. *

	Hiç Katılmıyorum	Katılmıyorum	Ne Katılıyorum Ne Katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
4. Komşu mekanlardan gelen sesler rahatsız edici değildir.	◯	◯	◯	◯	◯
5. Koridordan gelen sesler rahatsız edici değildir.	◯	◯	◯	◯	◯
6. Alt ve üst katlardan gelen sesler rahatsız edici değildir.	◯	◯	◯	◯	◯

AYDINLATMA Konforunun size göre memnuniyet düzeyini ifade eden katılım derecenizi 1-5 arası bir puanla puanlandırmanızı rica ediyoruz. *

	Hiç Katılmıyorum	Katılmıyorum	Ne Katılıyorum Ne Katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
7. Yalnızca pencerelerle içeri alınabilen gün ışığı miktarı yeterlidir.	◯	◯	◯	◯	◯
8. Aydınlatma elemanları ile oluşan mekandaki hakim renk çalışmaya elverişlidir.	◯	◯	◯	◯	◯
9. Aydınlatma elemanlarının yarattığı parlama ve yansıma rahatsız edici değildir.	◯	◯	◯	◯	◯

Figure A.2. Survey Form (Page2)

HAVALANDIRMA Konforunun size göre memnuniyet düzeyini ifade eden katılım derecenizi 1-5 arası bir puanla puanlandırmanızı rica ediyoruz. *

	Hiç Katılmıyorum	Katılmıyorum	Ne Katılıyorum Ne Katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
10. Doğal olarak havalandırıldığında mekanın içindeki hava yeterlidir.	◯	◯	◯	◯	◯
11. Mekandaki nem oranı uygundur.	◯	◯	◯	◯	◯
12. Havalandırma sistemi ile mekandaki temiz hava iyi ayarlanmaktadır.	◯	◯	◯	◯	◯

MEKANSAL Konforun size göre memnuniyet düzeyini ifade eden katılım derecenizi 1-5 arası bir puanla puanlandırmanızı rica ediyoruz. *

	Hiç Katılmıyorum	Katılmıyorum	Ne Katılıyorum Ne Katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
13. Çalışma mekanımın büyüklüğü elverişlidir.	◯	◯	◯	◯	◯
14. Çalışma mekanımda kişisel eşyalarım için yeterince yer bulunmaktadır.	◯	◯	◯	◯	◯
15. Çalışma mekanım farklı eylemler için kullanışlıdır.	◯	◯	◯	◯	◯

KİŞİSEL Konforun size göre memnuniyet düzeyini ifade eden katılım derecenizi 1-5 arası bir puanla puanlandırmanızı rica ediyoruz. *

	Hiç Katılmıyorum	Katılmıyorum	Ne Katılıyorum Ne Katılmıyorum	Katılıyorum	Kesinlikle Katılıyorum
16. Çalışma mekanımda kendimi güvende hissediyorum.	◯	◯	◯	◯	◯
17. Çalışma mekanımın estetik bir değeri vardır.	◯	◯	◯	◯	◯
18. Çalışma mekanımdan genel olarak memnunum.	◯	◯	◯	◯	◯

Anketi başarıyla tamamladınız.
Katılımınız için teşekkür ederiz.
Soru ve görüşleriniz için m.gozdesimsek@hotmail.com adresinden ulaşabilirsiniz.

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Figure A.3. Survey Form (Page3)

APPENDIX B: FLOOR PLAN AND SECTION OF ANEL PLAZA

Figure B.1. Floor plan of ANEL Plaza

Figure B.2. Section of ANEL Plaza