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Title: **Happy Blue: The impact of water-bodies on happiness by visual perception of human defining landscape aesthetic in context of Rotterdam.**

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Happy Blue: The impact of water-bodies on happiness by visual perception of human defining landscape aesthetic in context of Rotterdam.

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Summary

In 2050, 70% of the expected world population will concentrate in cities creating pressure on land planning and resource management. Already, the cities of the world are taking different initiatives and projects within their economic capacity to address the challenge. Economic and Financial assessments are done to prioritize the projects and ultimately those assessments become the decision tools.

The conventional practise of cost-benefit analysis faces methodological challenges in case of assessing cultural eco-system service because of their non-marketable economic benefit. Due to this difficulty, within the assessment process some vital criteria remains unaddressed and the benefits associated with them lacks internalisation. As a result those services are devaluated, making them vulnerable in case of management and protection. Therefore, the driving decision maker of development projects mainly considers the objective wellbeing issue and subjective gain of Human remains unnoticed.

The main objective of this research is to find out a solution and built up a model to assess this intangible good. Aesthetic service of Eco-system services needs human perception and for measuring human perception the model that has been formulated for this research has taken "Water-body" as an example from the landscape elements and to assess its aesthetic service "Happiness" has been taken as the measuring scale.

Consulting Aesthetic theories it has been understood that Aesthetic services are not dispersed randomly across a landscape, but rather follow particular patterns in terms of the intensity, richness and diversity in their provision resulting hotspots and cold-spots in urban landscape. Therefore, the possibility of measuring them can be realized. Consulting and going through the previous researches conducted regarding landscape aesthetics and human perception three measurable indicators, i.e. availability, accessibility and acceptability were isolated to valuate aesthetic service in urban landscape. Therefore, the main objective of this endeavour was to explain how the availability, accessibility and acceptability of water-bodies through aesthetic service impacts happiness on the ground of "Need gratification". Due to availability of data from "The municipality of Rotterdam" the opportunity to conduct the research has been materialized.

This was an "Explanatory-Quantitative Research", as the subject matter is "Unconscious Happiness" the result can be generalized for the human race but not only from theory from research strategy the generalizability needed to be induced. Therefore, survey as research strategy has been taken and a massive volume of data were analysed to draw conclusion.

"Human unconscious happiness is driven by "Availability", "Accessibility" and "Acceptability" of the landscape elements." – The statement has been proved through statistical analysis in this research. Landscape element generates pictorial information on "Stewardship", "Coherence", "Disturbance", "Historicity", "Visual Scale", "Imageability", "Complexity", and "Naturalness" in comparison with other elements within the environment by "Spatiotemporal mapping" of "Visual Stimuli". Human evaluates their chances for "Happiness" through "Legibility" and "Mystery". Therefore, "Available", "Accessible" and "Acceptable" conditions of visual stimuli are the conditions for "Need gratification".

In context of Rotterdam, increasing “Availability” and “Accessibility” of water-body still has scope to increase happiness. However, only increasing the volume and propensity of exposure is not the solution. The composition of the water-mass needs contextual fit and needed to be in coherence with the urban setting. Though, the River Mass is the key performer of water borne happiness for Rotterdam, the increment of Rotterdam’s in-dyke water-bodies will bring significant happiness. Even a small mass of water-body can bring major change for the unconscious happiness of the people if coherence with the other landscape elements can be ensured. Rather than the presence of a big chunk of water-body, small repeated water-mass in urban landscape can create enough impact if frequency and duration of human-water interaction can be increased. In consideration of “Acceptability” the four major lakes of Rotterdam gets the highest preference in case of paying water premium. Water premium here reflects the comprehensive bundle of visual services, but due to absence of market equilibrium revealed preference should not be considered as the only means for extracting aesthetic service for explaining “Happiness”. Lastly, the findings concluded that people are willing to purchase aesthetic service conveyed by water-body to avail “Happiness”.

The recommendation focuses on the structural and non-structural measures of “Integrated Water Resource Management”. Human-Water-body interaction for structural measures and protection of natural sources for non-structural measures should get the highest prerogative, also strong policies, co-ordination, control and awareness are advocated for the greater benefit for “Gratification of Unconscious Human Happiness”.

Keywords

Visual perception, Aesthetic service, Urban landscape, Water-body, Happiness.

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Abbreviations

3A	Accessibility-Availability-Affordability
3E	Economy-Equity-Ecology
3R	Reduce-Reuse-Recycle
3S	Sustainability-Stewardship-Security
CBS	Centre Bureau of Statistics
GIS	Geographic Information System
IHS	Institute for Housing and Urban Development
IWRM	Integrated Water Resource Management
JJ/WBGSP	Joint Japan/ World Bank Graduate Scholarship Programme
KMO	Kaiser-Meyer-Olkin
MLR	Multivariate Linear Regression
NASA	National Aeronautics and Space Administration
NGO	Non-Government Organisation
NWP	Netherlands Water Partnership
PCA	Principal Component Analysis
RCI	Rotterdam Climate Initiative
TIR	Total Indicator Reading
UK NEAFO	United Kingdom National Ecosystem Assessment Follow-on
UN	United Nations
UNEP	United Nations Environment Programme
WTP	Willingness to Pay
WRI	World Resources Institute

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Chapter 1: Introduction

Chapter 1 provides a background of the study giving emphasis on subjective wellbeing issues that are associated with the element "water" from subconsciously ingrained human notion on preference context. This Chapter puts forward the problem statement, rationale of the study, scope and limitation alongside the research objectives and questions with an intention to convey an understanding of the directed topic that has been elaborated in the research.

1.1 Background of the Study

Our innate relationship with water goes far deeper than the notion of food, economics, or proximity. The whole process actually started with human evolution and existence. According to present day science the pre-requisite of the possibility for a planet to have living organism is the existence of water (Young, 1999; NASA, 2006). Through all the endeavours for the search of life from nearby Moon to the planet Mars or further 4.24 light years away in the Proxima Centauri scientists have always hunted for traces of blue, the presence of water (NASA, 2004).

Life evolved from water. From ocean to land, with the early form of an amoebic being, gradually mammals crawled on land and from generation to generation of human evolution, modern men took their present shape with the complicated neuronal structure, the human brain (Alexander, 1990; Noonan, 2010).

Not only two-thirds of the Earth's surface is water, when we are born, approximately 78% of our body mass constitutes of water, and the brain continues to be made of 80% of it. The physical connectivity with it starts from the very beginning when human fetus spends first nine months of life immersed in the watery amniotic fluid of their mother's womb, taking nourishment, feeling comfort and there the brain starts to develop. In addition, it has estimated that 80% of the world's population lives within sixty miles of the coastline of an ocean, lake, or river (Nichols, 2014).

Whether searching the universe for unexplored life or new settlement possibility or roaming here on the planet Earth, humans have always sought to be by or near water but the influence of water in our brain is not confined to mere utility and food source. Firstly, it is without doubt that water is one of the most valuable resources of the planet. The worldly tensions, inequality, poverty, environment, economy, famine all can be related to this single component. Secondly, it has been established that access to water is a critical factor in household welfare, in large part because of the well- established health benefits of a reliable, clean water supply (Florida, 2014). A limited water supply affects the lives of the people in many ways beyond health. When a family's water supply is limited or contested, it can be a source of tension within and among households and inconvenient access to water may contribute to stress or unhappiness (Devoto, et al., 2013). Limited water, unclean water affects the vulnerable group of the society, the woman and the child. Thirdly, the trend of growth of water front cities can be seen all around the globe with water-based recreational

amenities having a positive impact on population growth (Ballas, 2013). Lastly the precipitation, the humidity present in air defines physical wellbeing.

In addition to these wellbeing issues, from neurological research it has been found that the visual appearance of water, i.e. its quantity, its colour also its sound, the fear and scope associated with it works at subconscious level of human happiness. The impact of water on each of the human senses can be characterized by calm and a sense of general happiness, we get inspired by water and elements associated with it; its blue colour and gentle motion; the smells and tastes, the perception in water or rain; or water play (Nichols, 2014). Therefore, the cognitive choice that we make in investing in water front property and water associate tourism, is not only an obstinate cost-benefit driven economic formula but it can also be explained by our quest to happiness by subconscious neuronal preference through perceptual maps that our brain builds using past experience.

From hunters and gatherers to the phase of cultivation, humans always looked for favourable atmosphere or living condition and also as a biological entity humans need certain environmental condition to survive. In quest of survival or adaptation, through the unconscious process of information collection and storing, human compares exposed situations or circumstances through perpetual analysis and screening associating with the hedonic unconscious storage in brain (Nichols, 2014). Therefore, through this visualisation process of mapping and pattern detection of liveable atmosphere, humans look for need gratification.

This hedonic comparison through the visualisation process and need gratification can also be explained by "Livability Theory" from social science perspective. The theory states that, “Livability” is the degree to which a living environment fits the adaptive repertoire of a species. When applied to human society, it denotes the suitability of institutional arrangements with human needs and capacities. Livability theory explains experiential differences in happiness in relation to need-environment fit (Veenhoven, 2014).

Therefore, the degree of gratification of biological or psychological need of an individual, matched by environmental characteristics, denote the degree of happiness and these needs can be of both social and natural. Hence, in our living environment the quality that our brain maps for happiness through need gratification is not only the conscious notion of supply of plentiful water for daily usage, food and industrial production, it also maps the unconscious quality that conveys through visualisation.

1.2 Problem Statement

The Population Division of the United Nations Department of Economic and Social Affairs estimated the world population at approximately 7.2 billion by June 2013. In 2050, the expected world population will be in between 8.3 billion to 10.9 billion and 70% of this population will concentrate in cities. This trend is already visible in the present cities by creating pressure on land planning to resource utilisation. As a result with other measures, the cities of the world are adopting water-oriented city planning approaches for sustainability by

optimising the use of the resource "water" (UN Water, 2015). Water oriented city planning incorporates a comprehensive package of different procedures such as modern rainwater management, innovative urban surface design, new greening concepts, urban rainwater harvesting and water reuse, an urban hydraulic cross-linking system, and ultimately entirely new types of housing and architecture (Koester, et al., 2014). Through this carefully chalked out conscious endeavour of water utilisation, our gaze through to unconscious human happiness becomes blurry, but a city has always been a happiness project from the time back to Socrates (Montgomery, 2013).

The driving forces of sustainable water resource management are conscious oriented and the problem lies on, not having direct connectivity of it with affective experience of unconscious human happiness, generated by landscape aesthetic as presented in Figure-1. This difficulty rises because of the problem associated with internalising the externality associated with aesthetic service of cultural eco-system services. Aesthetic services are not dispersed randomly across a landscape, but rather follow particular patterns in terms of the intensity, richness and diversity in their provision resulting hotspots and cold-spots in urban landscape. Existing methodological challenges discourages aesthetic services mapping assessments in the totalitarian city planning and water-body as landscape element does not get justified consideration as a result lacks in management and protection.

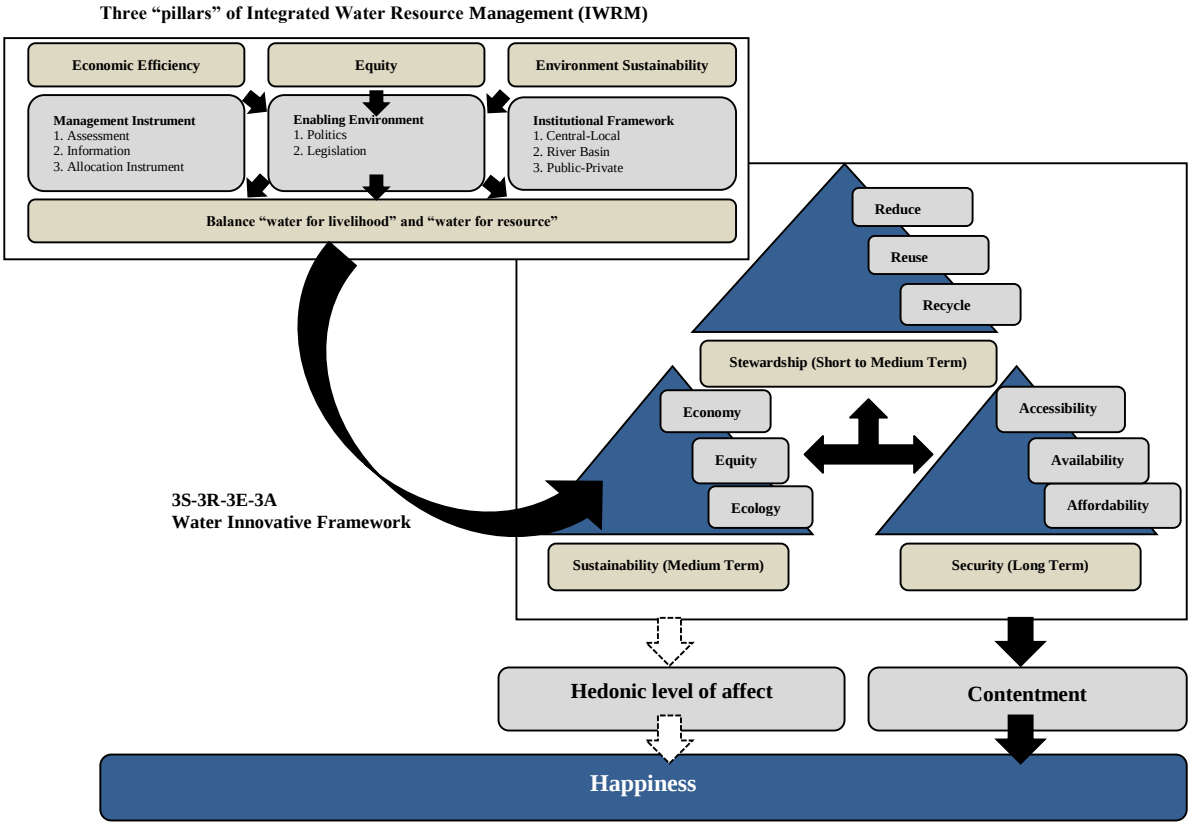

Figure 1: Linkage of Happiness with Water Innovative Framework, Source: Author, 2015. Based on Global Water Partnership, 2015 and Veenhoven, 2009.

We take ourselves to some coastal watery retreat, away from the conflict and the constant struggle that is present in our city life, there our adrenaline is rushed, dopamine explodes and production of endorphin increases and later when we come back to our usual frontier we

bring a piece of happiness within ourselves (Nichols, 2014). Not only in some secluded retreat in some coastal beach, we need to understand the way "water", the largest feature of earth plays its role in increasing our happiness in a changed atmosphere, a bustling city scape and from this aspiration, a researchable planning question can be generated.

1.3 Research Objectives

Related to this topic, the detailed picture of phenomenon and some theoretical understanding is present, at primary glance. Therefore, the main objective of the research is **to explain** how the availability, accessibility and acceptability of water- bodies through visual perception by humans, impacts happiness in an urban landscape taking, the city of Rotterdam as an example. Therefore, the specific objectives are, to examine the landscape aesthetic simulator associated with visual perception of water-bodies that explains unconscious happiness, and through it incorporating full economic value of this natural capital to cultural eco-system services.

1.4 Provisional Research Question

The main research question is:

How does aesthetic service of water-body in urban landscape impact happiness of people in the city of Rotterdam?

1.5 Provisional Research Sub-questions

The sub-research questions are:

1. How does availability of water-bodies influence landscape aesthetic service in the city of Rotterdam?
2. How does accessibility of water-bodies influence landscape aesthetic service in the city of Rotterdam?
3. How does acceptability of water-bodies influence landscape aesthetic service in the city of Rotterdam?

1.6 Significance of the Study

Happiness economics with the growing knowledge of subjective level of human satisfaction can expand the horizon to better understand the association of landscape components for a sustainable city. The 3S principles-stewardship, sustainability and security, adopted in water oriented city planning should not only generate some intransigent objective utility. The most influential subject of the cities are its people, and the happiness of people works both at subjective and objective level, so water as an important property of people's livelihood and living environment need to be understood from happiness angles. A city should not only bear

the tag of a sustainable city, it should be a happily sustainable one. Therefore, we need to understand "water" to interpret it as a happiness instrument for city planning and to adopt policy to accommodate happiness in our urban environment.

1.7 Scope and Limitation

In the literatures of happiness and life-satisfaction, subjective wellbeing are normally measured using questionnaires and numerical scales that later provide a basis for an econometric analysis. The accurate method to use to interpret happiness in some numeric and dataset was one of the challenges of this research; also generating massive survey relating to the subject depending upon the availability of time was out of scope of the course. Therefore, a large volume of secondary survey data regarding happiness of the inhabitants from "The Municipality of Rotterdam" created scope to conduct this research. Again, there were some limitation regarding having data related to the different typology of the water-body. Considering these, the inland neighbourhoods of Rotterdam with its freshwater sources of open water-bodies have been considered here for homogeneity and to remove the drawback.

1.8 Description of the Research Area

Every city is unique due to its factor endowments and analysis has to be done keeping in mind that result may vary from local to regional level. Therefore, this study performs a spatially explicit participatory mapping for aesthetic ecosystem service and several disservices that are influential for the perception of people living in the urban landscape of Rotterdam, The Netherlands. Here, in the procedural part of this thesis, happiness features from water associated landscape component of seventy-two neighbourhoods of Rotterdam, has been explored with relevant bio-geophysical and socio-economic context.

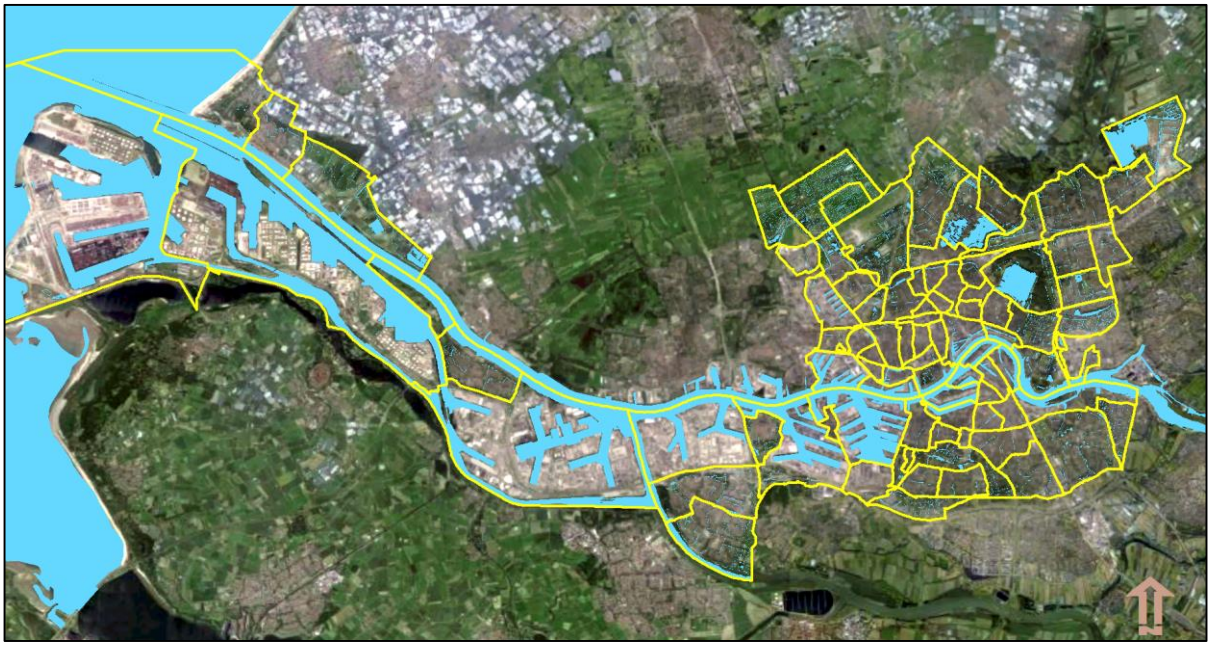

Figure 2: Map of Rotterdam with Water-bodies and Neighbourhood Boundaries, Source: Gemeente Rotterdam, 2013; Google Maps, 2015.

Chapter: 2 Literature Review

Chapter 2 links the research question by elaborating and creating relation among definitions and views. Particularizing the characteristics of the discussed good, this chapter puts forward the major landscape aesthetic theories, visual perception process, and factors relating visual stimulation, selecting indicators for best fit alongside the conceptual framework to lead the way to quantitative research.

2.1 Water-body and its Role as Natural Capital of Eco-System Services

Water-body is a significant accumulation of water forming Earth's physiographical feature (Oxford Dictionaries, 2015). It generally refers to natural and artificial surface water of varied sizes, like; oceans, seas, rivers, lakes, ponds, wetlands, and also puddles. It can be contained or moving. In this research paper, inland water-body is considered and it can be defined as any of the waters as; lakes, canals, rivers, watercourses, inlets, and bays within the territory of a state (Merriam-Webster, 2015).

Water-bodies, forming natural capital of agro-ecosystems and urban-ecosystems of environment, provide services to sustain and fulfil human life. Natural capital is the stock of all the elements of ecosystems including biotic organisms, geological elements, water and the atmosphere and provides the raw material for life and human activities. Ecosystem services transform natural capital into goods and services useful to humans, so here human plays a passive role (UNEP, 2015). Each physical environment due to distinctiveness possesses their own unique natural capital and has varied degree in the output of services (Figure-3).

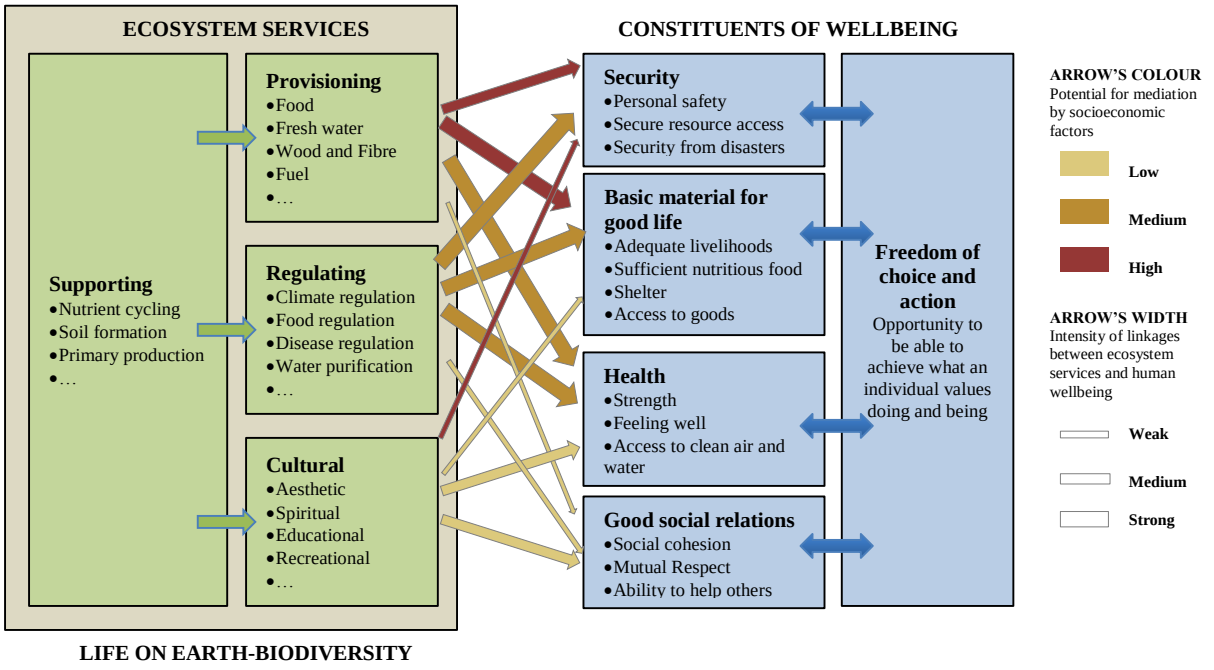

Figure 3: The Role of Ecosystem Services. Source: WRI, 2005.

2.2 Landscape Aesthetic and Visual Perception

Landscape can be defined as an entity of natural and/or built environment, perceived by people, whose character is the result of the action and interaction of natural and/or human factors (Council of Europe, 2000). "Landscape" reflects it, an outward expression of human perception and composed of not only what lies before our eyes but also what lies within our heads. It is a cultural image, a pictorial way of representing, structuring or symbolising surroundings (Meinig and Jackson 1979; Cosgrove, 1988). The definition of "Landscape Aesthetic" is closely connected with the physiological and psychological processes, it is the landscape apprehend or visually captured by spatiotemporal mapping of aesthetic experience in the human brain (Figure-4).

In urban context, visual perception refers to the preserved natural and built landscape not urban environment. For understanding aesthetic, 'Landscape' is preferable to 'Environment' because they are not synonymous; the former refers to visually perceived scene, while the latter is much more general and imprecise and has less human involvement (Appleton, 1980; Bourassa, 1988). Therefore, the aesthetic service that water-body delivers from landscape on human is more contextual and related to this happiness research.

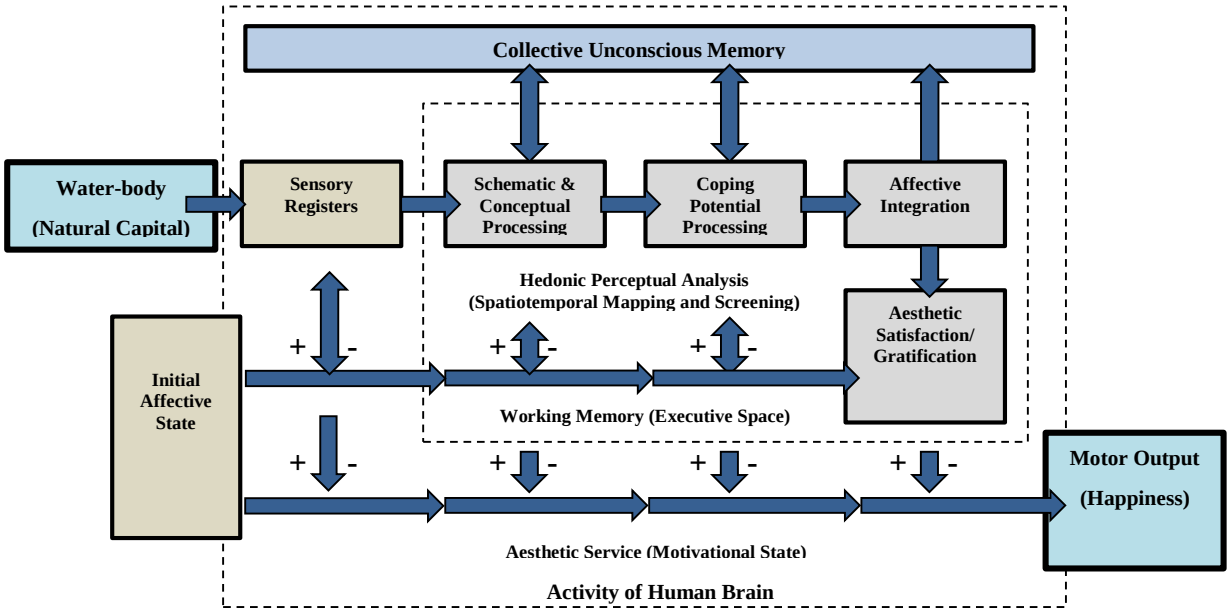

Figure 4: The Process of Spatiotemporal Mapping by Human Brain, Source: Author, 2015. Based on Hsu, 2009; Jorgensen, 2011.

2.3 Theories of Happiness and Gratification of Need

The American psychologist, Silvan Tomkins, in his "Affect Theory" described that, when human being are affected by a stimulus of some kind, an event or even a memory, they experience an emotion as a result. Affect is a biological pattern of events, triggered by a stimulus and Tomkins sorted out nine affects. Feeling is about the awareness of an affect; every time an individual experiences an affect, it is logged and filed away in the memory. The memory of previous experiences is added to the feeling, amplifying the awareness, to

create the emotion (Tomkins, 1992). To summarise, an affect is a biological, innate, natural response to a stimulus and is transient; and it explains feelings of "Happiness".

According to Tomkins, individual freedom is the consequence of the marriage of affect and cognition, but this freedom is limited by biological and social systems. Imagery of past experience is stored at the heart of memory and retrieved simultaneously with perceived images at the very moment. Imagery creates appeal to the present perceived scenario, not in isolation but in the dramatic interplay of other bio-psycho-social system (Tomkins, 1992).

According to Veenhoven, "Affect theory" provides the most complete explanation of happiness rather than Set point and Cognitive theory. "Affect theory" states that happiness is a reflection of how well we feel generally, it is a heuristic method of drawing conclusion, depending upon the frequency of affective experience of feeling good (Schwartz and Strack, 1991; Veenhoven, 2009). The degrees to which a living environment fits the adaptive repertoire of a species, is crucial for affective experience. In "Livability theory", Veenhoven also mentions experiential differences in happiness in connection to need-environment fit (Veenhoven, 2014). We infer our "Happiness" from on-going affective experience and this affective experience reflects need-gratification. Therefore, the propensity in level of need or demand gratified justifies the experiential difference of "Happiness" (Diener, et al., 1991; Veenhoven, 2014).

Affect theory of how happiness is assessed

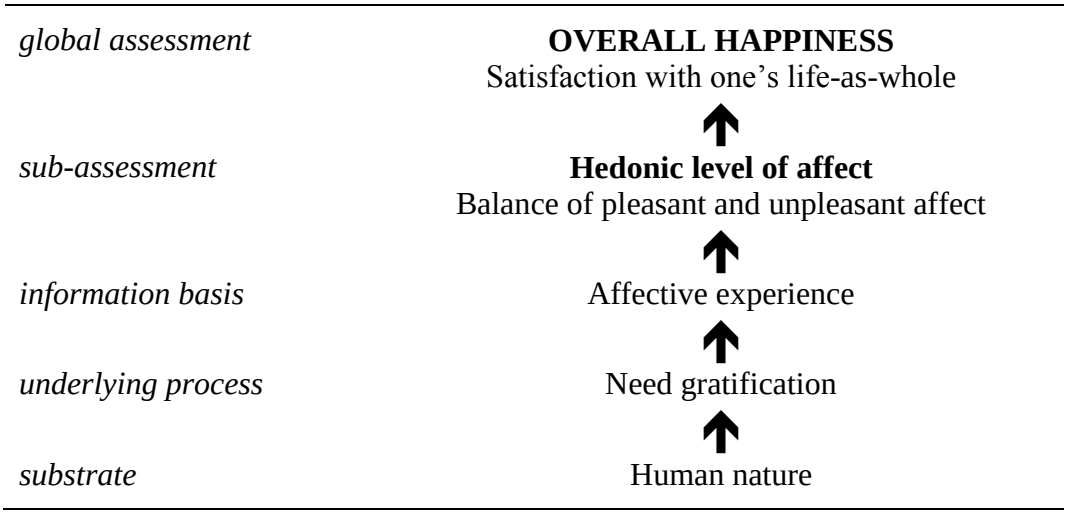

Figure 5: Happiness Assessment Process According to Affect Theory, Source: Veenhoven, 2009.

Veenhoven, to explain happiness emphasized on the stock of affective experience as the basis for information and in the underlying process he emphasised on the functions of affects on gratifying the need. The overall evaluation of life is assessed by the most noticeable affective experiences and that these are typically intense affects. Yet research using the "Experience Sampling Method" shows that it is rather the relative frequency of positive to negative affect that matters (Diener, et al., 1991; Veenhoven, 2009).

Affects are a vital part of our adaptive selection and linked to the gratification of human needs. 'Needs' are basic requirements for survival. Nature safeguards the gratification of these needs with affective signals such as hunger, love and zest. In this view, positive mood

signals that all needs are sufficiently met at the moment. “Needs” are inborn and universal while “wants” are acquired and can de variable across cultures (Veenhoven, 2009).

Happiness is a desirable state and depends in the end on the gratification of human needs and man can advance towards happiness also by improving the “Livability” of the environment (Veenhoven, 2009). “Cognitive theory” implies that conditions for happiness can differ wildly across cultures, while “Affect theory” rather predicts that there will be much similarity in conditions for happiness. Therefore, analysing happiness through affect produces universal result.

2.4 Theories of Landscape Aesthetic and Human Behaviour

A large volume of study is present in different disciplines about the process of human perception and aesthetic experience, but up to 1982 because of its complexity, most of the notable philosophers ignored addressing the aesthetics of elements of nature or objects of landscape and mainly concentrated on well-defined objects of art (Hepburn, 1968; Rose, 1976; Appleton, 1982; Bourassa, 1987). Kevin A. Lynch in his book, “A theory of good city form” emphasizes the importance of landscape aesthetics by saying:

“*Esthetic experience is a more intense and meaningful form of that same perception and cognition which is used, and which developed, for extremely practical purposes. Theory must deal with the esthetic aspects of cities, even though it may be a more difficult part of its task. Indeed, it must deal with function and esthetics as one phenomenon.” (Lynch, 1981, p.104)*

James Marston Fitch in “Experiential bases for esthetic decision” also supports the view:

“A fundamental weakness in most discussion of aesthetics is the failure to relate it to experiential reality.” (Fitch, 1970, p.76)

2.4.1 Earlier Theories of Aesthetic Experience

2.4.1.1 Animal Instinct

Famous American philosopher, psychologist, and educational reformer John Dewey realizes the importance of addressing aesthetic experience in our day to day life and in “Art as Experience” placed argument that aesthetics is a part of everyday experience and not something that comes into play only in, certain experiences of artists or art experts (Dewey, 1958; Bourassa, 1987). Landscape aesthetics presumes a broad comprehension of aesthetics, set forth by John Dewey and without this initiation everyday landscape and human perception of and response to that landscape would be quite difficult for aesthetic inquiry. Dewey suggests that there is a biological basis for aesthetics and men seem to share some common response regarding to certain aesthetic exposure (Bourassa, 1987).

“I do not see any way of accounting for the multiplicity of experiences of this kind (something of the same quality being found in every spontaneous and uncorked aesthetic response), except on the basis that there are stirred into activity resonances of dispositions acquired in primitive relationships of the living being to its surroundings, and unrecoverable in distinct or intellectual consciousness.” (Dewey, 1958, p.9)

An indirect suggestion of this idea is that, man may have some inherited responses to landscapes, which parallel matching responses in animals. Dewey also contributes to the theory of landscape aesthetics by abandoning the idea of beauty as the central concept of aesthetics (Bourassa, 1987). "In Art as Experience", Dewey criticises that,

"Unfortunately, it has been hardened into a peculiar object; emotional rapture has been subjected to what philosophy calls hypostatization, and the concept of beauty as an essence of intuition has resulted. For purposes of theory, it then becomes an obstructive term. In case the term is used in theory to designate the total aesthetic quality of an experience, it is surely better to deal with the experience itself and show whence and how the quality proceeds. In that case, beauty is the response to that which to reflection is the consummated movement of matter integrated into a single qualitative whole." (Dewey, 1958, p.129-130)

Dewey's rationality reduces aesthetic experience to a biological response to environment but at the same time helps this field of study by removing obstruction from the standard dictionary definition of aesthetics as "The Theory of Beauty" (Bourassa, 1987).

2.4.1.2 Human Instinct

Susanne Langer in her "Feeling and Form" strongly criticized the reductionism of aesthetic experience suggested by John Dewy.

"The chief assumption that determines the entire procedure of pragmatic philosophy is that all human interests are direct or oblique manifestations of 'drives' motivated by animal needs. This premise limits the class of admitted human interests to such as can, by one device or another, be interpreted in terms of animal psychology. An astonishingly great part of human behaviour really does bear such interpretation without strain; and pragmatists, so far, do not admit that there is any point where the principle definitely fails, and its use falsifies our empirical findings." (Langer, 1953, p.35)

2.4.1.3 Juxtaposition of Animal and Human Instinct

Restricting aesthetics to the philosophy of art is in true sense unworkable to generate an aesthetic theory of the ordinary landscape despite the fact that landscape surely has aesthetic quality. Therefore, Gaston Bachelard's philosophical proposal was a solution between the philosophies of Dewey and Langer by admitting the importance of biological motivation while also respecting the significance of art. Motivated by C.G. Jung, Bachelard suggests that human mental structure can be used as a model for aesthetic analysis (Bachelard, 1969; Bourassa, 1987).

2.4.2 Baseline Theory of Aesthetic Experience

Jung's idea provides a conceptual basis for a theory of aesthetic, which explains nature and art, biology and culture, and the ideas of Dewey and Langer. Jung divided the mind into three levels: consciousness, the personal unconscious and collective unconscious.

"[W]e have to describe and to explain a building the upper story of which was erected in the

nineteenth century; the ground floor dates from the sixteenth century, and a careful examination of the masonry discloses the fact that it was re-constructed from a dwelling tower of the eleventh century. In the cellar we discover Roman foundation walls, and under the cellar a filled-in cave, in the floor of which stone tools are found, and remnants of glacial fauna in the layers below. That would be a sort of picture of our mental structure. We live in the upper story, and are only dimly aware that our lower story is somewhat old-fashioned. As to what lies beneath the superficial crust of the earth we remain quite unconscious." (Jung, 1928, p.118-119)

The contents of the collective unconscious are known as "archetypes". According to Jung, the archetypes are the same for all individuals and are analogous to instincts.

"there is good reason for supposing that the archetypes are the unconscious images of the instincts themselves, in other words, that they are patterns of instinctual behaviour." (Jung, 1959, pp. 43-44)

Jung is his literature "Mind and earth", discussed the relationship of the mind with the conditions of its environment. Here Jung compares the mind with the human body as a whole:

"This… psychic organism corresponds exactly to the body, which, though constantly showing individual variation, is none the less in all essential features the general human body, which in its development and structure still preserves those elements that connect it with invertebrate animals and finally with the protozoa. Theoretically it should be possible to shell out of the collective unconscious not only the psychology of the worm, but even that of the individual cell." (Jung, 1928, p. 110)

Thus, human mind's collective unconscious posited by Jung is the locus of archetypes, which are images of the instincts coming into play in man's experience of landscape. Jung's theory is also quite compatible with Langer's aesthetics because it recognizes that while one part of human mental structure is shared with other animals, another part is uniquely human. In summary, there is a place in the human psyche for uniquely human activities, which are in agglomeration with animal psyche (Bourassa, 1987) and his hypothesis created base for all advanced theories.

2.4.3 Later Theories of Aesthetic Experience

The theories that later followed regarding landscape and human preference are more or less influence by C.S. Jung's hypothesis. They were further matured by Emanuel Kant; through diagram and literature he elaborated the process of information flow inside human mind in relation to external stimulation.

2.4.3.1 Habitat and Prospect-Refuge Theory

Famous geographer, Jay Appleton's book "The Experience of Landscape" is the first major attempt to establish a theory of landscape aesthetics. Following Dewey's biological drive and Jung's psychoanalysis, Appleton proposes:

"aesthetic satisfaction, experienced in the contemplation of landscape, stems from the spontaneous perception of landscape features which, in their shapes, colours, spatial arrangements and other visual attributes, act as sign-stimuli indicative of environmental conditions favourable to survival, whether they really are favourable or not. This proposition we can call habitat theory." (Appleton, 1975, p-69)

Appleton further develops his argument by accentuating his thesis in "Prospect-Refuge theory". The theory states that taste in art is an acquired preference for satisfying inborn desires of opportunity (prospect) and safety (refuge). The relationship between habitat theory and prospect- refuge theory is outlined as follows:

"Habitat theory postulates that aesthetic pleasure in landscape derives from the observer experiencing an environment favourable to the satisfaction of his biological needs. Prospect-refuge theory postulates that, because the ability to see without being seen is an intermediate step in the satisfaction of many of those needs, the capacity of an environment to ensure the achievement of this becomes a more immediate source of aesthetic satisfaction." (Appleton, 1975, p. 73)

These two desires give us a means of understanding in successful and enduring aesthetics, and the ability to predict a landscape. In his book, Appleton categorizes the basic imagery and symbolism as the prospect, the hazard, and the refuge. These sign-stimuli provided by the landscape encompass the essence of Appleton's "Prospect-Refuge theory". According to his thesis prospects is direct or indirect, including panoramas and vistas while he classified refuges by functions- hides and shelters, by origin- natural or artificial, by substance in the earth such as caves or in vegetation, by accessibility and by efficiency. He further develops this framework by discussing surfaces, light and darkness, levels of symbolism and scale, and locomotion. According to him, these are important aspects of the aesthetic experience of landscape because they are crucial to survival, prospect, refuge or hazard (Bourassa, 1987).

2.4.3.2 Savannah Hypothesis

In 'Savannah Hypothesis" Gordon Orians's and Judith Heerwagen's objective was to see if humans have an evolved preference for an ideal habitat. They noted that because Homo sapiens spent much of their evolutionary past on the plains of tropical Africa, they should have a natural attraction for this type of landscape. The researchers, after showing participants hundreds of pictures of different landscapes, found significant support for their hypothesis and found that most of us have a preference for landscapes that resemble our evolutionary origin and the younger we are, the more foreseeable the preference. With age, we tend to adapt to where we live and develop a preference for it (Orians and Heerwagen, 1992).

A typical savannah features moderate cover from vegetation and trees to disallow natural predators to advance unnoticed. It also offers abundance to indicate the presence of ample food and water and allows easy mobility to venture and explore. Therefore, Landscapes that aid and encourage exploration, way finding and information processing should be more favoured than landscapes that obstruct these needs (Orians and Heerwagen, 1992) and our aesthetic experience to landscape can be answered by studying the environmental key-features found in the savannah type environments.

Orians's and Heerwagen's also photographed African savannah trees particularly "Acacia tortulis" and selected them varying in height-width ratio, height of branches, extent of canopy density, extent of canopy layers to test four hypotheses (Orians and Heerwagen, 1992) and found a low trunk is easier to climb than a high one; a broad umbrella-like canopy affords greater refuge from sun or rain than a narrow-high canopy and ultimately scores high in preference (Orians and Heerwagen, 1992). The results are considered to support the functional-evolutionary perspective.

2.4.3.3 Aesthetic-Affective Theory

Environmental psychologist Roger Ulrich conceived the 'Aesthetic-Affective Theory'. His theory derives from the "Biophilia hypothesis", which states that humans have an inherited affection for living things and assess an environment from a survival perspective within a fraction of a second. Aesthetic-Affective theory considers that natural settings and landscapes can produce in their viewers emotional states of wellbeing, which' can be identified through psychological and neurophysiological measures (Ulrich, 1984). Ulrich tested participants' feelings before and after viewing slides of urban and natural scenes. He found that participants shown scenes of cities with trees showed significant reduction of fear and increased positive feelings, compared with individuals shown scenes of treeless city scenes (Ulrich, 1979). In 1984, he reported on investigations of the recovery of patients in a hospital, comparing patients whose rooms viewed a blank wall with those who could see trees. The study found that those who viewed the trees had shorter stays in hospital (Ulrich, 1984). Overall, Ulrich's research findings provide support for his theory that immediate responses to nature are not controlled and cognitive; but unconsciously triggered and initiates emotional responses that play a central role in human wellbeing (Ulrich, et al., 1991).

2.4.3.4 Information Processing Theory

Information processing theory states that perceptual process of human involves extracting information from one's environment. They identified four predictor variables, coherence and legibility help one understand the environment and complexity and mystery encourage its exploration (Kaplan and Kaplan, 1989).

Coherence includes gestalt features of landscape that makes a scene comprehensible. Organization of major objects in landscape into a manageable number also increases comprehensibility. Repeated elements or shapes and texture increases manageability through grouping. Complexity or diversity creates involvement and breaks monotony and dullness. Legibility is safety in the context of space. It involves an opportunity to promise of function, to know one's way and the way back. It deals with the structure of the space. Legible spaces are easy to oversee to form a mental map. Lastly, mystery is the sense of continuity that involves a person to get deeper inside the view for gathering information (Kaplan and Kaplan, 1989).

With mystery, five physical attributes are related, they are, Screening: degree of visual obstruction or obscurity; Distance of view: measured from viewer, as distance increases, mystery decreases; Spatial definition: degree to which the landscape elements surround the observer; Physical accessibility: apparent means of moving through or into the landscape; and Radiance and shade. These are consistently ranked high for mystery (Gimblett, et al., 1985).

2.4.4 Consolidation of Aesthetic Theories into Concepts

In 2006, Tveit, Ode and Fry in the paper "Key Concepts in a Framework for Analysing Visual Landscape Character" presented a theory-based scheme for analysing visual character of landscape. They identified nine key visual concepts by consulting different landscape theories. The list of these nine concepts, definition according to the authors and most representative synonyms are presented in Table-1.

Table 1: Concepts Describing Visual Characteristics of Landscapes with Definitions, Source: Tveit, et al., 2006.

Concepts	Definition	Synonyms
Stewardship	Sense of order and care, perceived accordance to an ideal situation reflecting human care through active and careful management.	• Sense of order • Sense of care • Upkeep
Coherence	Unity of a scene, repeating patterns of colour and texture, correspondence between land use and natural conditions.	• Correspondence with ideal situation/harmony • Unity • Uniformity • Holistic • Land-use suitability • Balance and proportion • Intactness • Harmony
Disturbance	Lack of contextual fit and coherence, constructions and interventions.	• Intrusion • Alteration • Impact • Lack of contextual fit • Lack of coherence
Historicity	Historical continuity and historical richness, different time layers, amount and diversity of cultural elements.	• Historical continuity • Historical richness
Visual Scale	Landscape rooms or perceptual units: their size, shape and diversity, degree of openness.	• Landscape room • Visibility • Openness • Enclosure • Spaciousness
Imageability	Qualities of a landscape present in totality or through elements: landmarks and special features, both natural and cultural, making the landscape create a strong visual image in the observer, and making landscapes distinguishable and memorable.	• Sense of place • Genius loci • Grandness • Place identity • Vividness • Uniqueness • Historical continuity • Historical richness
Complexity	Diversity, richness of landscape elements and features, interspersion of pattern.	• Diversity • Variety • Richness • Spatial pattern/combination
Naturalness	Closeness to a preconceived natural state.	• Intactness • Wilderness • Natural • Ecological robust • Vegetation health
Ephemera	Changes with season, weather or other temporal effects.	• Seasonal changes • Weather changes

2.4.5 Concepts to Measurable Units

Abstract visual character of landscape elements according to psychological concepts and aesthetic theories, can be captured using measurable physical indicators of aesthetic stimuli, as presented in Table-2. Need gratification by these visual stimuli explains the affective causal relation towards happiness.

Table 2: Concepts to Measurable Units of Aesthetic Service, Source: Author, 2015 Based on Ode, et al., 2008.

Theory/ Concept	Visual Stimuli of Aesthetic theory	Data Source/ Unit of Measurement
Habitat and Prospect-Refuge Theory	Size	Size of water-body/ Size index
	Shape	Shape of water-body/ Shape index
	Scale Proportion	Percentage (%) of land cover
	Locomotion Source	Types of water-body
	Vista/ frontage Obstruction	Length of arc of view
	Ease of access	Length of radius of view
	Colour Efficiency Spatial arrangement	Revealed and stated preferences
Savannah Hypothesis	Height-width-size	Size of water-body/ Size index
	Repetition	Number (Count) of water-body
	Density Abundance	Percentage (%) of land cover Types of water-body
	Easy mobility	Length of arc and radius of view
Aesthetic-Affective theory	Vista/ frontage	Length of arc of view
Information Processing Theory	Coherence	Percentage (%) of land cover
		Revealed and stated preferences
	Complexity	Percentage (%) of land cover Number (Count) of water-body Type of water-body
	Legibility	Revealed and stated preferences
	Mystery	Length of arc of view Length of radius of view
		Revealed and stated preferences
Biophilia Hypothesis	Affinity to nature	Percentage (%) of presence of naturalness Revealed and stated preferences
Stewardship	Sense of order and care	Revealed and stated preferences
Disturbance	Lack of coherence	Revealed and stated preferences
Imageability	Quality of landscape in total	Revealed and stated preferences
Historicity	Diversity in cultural element	Revealed and stated preferences
Complexity	Distribution	Number (Count) of water-body
	Diversity	Types of water-body
Naturalness	Preconception	Revealed and stated preferences
Ephemera	Season based activity	Percentage (%) of area

These visual stimuli of aesthetic theories decide the service efficiency that the physical element of a landscape holds.

2.5 Aesthetic Service of Landscape Component

Water-body as a natural capital of eco-system and physical element of urban landscape, along with other services, provides aesthetic service by interacting with other landscape elements. Aesthetic service is predominantly unconscious and needs human involvement for perception and valuation, simultaneously at the same time because of its physical attribute and locational specificity, it creates a hotspot for impact (Melichar and Kaprova, 2013). Therefore, in this paper to interpret the impact associated with aesthetic service quantity of the service is measured alongside quality of the service (Frey, 2008; Wang and Wong, 2014).

The 3-A principal regarding long-term security of Water Innovative Framework focuses on the materialistic wellbeing of the human. This model can be adapted to some extent to internalize hedonistic aesthetic externality. The term "Affordability" should be replaced by "Acceptability" cause aesthetic service is an immaterial economic good.

Table 3: Indicators and Measurable Units, Source: Author, 2015 and UK NEAFO, 2014.

Indicators of Aesthetic Service				
Level of Aesthetic service by water-body	Quantity of service	Availability	Land cover according to typology (River, Lake, Canal)	Area Proportion
		Accessibility	Direct access according to typology	Water frontage
			Indirect access according to typology	Proximity
	Quality of service	Acceptability	Revealed Preference Stated Preference	Water Premium

2.5.1 Availability of Aesthetic Service

Quantity of service refers to the physical presence of the delivery or supply of service. "Availability" is related to quantity, denoting collection or combination of a specific service; it impacts the contextual specificity of value transfer by allowing human to visualise the size and location of that landscape element and overlay them with other relevant themes like, bio-geophysical or socio-economic for analysis (Costanza, et al., 2006; Melichar and Kaprova, 2013). The internal biophysical consideration regarding availability is the type or nature of the component under analysis; and is also related to coverage and quantity of service (Costanza, et al., 2006).

In case of availability, the aesthetic externality regarding land coverage is screened by human brain; so, the predicted interpretation by human perception and actual physical measurement in reality derives from different sources. Therefore, it will be contextual to understand how human guessing works, what is the variation, how close human are able to speculate the actual size. According to James Surowiecki, human as a group is able to predict the actual size (Surowiecki, 2004). In drawing conclusion, physical measurement of land coverage and predicted measurement of land coverage by a crowd or mass people are quite same. As a result, to predict perceived land coverage or other gestalt feature, taking into account of actual physical measurement is justifiable.

"Availability" is a key component of "Prospect refuge theory" and "Information processing theory". "Availability" in "Prospect refuge theory" shows prospect through abundance and for "Information processing theory" it addresses mystery through spatial definition (Gimblett, et al., 1985). It is also addressed in other landscape aesthetic theories and studies. It increases the propensity for exposure and duration, and increases dosage of visual stimuli (Jiang, et al., 2014). Availability of naturalness and green space also proves it's' influence on happiness (MacKerron and Mourato, 2013). The affective experience it mainly generates, is related to sense of secured future or assurance for the viewer and by thus gratifies the need influencing happiness.

2.5.2 Accessibility of Aesthetic Service

"Accessibility" is also related to quantity of service (Elliott and Hunsley, 2015). In case of water-body in urban landscape, the latitude of direct and indirect accessibility (Eves, 2005; Costanza, et al., 2006) is related to the degree of visual exposure. Direct visual accessibility maximizes aesthetic-affective experience (Ulrich, 1984), even length of panoramic vista or view from window influences affective experience and preferences (Jim and Chen, 2009).

"Accessibility" can be defined through the concepts of "territoriality" and "mobility". It is the easiness by which people can reach the desired activity sites, such as those proposing employment, shopping, medical care or recreation (Gregory, et al., 2011). Besides material values, the role of accessibility lies in cultural capital, atmospheric feeling and collective memory (Moran, 2004; Czepczynski, 2008; Semm and Palang, 2010). Sennett has developed a sensory analysis of "Accessibility"; he has focused on the city and the senses by showing how the physical spatial order, social relations and the public imaginary of places are complexly related by basic sensor systems. Sensuous meanings or perceptual interpretation are dispersed and fluid, infiltrating the daily life of individuals in more complex and insidious ways (Sennett, 1986; Degen, 2008; Semm and Palang, 2010).

In "Information processing theory", "Accessibility" measures "mystery" through screening, distance of view, and physical connectivity (Gimblett, et al., 1985). According to "Savannah hypotheses", accessibility creates refuge and in "Prospect refuge theory" it is related to prospect; having greater impact on unconscious affective experience. In addition, the research of Cohen-Cline and others suggest that greater access to green space is associated with less depression, even when controlling for genetic and shared environmental confounds (Cohen-Cline, et al., 2015).

2.5.3 Acceptability of Aesthetic Service

Aesthetic service itself is an intangible economic good. It involves human perception therefore is subjective in nature but can be impartially measured (Ambrey and Fleming, 2011). Non-market valuation, that determines "Acceptability", is the key determinants of aesthetic service and human satisfaction (Sovd, et al., 2006; Ambrey and Fleming, 2011) and pre-condition for quality measures. The two approaches of valuation technique that can be adopted in measuring acceptability are market based-revealed preference and non-market based-stated preference (Welsch, 2006; EC, 2015). Revealed preferences use hedonic pricing

and travel cost method. On the other hand, stated preferences use direct and indirect questionnaires (Ambrey and Fleming, 2011).

Direct questionnaire that states preference are sometimes subjected to criticism, because human may not have accurate judgement when valuating verbally. Therefore, revealed preference can be the other alternative that can be used for interpretation. Revealed preference works as a complex unit and from here extracting the preference for a particular stimulus, affecting aesthetic externality is difficult to isolate. Therefore, most of the water-body based visual landscape stimuli; i.e., colour, locomotion, stewardship, ephemera, legibility etc. that affects our acceptability are tied together and in this research work they are put under the broad umbrella of acceptability and measured as a single unit for secondary analysis. Untying it is out of the scope of this research.

In case of "Acceptability", the revealed approach of translating aesthetic externality in numeric value in real life scenario is associated with land price (Ferrer-i-Carbonell and Gowdy, 2007) and travel expense (Welsch, 2006) calculation, denoting Willingness to pay and Willingness to accept. Throughout the World, there is relatively high value in water front property. Therefore, to understand acceptability we need to understand, what this water premium actually measures.

Thorsnes showed, for example, that building lots that border forests sell at higher premiums of 19% to 35% (Thorsnes, 2002). Mahan, et al. found that property values are influenced by size of the nearest wetland, but not by wetland type; suggesting that implicit prices of the aesthetic externalities move with the real estate cycle (Mahan, et al., 2000). In addition, Bourassa, et al. suggested that varying premiums should be considered when valuing properties, depending on the supply of aesthetic externalities in a given city. He also mentioned that, these premiums are found to vary over time in dynamic markets, suggesting that hedonic valuation models should be updated on a regular basis (Bourassa, et al., 2006).

Benson, et al. examined the impact of views in Bellingham, Washington using dummy variables. They used four levels of ocean view (full, superior partial, good partial, and poor partial), two levels of lake view (view from a lakefront property and view from a non-lakefront property), and whether or not the property has a mountain view. Bourassa, et al. analysed the multidimensional feature of view (type of view, scope of view, distance to coast, and quality of surrounding improvements) and empirically tested the impact of views using dummy variables. The results indicate that aesthetic externalities have a significant impact on residential property values (Benson, et al., 1998; Bourassa, et al., 2003; Bourassa, et al., 2006). Views are also found to have substantial impact on property values in most studies (Darling, 1973; Plattner and Campbell, 1978; Gillard, 1981; Bond, et al., 2002). Therefore, one of the alternate means to measure acceptability is through water premium.

2.6 Conceptual Framework

Analysing and coinciding, "Happiness" and "Aesthetic" theories and concepts with indicators of "Aesthetic service", the conceptual framework that soundly represents the research objective has been presented, in Figure-6.

The service criteria of landscape aesthetic by water-body are, related to availability, accessibility and acceptability of the service. Through these service criteria, visual stimulation and perception process occurs resulting in different sensation. Positive sensation or affect gratifies our need. The propensity of these relative "Need gratification" creates experiential difference in happiness.

Gratification of Need and Happiness are proportionally related. With increase in gratification of need affective experience of happiness increases. In the following figure, the seesaw standing on the pivot represented by the black line is the state of mind, where horizontal dashes are showing the neutral state. With more gratification of need pressing one side, the positive feeling elevates on the other side. The higher the positivity and the longer the duration, the happier we are. This happiness is not materialistic.

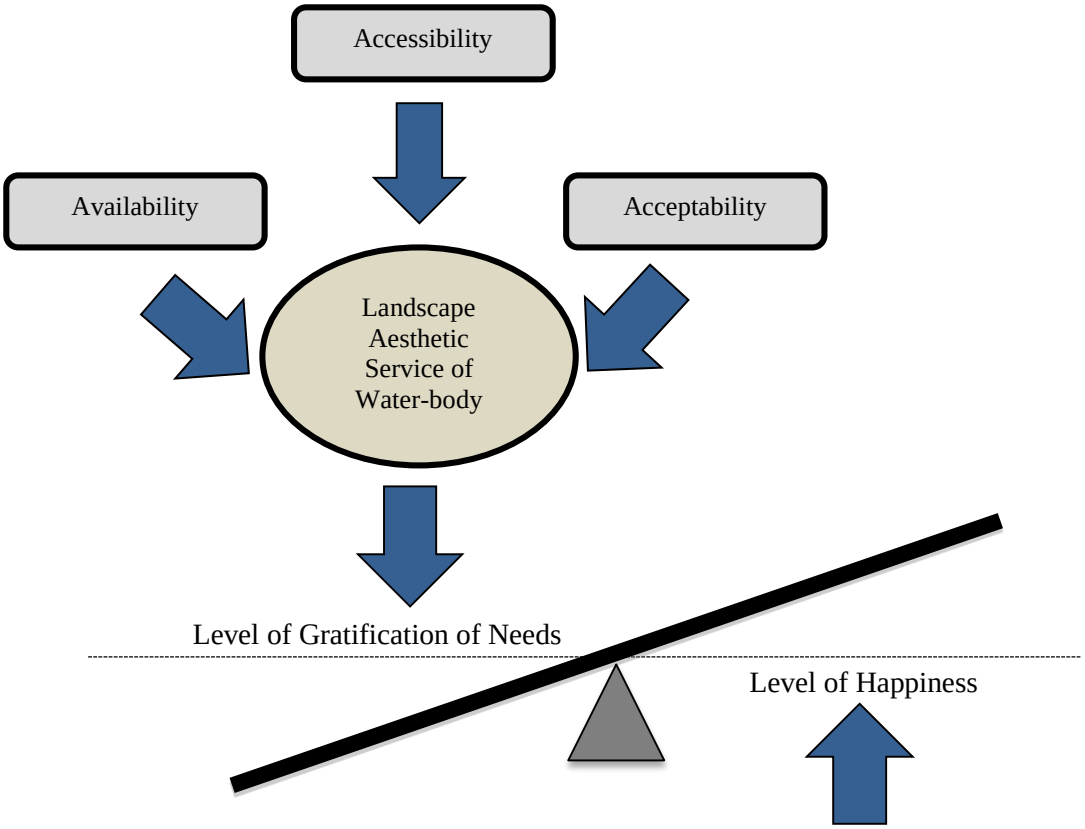

Figure 6: Conceptual Framework, Source: Author, 2015.

'Needs' provide unconscious happiness signal and is almost universal. Improvements of our living environment through available, accessible and acceptable services of water-bodies are prerequisites for affective experience of happiness.

Chapter: 3 Research Design and Methods

Chapter 3 describes the research design and methods that has been used to answer the research questions. At the beginning, it starts with defining variables and indicators that derived from conceptual framework and research question. Later, the chapter describes the two data analysis methods that have been used in the research. The chapter also includes information on the research instruments, unit of analysis, research models; and validity and reliability of collected data and conducted research.

3.1 Research Question(s)

The revised main and sub-research questions are stated below (Box-1).

Box 1: Revised Research Questions

Main research question:
How does aesthetic service of water-body in urban landscape impact happiness of people in the city of Rotterdam?

Sub-research questions:

1. How does availability of water-bodies influence landscape aesthetic service in the city of Rotterdam?
2. How does accessibility of water-bodies influence landscape aesthetic service in the city of Rotterdam?
3. How does acceptability of water-bodies influence landscape aesthetic service in the city of Rotterdam?

3.2 Operationalization: Variables and Indicators

Table 4: Overview of Research Question, Source: Author, 2015.

Research Question	Variables in Broad	Variables	Indicators	Data Collection	Analysis
How does aesthetic service of water-body in urban landscape impact happiness of people in the city of Rotterdam?	Landscape Aesthetic services of water-body	Availability of water-body	Land cover data	Data extracted from maps, Secondary Data	Quantitative and Descriptive statistics (STATA)
			Typology of water-body	Data extracted from maps, Secondary Data	
		Accessibility to water-body	Direct-Frontage	Data extracted from maps, Secondary Data	
			Indirect-Proximity	Data extracted from maps, Secondary Data	
		Acceptability of water-body	Willingness to pay and Willingness to accept	Land price or Property value from secondary data, Travel distance cost, Questionnaire	
	Happiness	Happiness	Satisfaction/ Gratification of need	Database, Questionnaire	

In operationalization, the conceptual framework has been translated into empirical measurable variables and indicators, as presented in Table-4 with the definitions of them that are presented in Table-5 and Table-6. The theories or concepts that are discussed in literature review are placed alongside each of the variables that are also elaborated in Literature section and can be linked to a specific question that the research aims to answer.

Table 5: Definitions of Variables, Source: Author, 2015 Based on Diener, et al, 1991; Costanza, et al, 2006; Sovd, et al, 2006; Veenhoven, 2009; Ambrey and Fleming, 2011; and Melichar and Kaprova, 2013.

Variables	Definition	Theory/ Concept
Availability of water-body	Availability denotes collection or combination of a specific service, it impacts the contextual specificity of value transfer by allowing human to visualise the size and location of that landscape element and overlay them with other relevant themes like, bio-geophysical or socio-economic for analysis (Costanza, et al., 2006; Melichar and Kaprova, 2013).	Prospect-Refuge Theory & Information Processing Theory
Accessibility to water-body	Accessibility is correlated to quantity (Elliott and Hunsley, 2015). In case of water-body in urban landscape, the scope of direct and indirect accessibility (Costanza, et al., 2006) is related to the degree of exposure.	Aesthetic-Affective Theory & Information Processing Theory
Acceptability of water-body	It is subjective in nature, involves human perception and can be objectively measured (Ambrey and Fleming, 2011). Non-market valuation, that determines acceptability, is the key determinants of aesthetic service and human satisfaction (Sovd, et al., 2006; Ambrey and Fleming, 2011) and pre-condition for quality measures.	Prospect-Refuge Theory, Savannah Hypothesis & Information Processing Theory
Satisfaction/ Gratification of need	We infer happiness from on-going affective experience and this affective experience reflects need-gratification. Therefore, the propensity in level of need or demand gratified justifies the experiential difference of happiness (Diener, et al., 1991; Veenhoven, 2009).	Affect Theory & Livability Theory

Table 6: Definitions of Indicators, Source: Author, 2015 Based on Eves, 2005; Costanza, et al., 2006; Ambrey and Fleming, 2011; and MacKerron and Mourato, 2013.

Indicators	Definition
Land cover data	Gestalt features; i.e. area, scale, shape, and fractionalization also Compositional features: i.e. ratio of built area, green area and area of water-bodies (Costanza, et al., 2006; MacKerron and Mourato, 2013).
Typology of water-body	Typology relates to land-cover and quantity of service type (Costanza, et al., 2006; MacKerron and Mourato 2013). Inland water bodies are areas of water, natural and human-influenced, large and small, which are distinct from one another in various ways. The largest inland water bodies are rivers, while the smallest are ponds. Smaller accumulations of water, such as puddles or swimming pools are not usually referred to as bodies of water in the geographical sense and discarded in this research.
Direct-Frontage	Frontage is the boundary between a plot of land or a building and the road onto which the plot or building fronts. For water-body frontage refers to the full length of this boundary (Eves, 2005; Costanza, et al., 2006).
Indirect-Proximity	A gestalt principle of organization holding that other things being equal, objects or events that are near to one another in space or time are perceived as belonging together as a unit (Eves, 2005; Costanza, et al., 2006).
Willingness to pay and Willingness to accept	Willingness to pay (WTP) is the maximum amount an individual is willing to sacrifice to procure a good or to avoid something undesirable. The price of any goods transaction will thus be any point between a buyer's willingness to pay and a seller's willingness to accept (Ambrey and Fleming, 2011).

3.2.1 Dependent Variable, Y= Happiness

The Y variable represents, self-reported happiness ranking by the inhabitants of Rotterdam. The happiness measure in this study is one of the most direct measures of happiness since the respondents are asked to make a judgment of whether they are happy or unhappy. The original data is ordinal and has a scale of four (4). The question for the collected data is, "All in all, are you happy?" where, 1 = very happy, 2 = happy, 3 = not so happy, and 4 = not at all happy. The data has been collected from "The Municipality of Rotterdam" and represents the year 2009.

In the research, two (2) types of geographical models have been used. Therefore, the original survey data has to be averaged and made continuous according to the two models. The ordinal data has been also adjusted and inversed due to bring clarity to interpretation. Ultimately the question become, "All in all, are you happy?" where, 1 = not at all happy, 2 = not so happy, 3 = happy, and 4 = very happy.

3.2.2 Independent Variable, X_1= Availability

The X_1 variable represents, spatial data according to land coverage and coverage type, denoting availability. "Total Land Area (X_{11})", "Total Green Area (X_{12})", "Area of Outer-dyke Tidal Water-body (X_{13})", "Area of In-dyke Water-body (X_{14})", "Open Space Ratio (X_{15})", and "Dwelling per Hectare (X_{16})"; are the indicators of this category. The data has been collected from "Centre bureau of Statistics Netherland" and from "The Municipality of Rotterdam". The data is continuous and crosschecking has been done to represent the year 2009.

Figure 7: In-dyke and Outer-dyke Area of Rotterdam, Source: RCI, 2013.

3.2.3 Independent Variable, X_2= Accessibility

The X_2 variable represents, spatial data according to proximity of coverage types, denoting accessibility. "Frontage and Proximity of Outer-dyke Tidal Water-body (X_{21})", "Frontage and Proximity of In-dyke Water-body (X_{22})", and "Frontage and Proximity of In-dyke Lake (X_{23})"; are the indicators of this category. The data has been generated using buffer analysis from the GIS maps collected from "The Municipality of Rotterdam". Six (6) proximity-based buffer zones have been created to measure impact (Brereton, et al. 2008), i.e. from 0-50m=1,

51-100m=2, 101-150m=3, 151-200m=4, 201-250m=5, and >250m=6. Here, the number one (1) is the closest and the number six (6) furthest from the specific water-mass.

"Outer-dyke Tidal Water-body" represents the River Mass and it's branches, "In-dyke Water-body" represents all type of open water-body within dyke area that includes; lake, canal, and different sizes of water reservoir; lastly "In-dyke Lake" represents only the four (4) major lakes of Rotterdam, they are; Zevenhuzerplas, Kralingsche Plas, Bergsche Achterplas and Bergsche Voorplas.

3.2.4 Independent Variable, X_4= Acceptability

The X_4 variable represents, hedonic pricing related data of Willingness to pay and Willingness to accept, denoting acceptability. "Value of House (X_{41})", and "Weekly Expense on Travel (X_{42})"; are the indicators of this category. The data is continuous and original data represents the year 2012 and 2013. The data has been collected from "The Municipality of Rotterdam", "Google Maps", and "Worldwide Inflation Data".

"Value of House" represented the year 2013. Therefore, back calculation has been done to suite the data for the year 2009, incorporating data of inflation. Inflation is calculated accordingly, i.e. 3% (2023-2012), 2.5% (2012-2011), 1.97% (2011-2010), and 0.82% (2010-2009).

"Weekly Expense on Travel" is based on traveling time and the data is at neighbourhood level. The shortest time taken by using public transport, to reach Rotterdam Central Station from Geographical-Centre of each neighbourhood is first generated, and then the time is converted into monetary unit by using average pay/hour for each neighbourhood. Again, inflation is calculated to make the data suited for the year 2009.

3.2.5 Independent Variable, Z= Bio-geophysical and Socio-economic

The Z variable represents, Bio-geophysical and Socio-economic indicators used in different research papers (Frey, 2008; Howley, 2011; Wang, et al., 2014), and consulting aesthetic theories of landscape as presented in Table-7. The data has been collected predominately from "The Municipality of Rotterdam".

Table 7: Description of Independent Bio-geophysical and Socio-economic Indicators, Source: Author, 2015 Based on Frey, 2008; Howley, 2011; Wang and Wong, 2014.

Indicator	Data Type	Indicator	Data Type, Unit
Income (Z_1)	Continuous, Currency	Working Hour (Z_8)	Continuous, Hour
Income Class (Z_2)	Ordinal, Scale (1-5)	Building Year (Z_9)	Continuous, Year
Percentage of Household with High Income (Z_3)	Continuous, Percentage	Area of House (Z_{10})	Continuous, Area
Unemployed Labour Force (Z_4)	Continuous, Percentage	Residence within 250m of Green Area (Z_{11})	Continuous, Ratio
Population Density (Z_5)	Continuous, Ratio	Residence within 300m of Primary Education (Z_{12})	Continuous, Ratio
Ethnic Diversity (Z_6)	Continuous, Percentage	Residence with Public Transport Stop (Z_{13})	Continuous, Ratio
Social Bonding (Z_7)	Continuous, Index	Residence within 300m of Daily Supply (Z_{14})	Continuous, Ratio

3.3 Research Strategy

This is an **"Explanatory Research",** where the main focus of the research is to explain, based on theoretical notions, a certain phenomenon and to draw a generalized conclusion at the end and for that it requires a large quantitative data. "Survey" is an efficient method for systematically collecting data from a broad spectrum of populations. It is also highly appealing when generalizability is a central research goal. Sometimes, survey research is the only means available for developing a representative picture of the attitudes and characteristics of a large population (Check and Schutt, 2012). Survey research has versatility, efficiency, and generalizability and; "counts and describes" what is out there (Sapsford, 2007). Therefore, **"Survey-based Research Strategy"** has been adopted here, based on the nature of the research objective and a large volume of **"Secondary Survey Data"** has been used for this research.

3.3.1 Reasons for Adopting Survey-Based Research Strategy

Survey-based research strategy has been adopted here; firstly because, a large volume of sampling is required to obtain information from a representative section of wider population to reveal correlation. Secondly, "Cross Sectional Survey" is adequate for this research to gain a representative picture of the present time (2009). Thirdly, the research has to deal with a large volume of secondary data in standardized format generated by using survey. Lastly, comparisons are needed to explain relationship among variables and for that "Survey" is the best strategy cause it investigates the interaction of different factors or variables and produces a better understanding of the subject to be enquired (Check and Schutt, 2012; Baars, 2015; Tudjman, 2015).

3.3.2 Limitation and Challenges in Survey-Based Research Strategy

Ensuring "External validity" is a major challenge and data is only reliable and robust if it involves adequate representative of population (Baars, 2015; Tudjman, 2015). Secondary data also reflects a discrete moment in time and needed adjustment to make comparable (Tudjman, 2015).

3.3.3 Strategies to Overcome the Limitation

A large volume of Secondary data has been collected from reliable authentic sources like, "The Municipality of Rotterdam", "Centre bureau of Statistics Netherland", and others to remove the risk of "External validity". "Internal validity (validity of measurement)" is ensured by using in this research the same questions (measurements) that has been used in the original dataset and by thus ensuring that they are measuring the same thing that the way they were intended to measure originally (Tudjman, 2015).

Using the same measurement unit as in the original data has ensured "Reliability of data". Proper conversion of data has been done to remove discreet moment in time and problem with multiple sources. Amplified analysis has been conducted by using more than one (1) secondary datasets to check the reliability of the secondary data.

3.4 Data Collection Methods and Sampling

3.4.1 Type of Data Collection Method and Sources of Information

Survey-based strategy of the research, directed it to adapt quantitative data collection method and sampling. In addition, the operationalization part for data collection channelized it towards adopting quantitative method. A large volume of **"Quantitative"** data has been collected from secondary data sources and this **"Secondary data"** has been collected from **Databases, Surveys and Maps** from government and reputed sources (Annex-3).

3.4.2 Argument for Selecting the Specific Data Collection Method

Quantitative methods and sampling has been adopted in this research to revel relationship of happiness with aesthetic service of water-bodies in urban landscape. A large volume of numeric surveyed secondary data in statistical form has been used in STATA. Quantitative research explains phenomena by collecting numerical data that are analysed using mathematic based methods (Aliaga and Gunderson, 2000; Muijs, 2011). Therefore, quantitative research is essentially about collecting numerical data to explain and generalize a particular phenomenon for a larger population and for this research paper the phenomenon is "Happiness".

There are four main types of research questions that quantitative method is particularly suited to finding an answer to: the first type of research question is that demands a quantitative answer, the second type where study on numerical changes is necessary, the third type is to explain a phenomenon, that allow us to predict scores on one factor, or variable (e.g. happiness) from scores on one or more other factors, or variables (e.g. gestalt feature, proximity, water premium, etc.) and final activity for which quantitative method is especially suited is the testing, whether there is a relationship between variables, for example, happiness and aesthetic services (Muijs, 2011). As the research question is explanatory type with testing component, so selecting quantitative method is the most suited approach and best fits the research strategy.

3.4.3 Limitation and Challenges of Data Collection Method

The main limitation and challenge with "Secondary data collection Method" is choosing the most authentic source from where the quantitative data has to be collected. Re-testing collected data for "Validity" and "Reliability" can overcome the obstacle.

3.4.4 Unit of Analysis

Two types of geographical based models (Model-1 & Model-2) have been isolated for in-depth study and comparison purpose within the scope of survey. In the Earth, due to factor endowments too much generalization has the chance to produce non-reflective results. The research work this paper is analysing is about the collective unconscious happiness of human being. Therefore, studying it from different level is also explore-able to find out the relevance and changes due to difference in modeling.

The unit of analysis of **Model-1** is "Neighbourhood". Rotterdam has ninety-two neighborhoods' but due to some missing data, seventy-two units have been statistically analysed. The data that is used for analysing has been adjusted and the statistical findings represent the year 2009. The description of data sources and conversion for Model-1 are attached as annexure (Annex-5).

The unit of analysis of **Model-2** is "Individuals". Among happiness data of Two hundred Seventy thousand Three units, due to some missing data in case of other variables, approximately One hundred Sixty Four thousand units have been statistically analysed. Like Model-1, the statistical findings represent the year 2009. The description of data sources and conversion for Model-2 are attached as annexure (Annex-6).

3.5 Data Analysis Method

Principal component analysis and Multivariate regression analysis methods have been used to formulate scientific results.

3.5.1 Principal Component Analysis

Principal Component Analysis with "Varimax Rotation" has been employed on the data to capture aesthetic services of water-body and their loadings on happiness. Principal component analysis is predominantly used where correlation is higher among independent variables (Kaiser, 1960; Kline and Wichelns, 1998; Howley, 2011). Kaiser-Meyer-Olkin measure of sampling adequacy has been done to find if the data is informative enough for principal component analysis.

3.5.2 Statistical Equation for Multivariate Regression

The equation of the multivariate linear regression model that is used for analysing the data is,

$y = \beta_0 + \sum \Upsilon_k x_k + \sum \delta_k z_k + \varepsilon$

In the above equation, Dependent variable, y = Happiness

x_k = Independent variables of Aesthetic Service

Where, x_1 = Availability (Land cover and typology related data)

x_2 = Accessibility (Frontage and proximity related data)

x_3 = Acceptability (Water premium related data)

z_k = Controlled Independent variables

β_0, Υ_k, δ_k = Regression coefficient

ε = Random error

For Model-1, y measures happiness of “Neighbourhood”. x and z are vectors simultaneously including variables of aesthetic services of water-body and variables suggested by previous studies at neighbourhood level.

For Model-2, y measures happiness of “individuals”. x and z are vectors simultaneously including variables of aesthetic services of water-body and variables suggested by previous studies at individuals and neighbourhood levels.

3.6 Validity and Reliability of the Research Design and Methods

“Internal Validity” refers to the extent to which the chosen research instrument accurately measures that it is intended to measure (Sapsford, 2007; Tudjman, 2015). In all cases, the instrument, as from operational definition, has been logically consistent and covered comprehensively the concept that is studied. The secondary data that this research used also measures the different indicators according to operational definition.

“External Validity” refers the degree of generalizing the research finding for the target population (Baars, 2015). In this research, adequate sampling and homogenous geographical clusters increased “External Validity” and generalizing the result for broader population has been ensured.

Reliability is the consistency of measurement, or the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects (Baars, 2015; Tudjman, 2015). Therefore, it has been ascertain by ensuring transparency and keeping record of every steps. For this research transparency in the data collection, data modification, data alteration, and accepting data from reputed source increased its reliability.

Chapter: 4 Research Findings

In chapter 4, using secondary survey data on Model-1 and Model-2, the statistical link between happiness and aesthetic services of water-body in Rotterdam has been tabulated. Statistical interpretation is also provided that helps to draw a raw conclusion.

4.1 A Geographical Overview

This section, gives a general idea about the research area as a whole, the residential location of the individuals providing the self-proclaimed happiness statement and concerning neighbourhood areas as shown in Figure-8 for a better understanding to relate with statistical discussion.

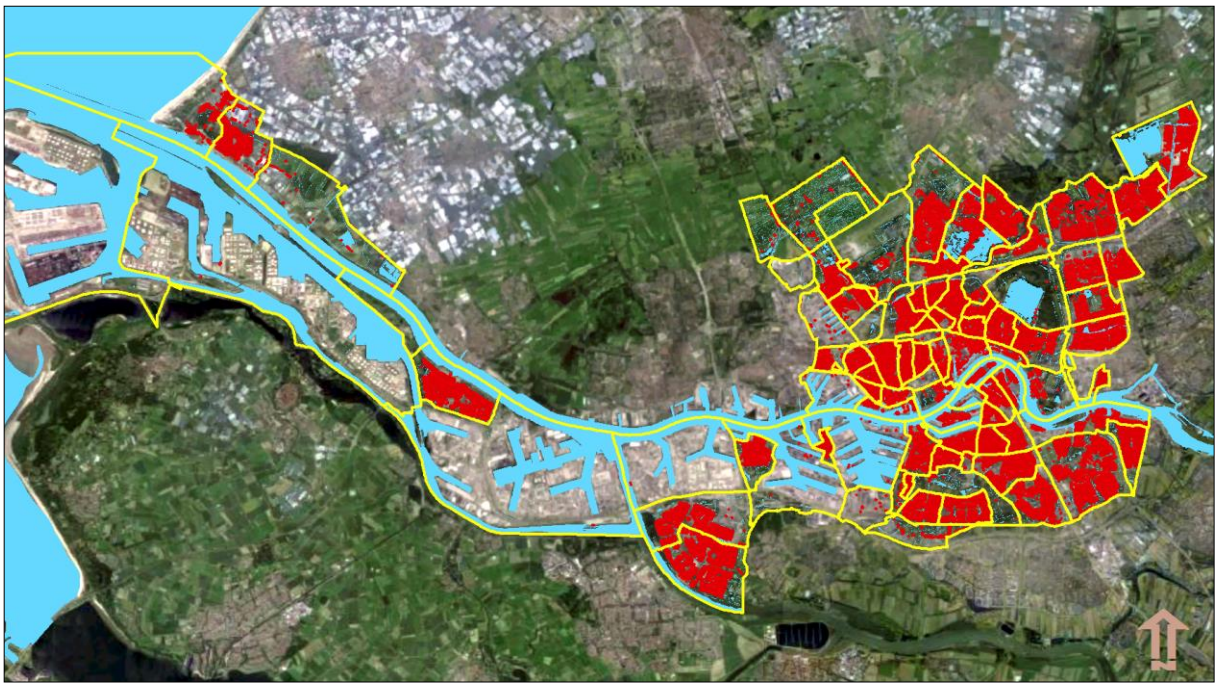

Figure 8: Map of Rotterdam Showing Neighbourhood Boundary, In-dyke and Outer-dyke Water-body, and Position of Individuals in Red Dots. Source: Gemeente Rotterdam, 2013 and Google Maps, 2015.

4.2 Model-1

The "Descriptive Statistics" of Model-1 has been shown in Table-8, with the maximum (92) and minimum (76) number of observations. Twenty-Five (25) independent variables or indicators that came out significant from the theories, concepts, and from previous research are listed in the table. Among them Twenty (20) independent variables or indicators have subsisted for further statistical analysis after removing multi-collinearity and making linear relationship between the dependent and independent variables (Annex-5).

The statistical analysis for Model-1 started with "Principal Component Analysis" and later "Multivariate Linear Regression" has been done to have a detailed picture of the phenomenon.

Table 8: Descriptive Statistics of Model-1, Source: Author, 2015

	Mean	SD	Min	Max	*N*
Average Happiness	3.104276	0.2050113	2.666667	4	80
Total Land Area	2139.489	3387.55	43.29554	24281.35	92
Tidal Water Area Outer-dyke	1209.968	5764.979	0	50452.29	92
Water Area In-dyke	191.7768	388.7991	0	2108.823	92
Total Green Area	0.2424344	0.1819202	0.0294343	0.9298217	92
Open Space Ratio	4.497397	17.35074	0	131.2131	92
Dwelling per Hectare	33.19954	29.75574	0	107.8329	92
Average Distance from Tidal Water Outer-dyke	5.29546	1.188428	1.666667	6	87
Average Distance from Water In-dyke	3.252058	1.422325	1	6	87
Average Distance from Lake In-dyke	5.878363	0.3345563	4.642167	6	87
Average House Value	179994.3	147739.1	77905.02	1010548	85
Weekly Expense on Travel	42.4263	23.58301	7.051282	127.9968	76
Average Working Hour per Week	30.87084	7.552245	0	60	80
Income after Tax Deduction	22701.32	5760.312	16600	42700	76
Average Income Class	3.299249	0.5654078	2.083333	5	80
Percentage of Household with High Income	0.1106522	0.1137068	0	0.5	92
Average of Building Year	1958.336	18.93784	1910.269	2005.387	87
Average Area of House	83.98694	14.14947	62.55647	123.85	86
Population Density	0.0071163	0.0059447	1.09e-07	0.0195466	85
Unemployed Labour Force	0.0679066	0.0467744	0	.25	92
Ethnic Diversity	1.871636	13.60191	0	128	88
Social Index Bonding	4.370652	2.445293	0	8.2	92
Residence within 250m of Green Area	0.467796	0.3204753	0	1	92
Residence within 300m of Primary Education	0.4620727	0.342877	0	1	92
Residence with Public Transport Stop	0.7114013	0.3215098	0	1	92
Residence within 300m of Daily Supply	0.5527493	0.3773764	0	1	92

4.2.1 Principal Component Analysis

Kaiser-Meyer-Olkin measure of sampling adequacy establishes the logic for principal component analysis. Here in Table-9 most of the kmo of the variables have value greater than 0.5, so it can be said that the data is informative enough for principal component analysis.

Table 9: Kaiser-Meyer-Olkin Measure of Sampling Adequacy, Source: Author, 2015.

Variable	kmo
Total Land Area	0.6724
Tidal Water Area Outer-dyke	0.4071
Water Area In-dyke	0.6233
Total Green Area	0.7175
Average Distance from Tidal Water Outer-dyke	0.3524
Average Distance from Water In-dyke	0.7473
Average Distance from Lake In-dyke	0.3462
Average House Value	0.7605
Weekly Expense on Travel	0.8767
Average Working Hour per Week	0.2431
Average Income Class	0.8421
Average of Building Year	0.3635
Population Density	0.8936
Unemployed Labour Force	0.8327
Ethnic Diversity	0.7881
Social Index Bonding	0.3866
Residence within 250m of Green Area	0.4515
Residence within 300m of Primary Education	0.8199
Residence with Public Transport Stop	0.8074
Residence within 300m of Daily Supply	0.8686
Overall	0.7264

Table 10: Principal Component Analysis of Model-1, Source: Author, 2015.

Component	Eigenvalue	Difference	Proportion	Cumulative
Component 1	7.5107	5.48304	0.3755	0.3755
Component 2	2.02766	0.331206	0.1014	0.4769
Component 3	1.69645	0.391526	0.0848	0.5617
Component 4	1.30493	0.139285	0.0652	0.6270
Component 5	1.16564	0.130936	0.0583	0.6853
Component 6	1.03471	0.0749613	0.0517	0.7370
Component 7	0.959744	0.199251	0.0480	0.7850
Component 8	0.760493	0.0537192	0.0380	0.8230
Component 9	0.706774	0.146781	0.0353	0.8584
Component 10	0.559993	0.00773446	0.0280	0.8864
Component 11	0.552258	0.116927	0.0276	0.9140
Component 12	0.435331	0.126315	0.0218	0.9357
Component 13	0.309016	0.0852334	0.0155	0.9512
Component 14	0.223783	0.0295663	0.0112	0.9624
Component 15	0.194217	0.0417005	0.0097	0.9721
Component 16	0.152516	0.0199552	0.0076	0.9797
Component 17	0.132561	0.00424686	0.0066	0.9863
Component 18	0.128314	0.0488554	0.0064	0.9928
Component 19	0.0794586	0.0140019	0.0040	0.9967
Component 20	0.0654568	.	0.0033	1.0000

The principal component analysis resulted in six (6) factors with an eigenvalue > 1, together explaining approximately 74% of the variance, as presented in Table-10. The table also shows that, component-1 is the principal one behind explaining 38% variation in the data, while component-2 explains 10% variation and so on. Also, from Scree plot (Figure-9), it can be seen that compont-1 has an eigenvalue greater than 7 (7.51 to be exact) and component-2 has an eigenvalue of 2 (2.02 to be exact) resulting in a steep curve. The red line shows the limit where, eigenvalue=1.

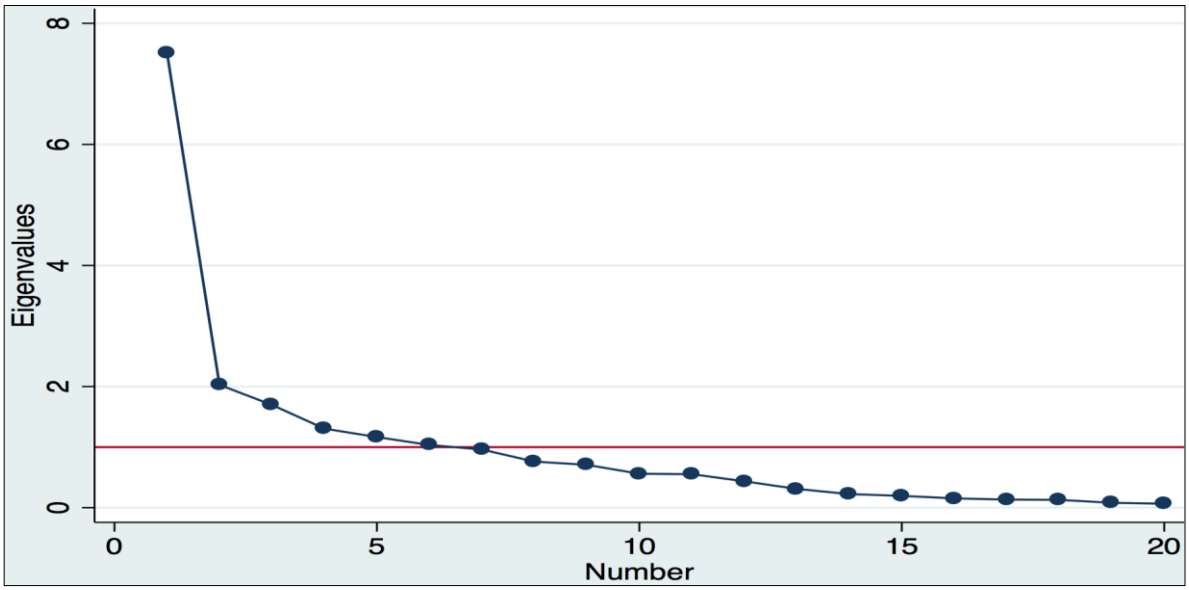

Figure 9: Scree Plot of Eigenvalues after PCA, Source: Author, 2015.

Table 11: Varimax, Orthogonal Rotation (Keeping Loading Values> .3), Source: Author, 2015.

Variable	Comp-1	Comp-2	Comp-3	Comp-4	Comp-5	Comp-6	Unexplained
Total Land Area		-0.5019					0.195
Tidal Water Area Outer-dyke						0.7963	0.1476
Water Area In-dyke				0.4442			0.2907
Total Green Area		-0.4206					0.1767
Average Distance from Tidal Water Outer-dyke			0.7148				0.1719
Average Distance from Water In-dyke			-0.5306				0.149
Average Distance from Lake In-dyke				-0.6520			0.3043
Average House Value	-0.3471						0.2254
Weekly Expense on Travel						0.3095	0.2808
Average Working Hour per Week					0.5881		0.4609
Average Income Class	-0.3184						0.2081
Average of Building Year					0.5713		0.4077
Population Density							0.2804
Unemployed Labour Force	0.3389						0.3117
Ethnic Diversity	0.3313						0.1939
Social Index Bonding		0.5951					0.2554
Residence within 250m of Green Area				0.5246	-0.3406		0.3346
Residence within 300m of Primary Education	0.3452						0.263
Residence with Public Transport Stop							0.3535
Residence within 300m of Daily Supply							0.2495

The "Varimax Orthogonal Rotation" from the PCA of the multiple value items designed to capture happiness values has been presented in Table-11 and Figure-10.

4.2.1.1 Result of PCA for Model-1

The statements relating to "House Value", "Income Class", "Unemployed Labour", "Ethnic Diversity" and "Proximity to Primary Education" are loaded highly on the first component and can explain approximately 38% variance in happiness. Statements relating to "Land Area", "Green Area" and "Social Index Bonding" are loaded moderately high on the second component and can explain approximately 10% variance in happiness. Statements relating "Proximity and Frontage to Outer-dyke Water-body and In-dyke Water-body" are also loaded moderately high on the third component and can explain approximately 8% variance in happiness. Lastly, statements relating to "In-dyke Area of Water-body", "Proximity and Frontage to Lake" and "Proximity to Green Area" are loaded on the fourth component, statements relating to "Working Hour" and "Building Year" is loaded on the fifth component, and statements relating to "Area of Tidal Water-body" and "Travel Expense" are loaded on the sixth component. They are less highly loaded and can explain approximately 7% 6% and 5% variance in happiness, consecutively. While, 26% of the remaining variance in happiness stays unexplained.

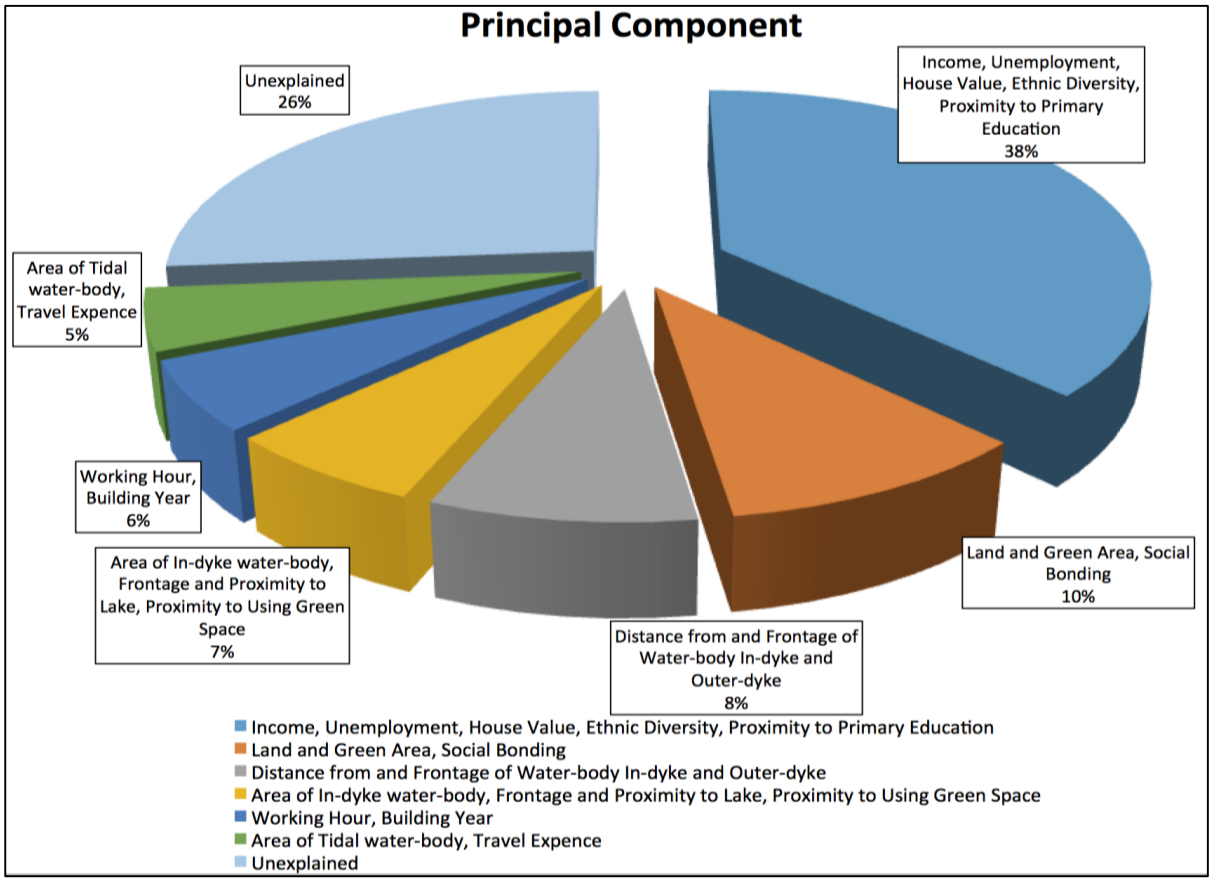

Figure 10: Loading Values of Components, Source: Author, 2015.

The numbers of components retained for analysis are typically determined by the number of eigenvalues of the correlation matrix that are greater than one (Kaiser, 1960; Kline and Wichelns, 1998; Howley, 2011). This means that the variance of each of the factors extracted is at least equal to the variance attributed by one of the variables used in the analysis (Howley, 2011). In case of Model-1, the component loading does not explicitly separate each indicator and need further input for best result. Therefore, the logic behind analysing the data more critically and the basis for Model-2 has been established.

4.2.2 Multivariate Linear Regression Analysis

Table-12 presents the result of the Multivariate Linear Regression of Model-1. The variables without the malice of multi-collinearity are regressed. VIF is well below 10, with 7.33 as highest, 1.32 as lowest and 3.8 as mean values (Annex-7).

Table 12: Happiness Outcomes as a Function of Different Independent Variables, Multivariate Linear Regression of Model-1, Source: Author, 2015.

Variables	(1)	Variables	(1)
Total Land Area	0.0000327 (0.0000216)	Average Income Class	0.1519563** (0.047026)
Tidal Water Area Outer-dyke	-0.0000105 (0.0000879)	Average of Building Year	-0.0010748 (0.0013013)
Water Area In-dyke	0.0000161 (0.0000625)	Population Density	-3.056627 (5.516333)
Total Green Area	-0.5408148* (0.2084923)	Unemployed Labour Force	-0.2334732 (0.7589133)
Average Distance from Tidal Water Outer-dyke	-0.0072867 (0.0192508)	Ethnic Diversity	0.0069643 (0.166794)
Average Distance from Water In-dyke	-0.016656 (0.0234983)	Social Index Bonding	0.0172454 (0.0206129)
Average Distance from Lake In-dyke	-0.0627625 (0.0392004)	Residence within 250m of Green Area	-0.0275115 (0.054835)
Average House Value	-0.0000214 (0.000036)	Residence within 300m of Primary Education	0.0111208 (0.0735349)
Weekly Expense on Travel	-0.0006348 (0.0011372)	Residence with Public Transport Stop	-0.1348937 (0.097343)
Average Working Hour per Week	-0.004394 (0.0047277)	Residence within 300m of Daily Supply	0.0616284 (0.0886397)
R-squared	0.5193		
Observations	72		

Note: Robust Standard Error in parentheses, *$p < 0.05$, **$p < 0.01$, *** $p < 0.001$.

4.2.2.1 Result of MLR for Model-1

According to the result represented in Table-12, 51% the total variability in Happiness can be explained by the independent variables. Here “Average Income Class” is significant, “Total Green Area” is less significant and rests of the independent variables are not significant at all. One (1) unit increase in “Average Income Class” will increase the dependent variable “Average Happiness” by 0.152 units keeping all other independent variable constant. One (1) unit increase in “Total Green Area” will decrease the dependent variable “Average Happiness” by 0.54 units keeping all other independent variable constant. Therefore, this model is less informative, for aesthetic assessment and the need of Model-2 for an in-depth study is again established.

4.3 Model-2

The "Descriptive Statistics" of Model-2 has been shown in Table-13, with the maximum (270,003) and minimum (215,158) number of observations. Twenty-Five (25) independent variables or indicators that came out significant from the theories, concepts, and from previous research are listed in the table. Among them Twenty-One (21) independent variables or indicators have subsisted for further statistical analysis after removing multi-collinearity and making linear relationship between the dependent and independent variables (Annex-6).

Table-14 presents the result of the Multivariate Linear Regression of Model-2. The VIF is well below 10, with 5.02 as highest, 1.11 as lowest and 2.57 as mean values (Annex-8).

Table 13: Descriptive Statistics of Model-2, Source: Author, 2015.

	Mean	**SD**	**Min**	**Max**	***N***
Average Happiness	3.085	0.368	1	4	270003
Total Land Area	0.165	0.137	0.021	0.558	239916
Tidal Water Area Outer-dyke	0.032	0.161	0	1.181	239916
Water Area In-dyke	0.013	0.025	0	0.195	239916
Total Green Area	0.218	0.129	0.029	0.929	239916
Open Space Ratio	0.164	0.572	0	13.121	239916
Dwelling per Hectare	4.496	2.763	0	10.783	239916
Distance from Tidal Water Outer-dyke	5.561	1.226	1	6	270003
Distance from Water In-dyke	3.283	1.805	1	6	270003
Distance from Lake In-dyke	5.873	0.663	1	6	270003
House Value	1.399	1.077	0.101	73.846	267339
Weekly Expense on Travel	0.392	0.208	0	1.279	239916
Working Hour per Week	3.222	0.878	0.1	7	237457
Income after Tax Deduction	21.61	4.612	0	42.7	266384
Average Income Class	3.251	0.907	1	5	266613
Percentage of Household with High Income	0.126	0.089	0	0.5	266384
Building Year	19.605	0.314	16.78	20.13	270001
Area of House	0.079	0.037	0.001	10.469	215158
Population Density	0.009	0.005	0	0.019	239916
Unemployed Labour Force	0.08	0.036	0	0.25	239916
Ethnic Diversity	0.49	0.188	0	0.862	266385
Social Index Bonding	0.509	0.147	0	0.82	239916
Residence within 250m of Green Area	0.527	0.286	0	1	239916
Residence within 300m of Primary Education	0.613	0.262	0	1	239916
Residence with Public Transport Stop	0.859	0.141	0	1	266384
Residence within 300m of Daily Supply	0.715	0.279	0	1	239916

4.3.1 Multivariate Linear Regression Analysis

Table 14: Average Happiness Outcomes as a Function of Different Independent Variables, Without Cut-off Values, Source: Author, 2015.

Variables	(1)	Variables	(1)
Total Land Area	-0.14*** (0.011)	Building Year	0.019*** (0.003)
Tidal Water Area Outer-dyke	0.052*** (0.008)	Area of House	-0.017 (0.02)
Water Area In-dyke	0.803*** (0.043)	Population Density	-8.956*** (0.279)
Total Green Area	-0.192*** (0.013)	Unemployed Labour Force	-0.226*** (0.036)
Distance from Tidal Water Outer-dyke	0.01*** (0.001)	Ethnic Diversity	-0.038*** (0.009)
Distance from Water In-dyke	-0.004*** (0.001)	Social Index Bonding	-0.215*** (0.007)
Distance from Lake In-dyke	0.023*** (0.001)	Residence within 250m of Green Area	-0.037*** (0.003)
House Value	0.014*** (0.002)	Residence within 300m of Primary Education	0.142*** (0.006)
Weekly Expense on Travel	0.062*** (0.008)	Residence with Public Transport Stop	0.106*** (0.007)
Average Working Hour per Week	-0.019*** (0.001)	Residence within 300m of Daily Supply	0.004 (0.006)
Income Class	0.115*** (0.001)		
R-squared	0.1124		
Observations	163908		

Note: Robust Standard Error in parentheses, *$p < 0.05$, **$p < 0.01$, *** $p < 0.001$.

In Table-14, the regression has been presented without the cut-off values. The number of observation is 1693,908. Among Twenty-One (21) regressed variables Nineteen (19) came out as highly significant for explaining the dependent variable "Happiness" with a *p* value smaller than 0.001 and the rest Two (2) came out as not significant for explaining "Happiness". In Table-15, the regression has been presented with the cut-off values.

Table 15: Average Happiness Outcomes as a Function of Different Independent Variables, With Cut-off Values, Source: Author, 2015.

Variables	(1)	Variables	(1)
Total Land Area	-0.143*** (0.011)	Distance from Lake In-dyke	
Tidal Water Area Outer-dyke	0.055*** (0.008)	Cut-2, 51-100m	0.122*** (0.009)
Water Area In-dyke	0.809*** (0.044)	Cut-3, 101-150m	0.153*** (0.009)
Total Green Area	-0.213*** (0.013)	Cut-4, 151-200m	0.144*** (0.009)
Distance from Tidal Water Outer-dyke		Cut-5, 201-250m	0.122*** (0.011)
Cut-2, 51-100m	-0.094*** (0.005)	Cut-6, >250m	0.175*** (0.008)
Cut-3, 101-150m	-0.089*** (0.005)	House Value	0.013*** (0.001)
Cut-4, 151-200m	-0.062*** (0.006)	Weekly Expense on Travel	0.062*** (0.008)
Cut-5, 201-250m	-0.138*** (0.006)	Average Working Hour per Week	-0.019*** (0.001)
Cut-6, >250m	-0.005 (0.004)	Income Class	0.113*** (0.001)
Distance from Water In-dyke		Building Year	0.016*** (0.003)
Cut-2, 51-100m	0.001 (0.002)	Area of House	-0.002 (0.02)
Cut-3, 101-150m	-0.008** (0.003)	Population Density	-9.459*** (0.282)
Cut-4, 151-200m	-0.039*** (0.003)	Unemployed Labour Force	-0.289*** (0.036)
Cut-5, 201-250m	0.009** (0.003)	Ethnic Diversity	-0.032*** (0.009)
Cut-6, >250m	0.018*** (0.003)	Social Index Bonding	-0.219*** (0.007)
		Residence within 250m of Green Area	-0.045*** (0.003)
		Residence within 300m of Primary Education	0.138*** (0.006)
		Residence with Public Transport Stop	0.104*** (0.007)
		Residence within 300m of Daily Supply	0.007 (0.006)
R-squared	0.1207		
Observations	163908		

Note: Robust Standard Error in parentheses, *$p < 0.05$, **$p < 0.01$, *** $p < 0.001$.

4.4 Result

The regression presented in Table-14 shows that, 11.24% of the total variability in "Happiness" can be explained by the independent variables.

4.4.1 Availability

Table-14 and Table-15: Independent variables related to "Availability" are land coverage and coverage according to typology. Here in statistical analysis, "Total Land Area" and "Total Green Area" came out as highly significant with a negative magnitude and; "Area of Outer-dyke Tidal Water-body" and "Area of In-dyke Water-body" came out as highly significant with a positive magnitude.

Table-14: One (1) unit decrease in "Total Land area" will increase the dependent variable "Average Happiness" by 0.14 units keeping all other independent variables constant. One (1) unit decrease in "Total Green Area" will increase the dependent variable "Average Happiness" by 0.192 units keeping all other independent variables constant.

Figure-11 and Figure-12 shows one to one relationship consecutively with "Happiness" and "Total Land Area", and "Happiness" with "Total Green Area". Here, Y-axis represents "Average Happiness". Through graph, we can see a positive relationship between "Happiness" and "Total Land Area", and "Happiness" and "Total Green Area", showing increment of land area and increment of green area increases happiness. Therefore, it is not logical to conclude that decrement of "Total Land Area" and "Total Green Area", will increase "Happiness" (Table-14), cause the regression also considers other variables. It can be concluded that, there is still scope to increase the "Area of Outer-dyke Tidal Water-body" and "Area of In-dyke Water-body" to increase "Happiness" in context of Rotterdam keeping all other variables constant.

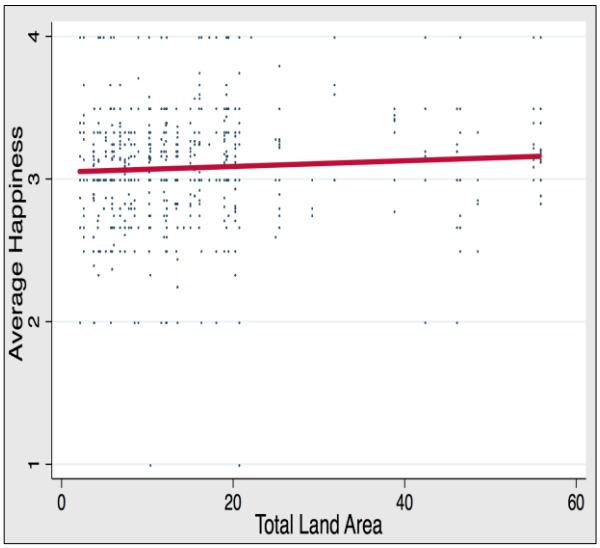

Figure 11: Scatter Plot of Average Happiness and Total Land Area, Source: Author, 2015.

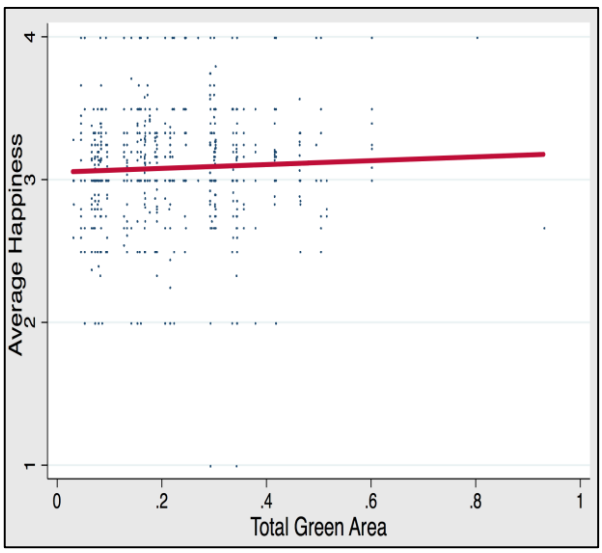

Figure 12: Scatter Plot of Average Happiness and Total Green Area, Source: Author, 2015.

Table-14: One (1) unit increase in "Area of Outer-dyke Tidal Water-body" will increase the dependent variable "Average Happiness" by 0.052 units keeping all other independent

variables constant and; one (1) unit increase in "Area of In-dyke Water-body" will increase the dependent variable "Average Happiness" by 0.803 units keeping all other independent variables constant.

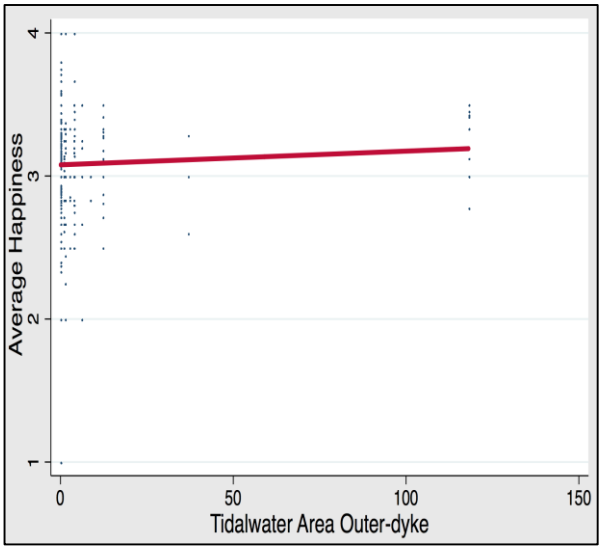

Figure 13: Scatter Plot of Average Happiness and Outer-dyke Tidal-water Area, Source: Author, 2015.

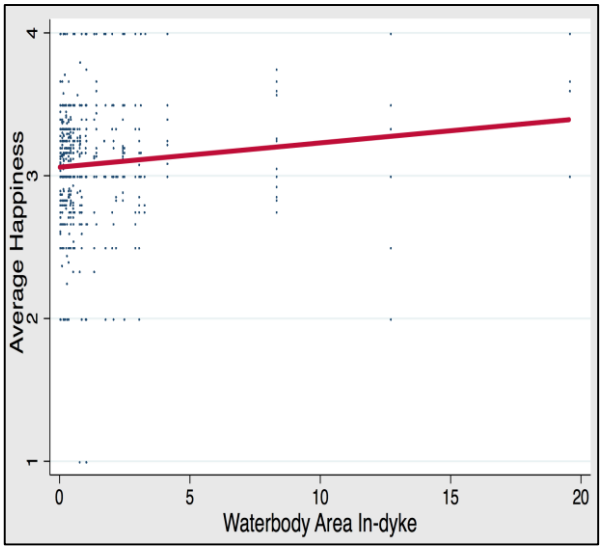

Figure 14: Scatter Plot of Average Happiness and Area of In-dyke Water-body, Source: Author, 2015.

Figure-13 and Figure-14 shows one to one relationship consecutively with "Happiness" and "Area of Outer-dyke Tidal Water-body" and "Happiness" with "Area of In-dyke Water-body". Here, Y-axis represents "Average Happiness". Through graph, we can see a positive relationship, corresponding the findings from the regression as presented in Table-14. Therefore, it again emphasizes the scope in increasing the available sources of the "Area of Outer-dyke Tidal Water-body" and "Area of In-dyke Water-body" to increase "Happiness" for the research area under study with more loading on increment of availability on "Area of In-dyke Water-body" (Figure-15).

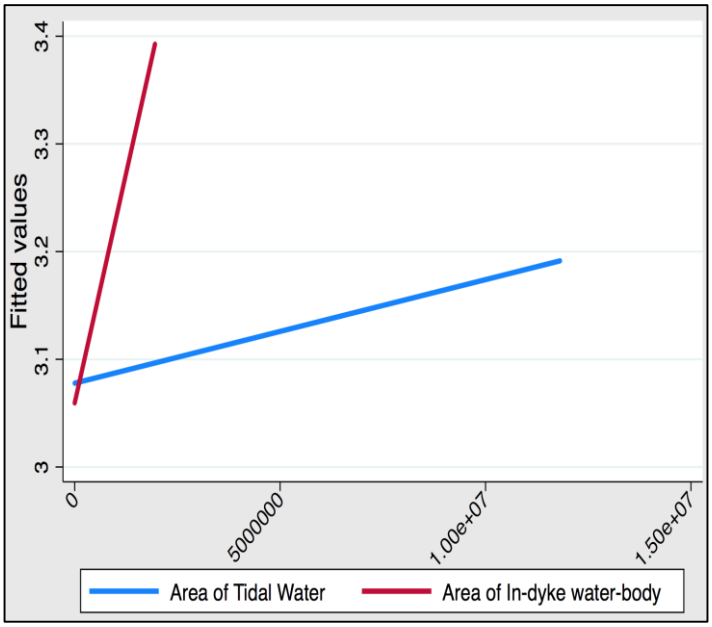

Figure 15: Fitted Lines of "Area of Outer-dyke" and "Area of In-dyke" Water-body in Comparison with "Average Happiness", Source: Author, 2015.

4.4.2 Accessibility

Table-14 and Table-15: Independent variables, related to "Accessibility" is "Water Frontage and Proximity" according to typology. Here in statistical analysis from Table-14, "Frontage and Proximity of Outer-dyke Tidal Water-body" came out as highly significant with a positive magnitude, but in Table-15 at cut-off level, it resulted overall highly significant with negative magnitude. In Table-14, "Frontage and Proximity of In-dyke Water-body" came out as highly significant with a negative magnitude. Again, in Table-14, "Frontage and Proximity of In-dyke Lake" came out as highly significant with a positive magnitude.

Table-15: Here independent variable "Frontage and Proximity of Outer-dyke Tidal Water-body" is a dummy variable and have baseline values. Therefore, comparing units within 0-50 meter distance having water-frontage and nearest proximity to "Tidal Water-body", a decrease of units within 51-100 meter distance of "Tidal Water-body" is highly significant and is more likely to increase "Average Happiness" keeping all other independent variables constant. Comparing units within 51-100 meter distance having nearer proximity to "Tidal Water-body", a decrease of units within 101-150 meter distance of "Tidal Water-body" is highly significant and is more likely to increase "Average Happiness" keeping all other independent variables constant. Again, comparing units within 101-150 meter distance having nearer proximity to "Tidal Water-body", a decrease of units within 151-200 meter distance of "Tidal Water-body" is highly significant and is more likely to increase "Average Happiness" keeping all other independent variables constant. Comparing units within 151-200 meter distance having nearer proximity to "Tidal Water-body", a decrease of units within 201-250 meter distance of "Tidal Water-body" is highly significant and is more likely to increase "Average Happiness" keeping all other independent variables constant. Lastly, keeping all other independent variables constant comparing units within 201-250 meter distance having nearer proximity to "Tidal Water-body", units within >250 meter distance of "Tidal Water-body" came out as not significant at all. The result is in correspondence with the graph presented in Figure-16.

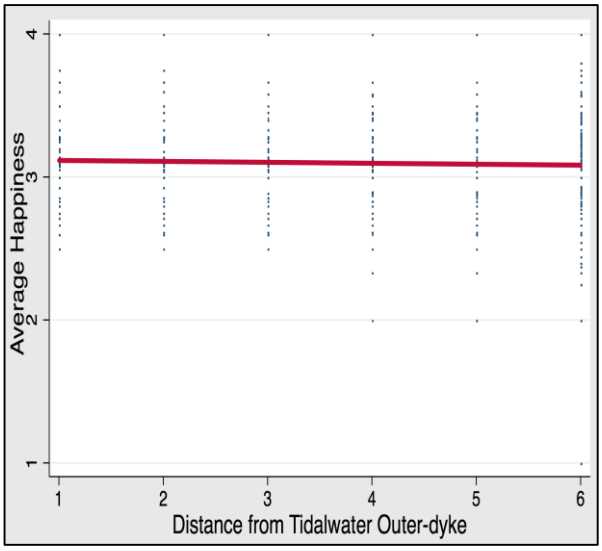

Figure 16: Scatter Plot of Average Happiness and Distance from Outer-dyke Tidal Water-body, Source: Author, 2015.

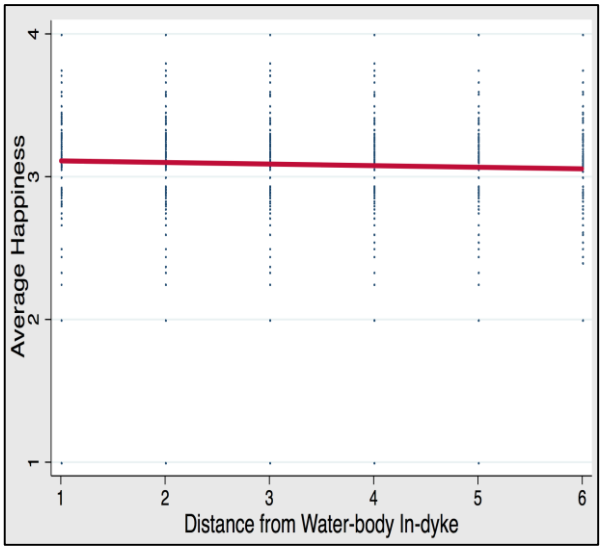

Figure 17: Scatter Plot of Average Happiness and Distance from In-dyke Water-body, Source: Author, 2015.

Table-15: Here independent variable “Frontage and Proximity of In-dyke Water-body” is also a dummy variable and have baseline values. Therefore, comparing units within 0-50 meter distance having water-frontage and nearest proximity to “In-dyke Water-body”, units within 51-100 meter distance of “In-dyke Water-body” came out as not significant at all, keeping all other independent variables constant. Comparing units within 51-100 meter distance having nearer proximity to “In-dyke Water-body”, a decrease of units within 101-150 meter distance of “In-dyke Water-body” is significant and is more likely to increase “Average Happiness” keeping all other independent variables constant. Again, comparing units within 101-150 meter distance having nearer proximity to “In-dyke Water-body”, a decrease of units within 151-200 meter distance of “In-dyke Water-body” is highly significant and is more likely to increase “Average Happiness” keeping all other independent variables constant. Comparing units within 151-200 meter distance having nearer proximity to “In-dyke Water-body”, an increase of units within 201-250 meter distance of “In-dyke Water-body” is significant and is more likely to increase “Average Happiness” keeping all other independent variables constant. Lastly, keeping all other independent variables constant comparing units within 201-250 meter distance having nearer proximity to “In-dyke Water-body”, an increase of units within >250 meter distance of “In-dyke Water-body” is highly significant and is more likely to increase “Average Happiness”. The result is in correspondence with the graph presented in Figure-17.

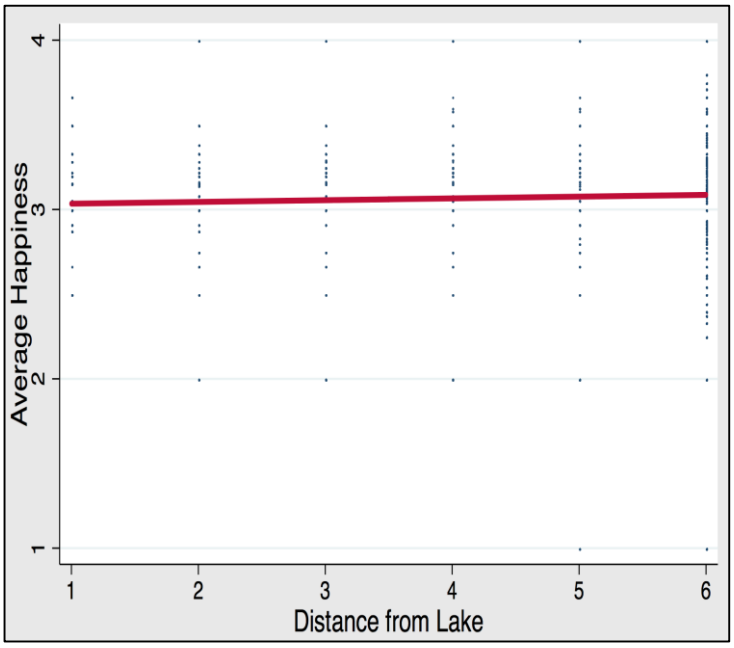

Figure 18: Scatter Plot of Average Happiness and In-dyke Lakes, Source: Author, 2015.

Table-15: Here independent variable “Frontage and Proximity of In-dyke Lake” is again dummy variable and have baseline values. Therefore, comparing units within 0-50 meter distance having water-frontage and nearest proximity to “In-dyke Lake”, an increase of units within 51-100 meter distance of “In-dyke Lake” is highly significant, keeping all other independent variables constant and is more likely to increase “Average Happiness”. Comparing units within 51-100 meter distance having nearer proximity to “In-dyke Lake”, an increase of units within 101-150 meter distance of “In-dyke Lake” is highly significant, keeping all other independent variables constant and is more likely to increase “Average Happiness”. Again, comparing units within 101-150 meter distance having nearer proximity

to “In-dyke Lake”, an increase of units within 151-200 meter distance of “In-dyke Lake” is highly significant and is more likely to increase “Average Happiness” keeping all other independent variables constant. Also, comparing units within 151-200 meter distance having nearer proximity to “In-dyke Lake”, an increase of units within 201-250 meter distance of “In-dyke Lake” is highly significant and is more likely to increase “Average Happiness” keeping all other independent variables constant. Lastly, keeping all other independent variables constant, comparing units within 201-250 meter distance, an increase of units within >250 meter distance of “In-dyke Lake” is highly significant and is more likely to increase “Average Happiness”. The result is in correspondence with the graph presented in Figure-18.

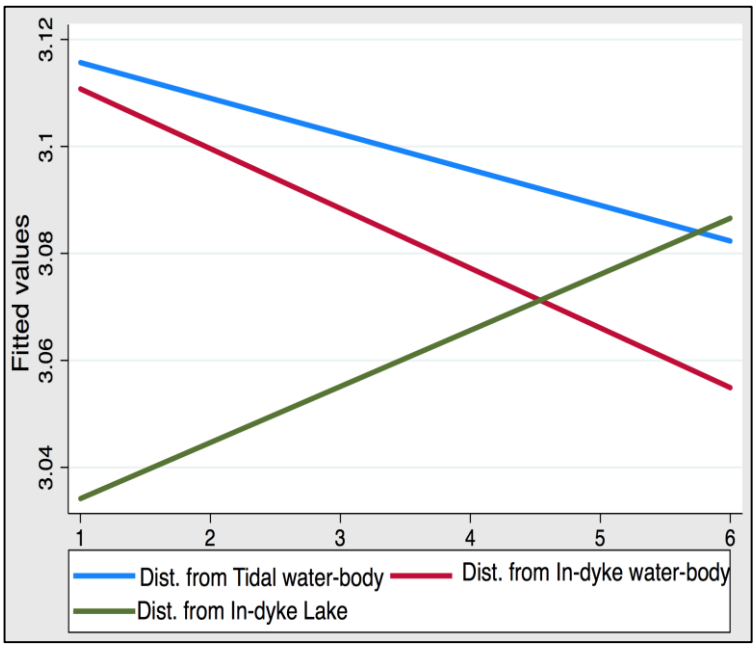

Figure 19: Fitted Lines. Distance of Outer-dyke water-body, In-dyke water-body and In-dyke Lakes with Average Happiness, Source: Author, 2015.

It can be conceded, from the result that having greater accessibility to “Outer-dyke Tidal Water-body” and “In-dyke Water-body” through “Frontage and Proximity” increases “Happiness”, while accessibility to “In-dyke Lake” shows a reverse result (Figure-19) for the area under study. In addition, from Figure-19 it is revealed that people who lives’ near “Tidal Water-body” are Happier than people living near “In-dyke Water-body”, but in case of decrement in accessibility, “In-dyke Water-body” shows a steep declination in “Happiness” rather than “Tidal Water-body”.

4.4.3 Related Independent Geo-physical Variables Regarding Availability and Accessibility

Table-14 and Table-15: Independent variables also related to “Availability” and “Accessibility” are “Percentage of Residence within 250m of Green Area”, “Percentage of Residence within 300m of Primary Education”, “Percentage of Residence with Public Transport Stop within Reasonable Distance” and “Percentage of Residence within 300m of Daily Supply”. Here in statistical analysis, “Percentage of Residence within 250m of Green area” came out as highly significant with a negative magnitude. “Percentage of Residence

within 300m of Primary Education" and "Percentage of Residence with Public Transport Stop within Reasonable Distance" came out as highly significant with a positive magnitude, but "Percentage of Residence within 300m of Daily Supply" resulted as not significant at all.

Table-14: One (1) unit decrease in "Percentage of Residence within 250m of Green Area" will increase the dependent variable "Average Happiness" by 0.037 units keeping all other independent variables constant. One (1) unit increase in "Percentage of Residence within 300m of Primary Education" will increase the dependent variable "Average Happiness" by 0.142 units keeping all other independent variables constant. In addition, one (1) unit increase in "Percentage of Residence with Public Transport Stop within Reasonable Distance" will increase the dependent variable "Average Happiness" by 0.106 units keeping all other independent variables constant. These finding are almost in correspondence with the figures presented below (Figure-20, 21 and 22).

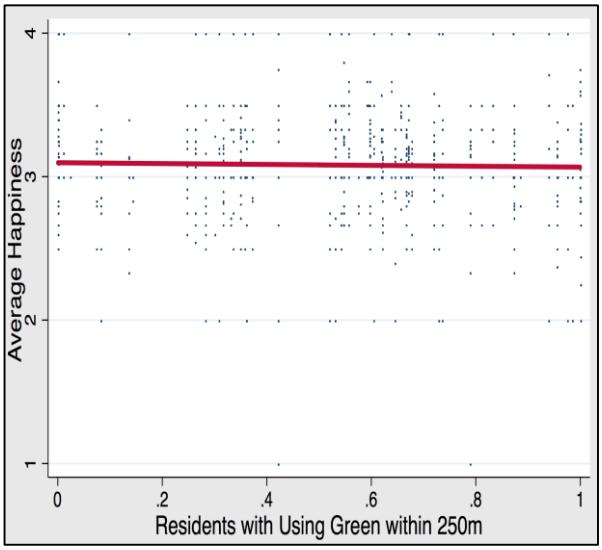

Figure 20: Scatter Plot of Average Happiness and Percentage of Residence within 250m of Green Area, Source: Author, 2015.

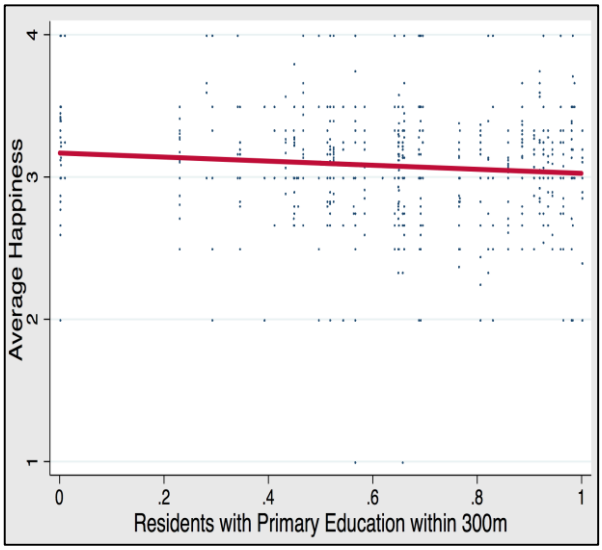

Figure 21: Scatter Plot of Average Happiness and Percentage of Residence within 300m of Primary Education, Source: Author, 2015.

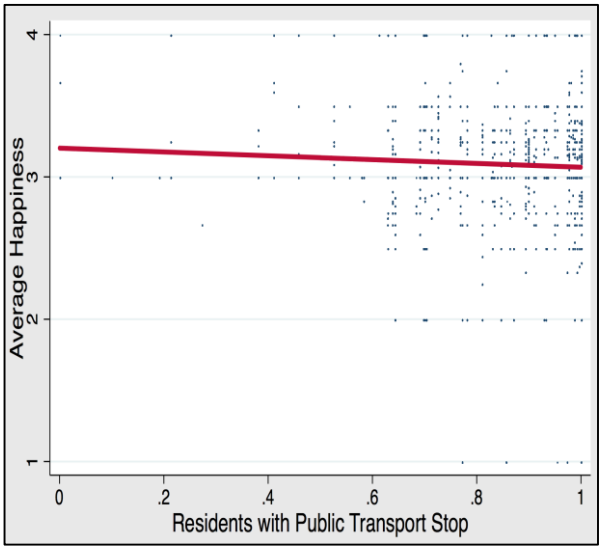

Figure 22: Scatter Plot of Average Happiness and Percentage of Residence with Public Transport Stop within Reasonable Distance, Source: Author, 2015.

4.4.4 Acceptability

Table-14 and Table-15: Independent variables related to "Acceptability" are hedonic pricing related indicators, "Value of House" and "Weekly Expense on Travel". Here in statistical analysis, they came out as highly significant with a positive magnitude.

Table-14: One (1) unit increase in "Value of House" will increase the dependent variable "Average Happiness" by 0.014 units keeping all other independent variables constant. One (1) unit increase in "Weekly Expense on Travel" will increase the dependent variable "Average Happiness" by 0.062 units keeping all other independent variables constant. These finding are in correspondence with the figures presented below (Figure-23 and 24).

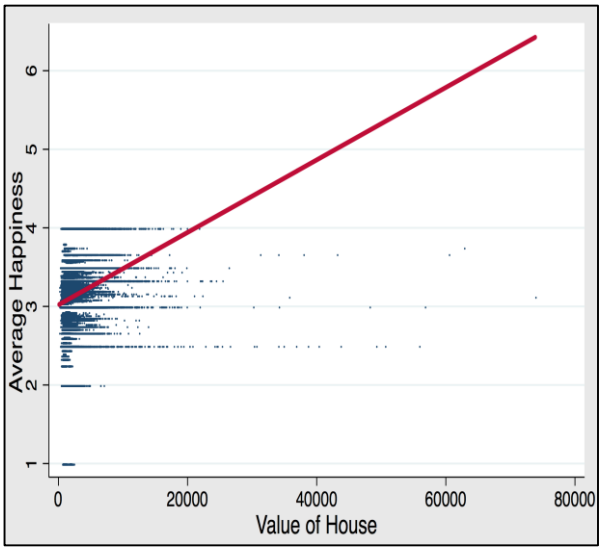

Figure 23: Scatter Plot of Average Happiness and Value of House, Source: Author, 2015.

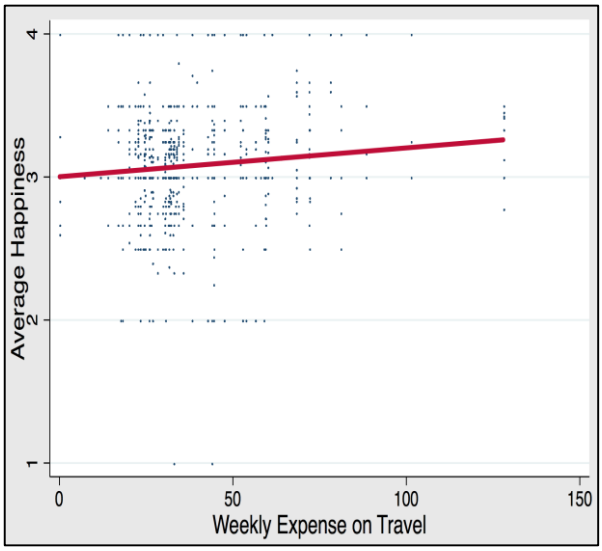

Figure 24: Scatter Plot of Average Happiness and Weekly Expense on Travel, Source: Author, 2015.

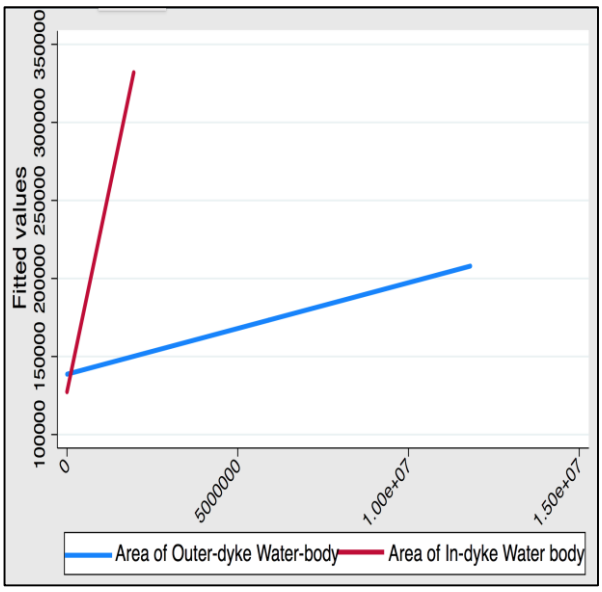

Figure 25: Fitted Lines of Value of House with Area of Outer-dyke and In-dyke Water-body, Source: Author, 2015.

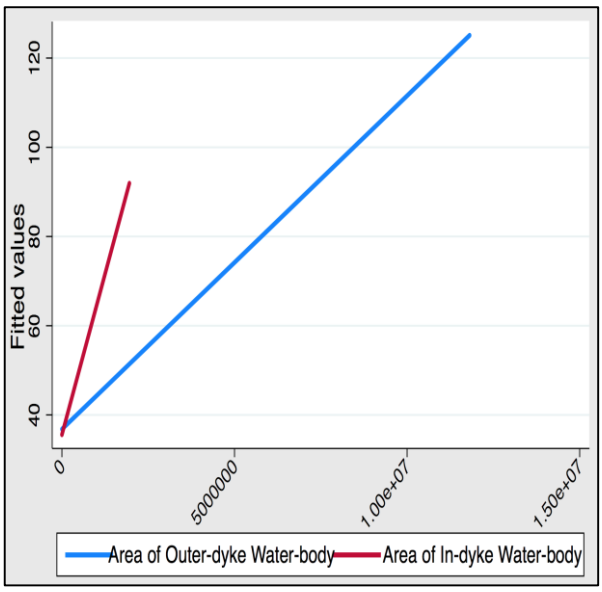

Figure 26: Fitted Lines of Weekly Expense on Travel with Area of Outer-dyke and In-dyke Water-body, Source: Author, 2015.

The graphs presented in Figure-25 show that, the "Value of House" moves proportionately with the "Area of Water-body, depicting the higher water premium people pays for it by prioritizing its acceptability. Again, Figure-26 shows that the acceptability of higher "Water Coverage Area" is higher among them, with people willing to pay more on "Travel Expense" to avail the aesthetic service.

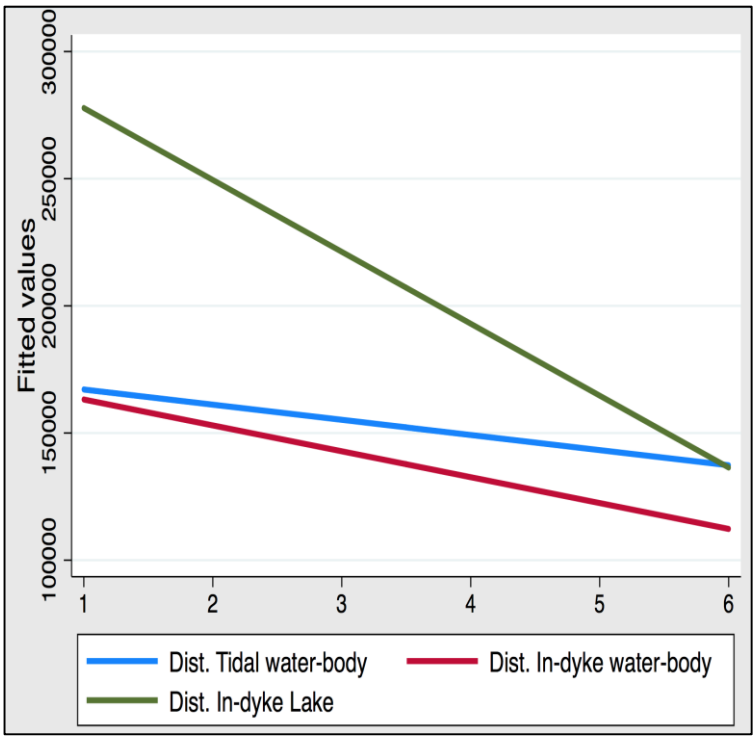

Figure 27: Fitted Line of Value of House with Distance of Outer-dyke Water-body, In-dyke Water-body and Lakes, Source: Author, 2015.

Figure-27 strengthens the statement that is described above. The "Value of House" is proportionate with "Proximity to Water-body", as shown in the graph. Peoples' acceptability to avail this service has created higher demand in the market and as a result increased the "Value of House".

4.4.5 Independent Variables Regarding Social and Living Condition

Table-14 and Table-15: Independent variables that are considered in this research related to social and living condition are, "Ethnic Diversity", "Social Index Bonding", "Population Density", "Building Year" and "Area of House" (Frey, 2008; Moro, et al., 2008; Howley, 2011; Wang and Wong, 2014). Here in statistical analysis, "Ethnic Diversity", "Social Index Bonding" and "Population Density" came out as highly significant with a negative magnitude. "Building Year" came out as highly significant with a positive magnitude. "Area of House" came out as not significant at all.

Table-14: One (1) unit decrease in "Ethnic Diversity" will increase the dependent variable "Average Happiness" by 0.038 units keeping all other independent variables constant. One (1) unit decrease in "Social Index Bonding" will increase the dependent variable "Average

Happiness" by 0.215 units keeping all other independent variables constant. In addition, one (1) unit decrease in "Population Density" will increase the dependent variable "Average Happiness" by 8.956 units keeping all other independent variables constant. On the other hand, one (1) unit increase in "Building Year" will increase the dependent variable "Average Happiness" by 0.019 units keeping all other independent variable constant.

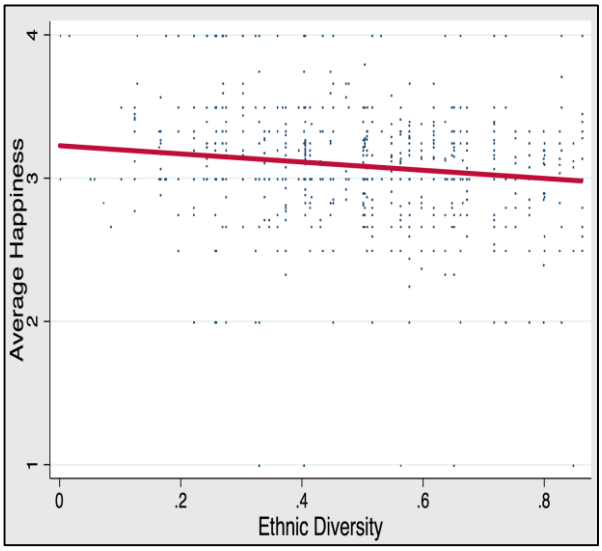

Figure 28: Scatter Plot of Average Happiness and Ethnic Diversity, Source: Author, 2015.

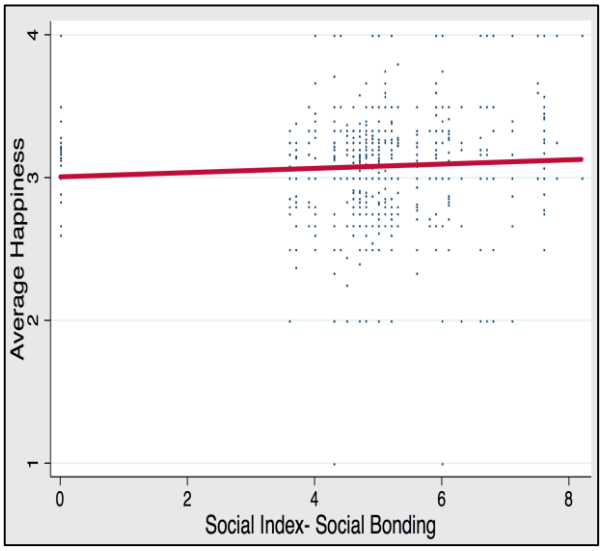

Figure 29: Scatter Plot of Average Happiness and Social Bonding, Source: Author, 2015.

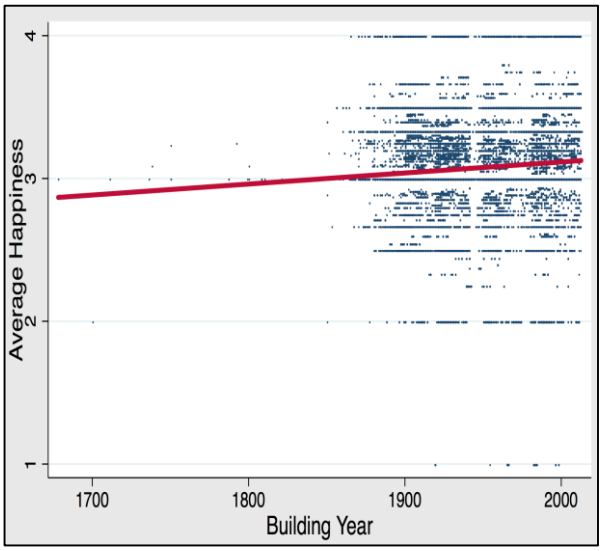

Figure 30: Scatter Plot of Average Happiness and Building Year, Source: Author, 2015.

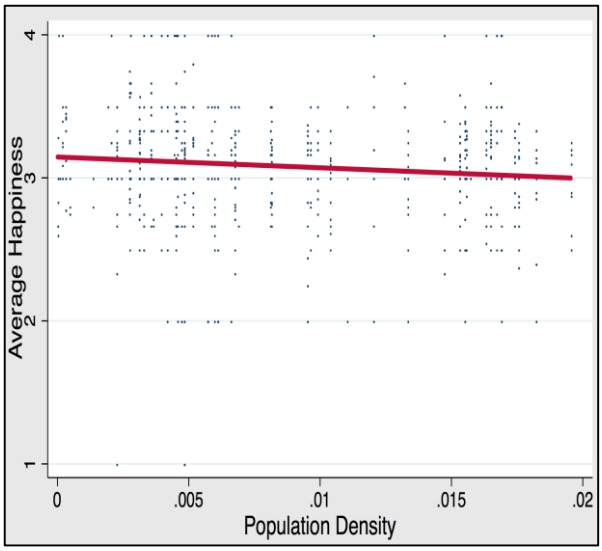

Figure 31: Scatter Plot of Average Happiness and Population Density, Source: Author, 2015.

The statistical finding from the table and the graph presented above (Figure-28, 30 and 31) confirms one another, in case of "Ethnic Diversity", "Population Density" and "Building Year". The higher the "Ethnic Diversity" the unhappier is the people. The lesser the "Population Density" the happier is the people. The "newer" the buildings with, higher "Building Construction Year" the happier is the people.

On the other hand, the result related to "Social Bonding" and result from graph (Figure-29) contradicts. Therefore, it can be concluded that the relationship with "Happiness" and "Social Bonding" is not a straight curve. Up to a certain level increment in "Social Bonding" increases "Happiness" but after that its' importance weakens.

4.4.6 Independent Variables Regarding Financial and Living Condition

Table-14 and Table-15: Independent variables related to financial and living condition are, "Average Working Hour per Week", "Percentage of Unemployed Labour Force" and "Income Class" (Frey, 2008; Moro, et al., 2008; Howley, 2011; Wang and Wong, 2014). Here in statistical analysis, "Average Working Hour per Week" and "Percentage of Unemployed Labor Force" came out as highly significant with a negative magnitude; and "Income Class" came out as highly significant with a positive magnitude.

Table-14: One (1) unit decrease in "Average Working Hour per Week" will increase the dependent variable "Average Happiness" by 0.019 units keeping all other independent variable constant. In addition, one (1) unit decrease in "Percentage of Unemployed Labor Force" will increase the dependent variable "Average Happiness" by 0.226 units keeping all other independent variable constant. On the other hand, one (1) unit increase in "Income Class" will increase the dependent variable "Average Happiness" by 0.115 units keeping all other independent variable constant.

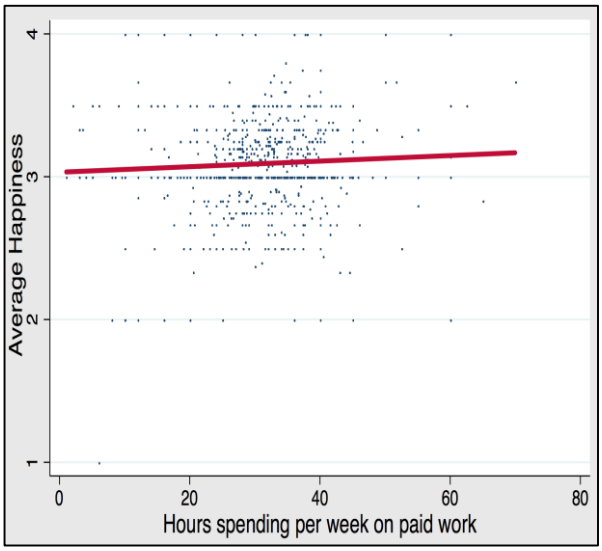

Figure 32: Scatter Plot of Average Happiness and Working Hour, Source: Author, 2015.

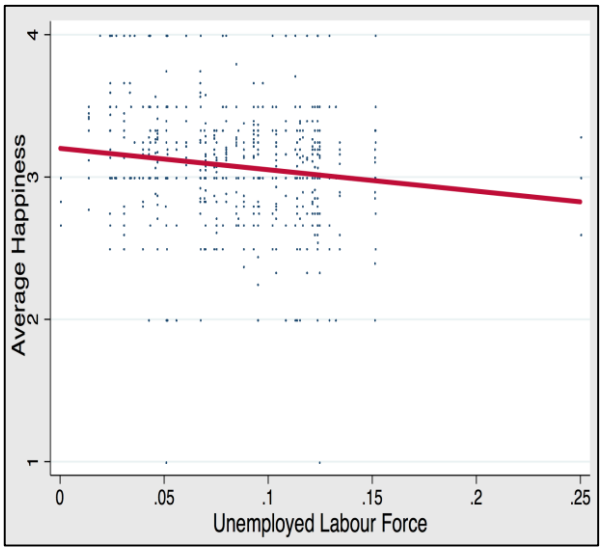

Figure 33: Scatter Plot of Average Happiness and Unemploed Labor Force, Source: Author, 2015.

The findings from the regression, and that from the graphs (Figure-32 and 33) correspondences more or less. Showing, increased "Unemployed Labour Force" makes people unhappier and unemployed people are engaged in less "Working Hour" of economic activity that makes them also unhappier.

On the other hand, people that belong to higher "Income class" are much happy showing a positive magnitude in regression and in graph (Figure-34).

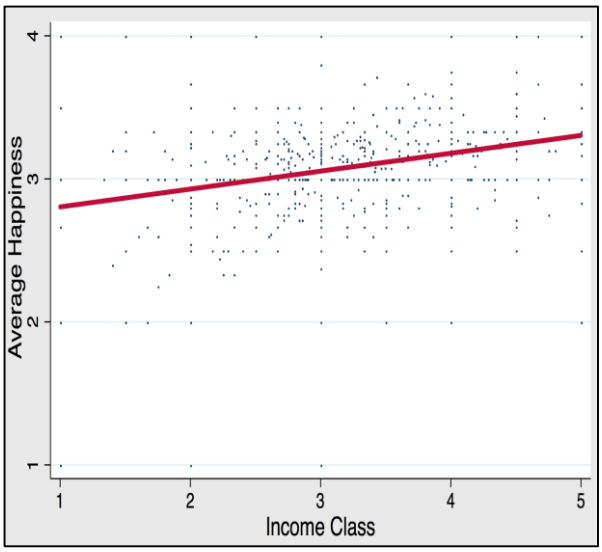

Figure 34: Scatter Plot of Average Happiness and Income Class, Source: Author, 2015.

Figure-34 represents that "Happiness" and "Income Class" are proportionately related. The higher the economic freedom of the people the happier they are.

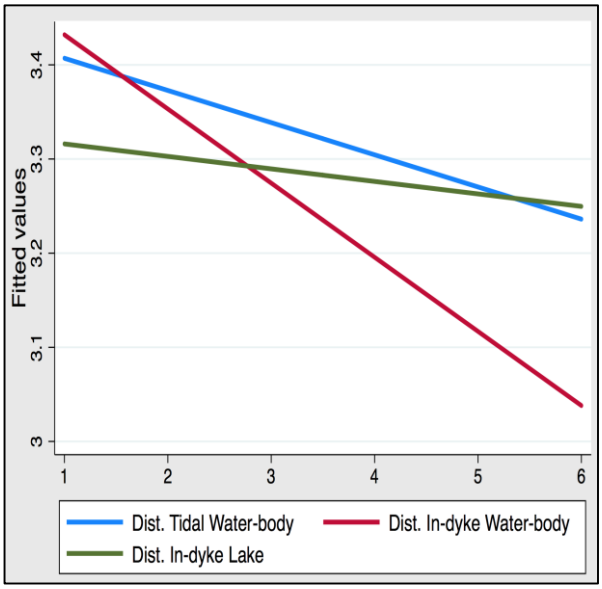

Figure 35: Fitted Line of Income Class with Distance from Outer-dyke Water-body, In-dyke Water-body, and Lakes, Source: Author, 2015.

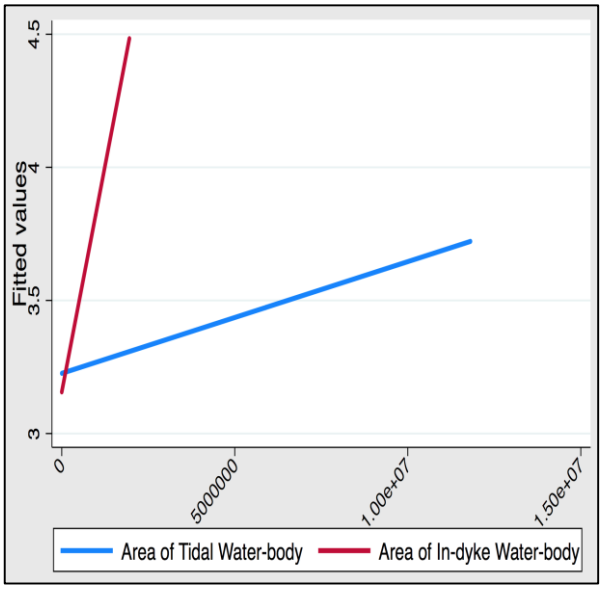

Figure 36: Fitted Line of Income Class with Area of Outer-dyke Water-body, and In-dyke Water-body, Source: Author, 2015.

Figure-40 and Figure-41 represent that "People" belonging to higher "Income Class" prefers the geographical location that has nearest proximity to water-body and maximum availability of water-body, as a resultant displaying the higher acceptability of the aesthetic service conveyed by water-body.

Chapter 5: Conclusions and Recommendations

The last chapter of this research presents the conclusive remarks for the whole study along with the answers of the research questions and probable interpretation related to theory under the answers. After interpretation, contribution of the research is drawn. Lessons learnt and recommendations are provided by focusing on the policy and planning measures that can be adopted by the city to ensure unconscious happiness. In the last part of this chapter, the scope for further research is also analysed.

5.1 Answers to the Research Questions

The research objectives are to investigate and assess the aesthetic service imparted by water-bodies on human happiness in Rotterdam, through theoretical understanding and previous landscape studies. In the process, an investigation has been conducted with a large volume of numerical data from the area under study to understand the crude impact that further has been refined through theories to answer the research questions and advocating recommendations.

5.1.1 Answer to the Research Sub Question 1

Q. How does availability of water-bodies influence landscape aesthetic service in the city of Rotterdam?

"Availability" denotes the collection or combination of a specific service in a certain bio-geophysical or socio-economic context by letting human to transfer value by visualising size and location of that landscape element (Costanza, et al., 2006). Therefore, in the perspective of the existing bio-geophysical and socio-economic context of Rotterdam, how the availability of the landscape element "water-body", provides "Aesthetic Service", has been narrated in this answer.

Considering other bio-geophysical and socio-economic context (Frey, 2008; Howley, 2011; Wang and Wong, 2014), the independent variables related to "Availability" are "Land Coverage" variables, sub-divided according to "Typology". After statistical analysis among the four (4) variables that fall under this group, "Total Land Area" and "Total Green Area" came out as highly significant with a negative magnitude and; "Area of Outer-dyke Tidal Water-body" and "Area of In-dyke Water-body" came out as highly significant with positive magnitude in influencing "Happiness".

"Total Land Area" is the geographical territory as a whole including green spaces and excluding water-bodies, while "Total Green Area" is exclusively the land coverage area by the green spaces. "Area of Outer-dyke Tidal Water-body" represents the River Mass and its branches that are outside the dyke area where "Area of In-dyke Water-body" represents all types of water-body inside the dyke area. This broader definition of water according to

typology has positive magnitude in increasing "Happiness" but variation in between them showing differences in typology influences variation in information or transfers different value (Costanza, et al., 2006; Melichar and Kaprova, 2013) in case of "Need Gratification".

The positive magnitude of "Land Coverage Area by Water-body" explains the reason behind "Total Land Area" and "Total Green Area" showing negative magnitude, cause in real scenario land is a finite space and here all its grey, blue and green patches have to compete to retain their places. In case of Rotterdam, the land coverage area of water-bodies, which are located inside its main urban core, shows higher influence (0.8%) regarding happiness than the River Mass (0.14%) that flows through it. Therefore, the result signifies that increasing the "Availability of In-dyke water body" by increasing the "Land Coverage Area" it holds has a major role to play in value transfer. We, as a human map the gestalt features (Costanza, et al., 2006; Tveit, et al., 2006; Ode, et al., 2008, Melichar and Kaprova, 2013) and rank the suitability of the living environment from the perspective of legibility and mystery (Kaplan and Kaplan, 1989). Therefore, in our immediate surrounding we search for abundance or availability (Jiang, et al., 2014) of the features that unconsciously makes us secure, enhances the frequency and duration of positive affective experience (Veenhoven, 2009), makes us interested enough to explore, and places us in an upper hand position (Appleton, 1975). The aesthetic simulator (Table-2) that the In-dyke-water body holds through their sizes and through their locomotion are more manageable and within the grip of human control thus reduces fear. Therefore, in case of Rotterdam, there is still scope to increase its In-dyke water coverage area.

"The River in the Outer-dyke Area" on the other hand brings chances of prospect also through its gestalt property (Costanza, et al., 2006). "Happiness" is not transferred by gestalt property alone but also transfers through the availability of vividness, biophilia, ephemera and other aesthetic properties (Costanza, et al., 2006; Tveit, et al., 2006; Ode, et al., 2008, Melichar and Kaprova, 2013). Creating in totality, a certain degree of coherence and complexity and gratifying need through legibility and mystery (Kaplan and Kaplan, 1989). From this perspective, the "Outer-dyke Tidal Water-body" of Rotterdam plays a higher role in influencing happiness (Figure-15) and a crucial performer for Rotterdam.

5.1.2 Answer to the Research Sub Question 2

Q. How does accessibility of water-bodies influence landscape aesthetic service in the city of Rotterdam?

Aesthetic service related to "Accessibility" is the quantity of exposure (Elliott and Hunsley, 2015) in relation to dosage and time span. In case of water-body in urban landscape, the scope of "direct" and "indirect" accessibility are the degree of exposure (Costanza, et al., 2006). Direct accessibility is the simplistic form of access. "Frontage" has the direct visual access as considered in this study. In case of people living in a water front property, their degree of exposure is highest by having the fullest dosage and prolonged period for visualising the water-body (Jiang, et al., 2014; Elliott and Hunsley, 2015). Indirect accessibility is on the other hand bears varied degree of complexity and obstruction. In this study, "Differences in degree of Proximity" measures intensity of indirect accessibility. The proximity of other factors from different studies that reveal locational preferences has been considered also (Bourassa, et al., 2006; Frey, 2008; Howley, 2011; Wang and Wong, 2014).

Independent variable in this research related to "Accessibility" is "Water-frontage and Proximity" according to typology. In statistical analysis, "Frontage and Proximity of Outer-dyke Tidal Water-body" and "Frontage and Proximity of In-dyke water-body" came out as highly significant with a negative magnitude (Table-15). However, "Frontage and Proximity of In-dyke Lake" came out as highly significant with a positive magnitude.

The results (Table-15, Figure-19) can draw a conclusion that "Outer-dyke Tidal Water-body" has higher degree of influence on happiness than "In-dyke Water-body" regarding frontage and proximity. Showing as the distance increases from it, "Happiness" gradually deceases with a gentle slope. On the other hand, accessibility in terms of frontage of "In-dyke Water-body" increases happiness but not as the same magnitude as "Outer-dyke Tidal Water-body" and the further one moves from it, happiness diminishes steeply showing a greater fluctuation (Figure-19). Therefore, on the ground of accessibility, regarding distance or proximity "In-dyke Water-body" has more sensitivity than The River Mass. The visual stimuli of the service can explain the phenomenon (Table-2). The River Mass because of massive physical feature (shape, size and length) and other aesthetic services in comparison to "In-dyke Water-body" provides higher dosage in visual aesthetic exposure and able to influence the "Happiness" having a greater catchment area by the physical law.

This result, on the ground of considering gestalt property only, contradicts with the result found through the study of the four (4) major lakes by "In-dyke Lake area". Showing that the further the people from the lakes the happier they are (Figure-19). This gives us information about the coherence. The gratification people expect depends on contextual fit or coherence of the landscape elements and the four (4) major lakes are not able to meet the demand. In case of other "In-dyke Water-body" for Rotterdam, the need is gratified by repetitions and coherence, which makes the landscape where they live and move, comprehensible through creating identity and grouping (Kaplan and Kaplan, 1989; Tveit, et al., 2006). Showing that even relatively small size of "In-dyke Water-body" can increase significant amount of happiness and have higher value to transfer rather than big chunks of "out of context" water-body.

In addition, human being looks for multiple sources of resources for survival and repetition of these happy spots imparts higher value in landscape assessment (Kaplan and Kaplan, 1989). Repetition is also necessary to increase the frequency of exposure (Kaplan and Kaplan, 1989; Veenhoven, 2009; Jiang, et al., 2014). Human mind likes solving a maze and calculates the shortest physical distance in every view to reach a resource, a winding path that disappears inside a forest suggests them greater possibility for explore (Gimblett, et al., 1985; Kaplan and Kaplan, 1989). A certain degree of mystery is tolerable rather than too simplistic approach where mind finds no riddle to solve. In the jungle of tall towers and solid urban facade of Rotterdam, the different shaped water-bodies and water channels are giving food for though and riddle to solve.

5.1.3 Answer to the Research Sub Question 3

Q. How does acceptability of water-bodies influence landscape aesthetic service in the city of Rotterdam?

"Acceptability" involves human perception as the assessment tool. "Revealed preference"

method has been used in this research, having "Value of House" and "Weekly Expense on Travel" as indicators disclosing acceptability. In the research, "acceptability" has been used as a bundle of aesthetic services influencing visual stimuli (Table-2), thus gratifying need. In statistical analysis, they came out as highly significant with a positive magnitude, showing people are willing to pay more on property price and on travel purpose to avail aesthetic service by living near water-body, corresponding with previous studies (Darling, 1973; Plattner and Campbell, 1978; Gillard, 1981; Bond, et al., 2002; Bourassa, et al., 2006). Therefore, the water premium that can be assumed through statistical analysis is truly representative for happiness or not – is one of the answer this section is going to analyse.

In our natural environment due to locational factor, two or more places can never be equal in visual aspect. Therefore, within a contained urban environment, there is shortage of desired places and competition prevails in gaining better aesthetic service (Bishop and Hulse, 1994; Bastian, et al., 2002). This makes the product or desired place having value differences with all other things remaining equal. In secondary data analysis, it revealed that people are willing to pay significant amount of water premium for availing aesthetic service that water-body imparts.

This water premium is influenced by the size and type of the water-body (Mahan, et al., 2000). "In-dyke Lake" gets the highest preference among different types of water-body (Table-27) in case of paying for water premium. It also reveals that people with higher income prefer location next or near to lake but according to findings they are less happy (Table-34, 35 & 36). This resulted in a difficulty in describing "water premium" corresponding with "aesthetic service" for explaining "Happiness". One of the reasons behind it can be of imperfect market equilibrium existing in case of Rotterdam (Bourassa, et al., 2006), suggesting that aesthetic service through acceptability cannot be properly measured by only using revealed preference and brings out the difference in conscious decision and unconscious gaining. Consulting the results (Figure-19, 27 and 35) it can be concluded that the aesthetic service of the "In-dyke Lakes" of Rotterdam are not fully explored to avail "Happiness".

5.1.4 Answer to the Main Research Question

Q. How does aesthetic service of water-body in urban landscape impact happiness of people in the city of Rotterdam?

Located geographically within the Rhine-Meuse-Scheldt River delta at the North Sea, Rotterdam is Europe's largest port with riverside setting and its maritime heritage (Gemeente Rotterdam, 2015). The rivers give waterway access into the heart of Western Europe through it. Therefore, the materialistic quality of life of its inhabitants depends much on the rivers and the waterways. The main objective of this study was to evaluate and explain the unconscious impact of these water-bodies on its inhabitants and interpret the impact that these water-bodies provide through aesthetic service.

The major source of aesthetic service related to water-body in case of Rotterdam is its River Mass. The information it is conveying is not only crucial for objective happiness but also for the subjective unconscious happiness of the inhabitants. Though this is the major source, rather than increasing its coverage area, the increase in coverage and frequency of "In-dyke

Water Area" through varied shapes and sizes can bring significant changes.

In a contained urban area this finding can bring out some solutions, because generally in developed urban areas there are shortage of spaces to take mass initiative for placing green and blue and other environmental up gradation. The result shows that even creating and preserving small pockets of water-body can be hotspots of impact, in case of Rotterdam.

The problem that was stated in the very first chapter of this paper was, if only ensuring water for daily supply through taps or ensuring uninterrupted waterways for transportation and economic activity is enough or there is more beyond these things that can-not be overlooked. In this concluding chapter, for answering the main research question, it is without doubt and by statistical support can be generalized that aesthetic service of the water-body as landscape element also has high significance for human unconscious happiness and for urban Rotterdam.

5.2 Contribution of the Research

Landscape study is generally followed by the procedures presented in Table-21 and Table-22 attached as annexure (Annex-10 and 11). The research model, that has been structured for this work is dependent on landscape users and a combination of "Descriptive inventories", "Public preferences", and "Economic analysis" study techniques. Therefore, it falls under the broader umbrella of "Psychophysical" and "Experiential" paradigms, touching all the aspects of "Landscape Assessment Models" differentiated by Daniel and Vining (1983) and by Lothian (1999), having major influence of subjectivist paradigm with touches of objectivity. As a result, a proposal for a new model for assessing landscape aesthetic service under the broader classification of "Cultural Eco-system Service Indicator" (UNEP-WCMC, 2010) is the main contribution that this research can offer. The new model can be best described as "Aesthetic-Econometric Model".

5.3 Lessons Learnt

The research is about the foundation of human emotion and its interaction with landscape components. Therefore, the conclusion that this research paper derives can be reflective for not only Rotterdam but also for a wider arena. In general, it can be said that to make a competitive city, for the betterment of its inhabitant's thus sustainable productivity and growth, the city should incorporate open water-bodies in their physical planning. The planning should be done ensuring adequate time of visual interaction between human and water-body. Therefore, justifying the importance of the fourth pillar of sustainability paradigm- "Culture" from psychophysical perspective (Plieninger, et al., 2013).

5.4 Recommendation

Cities in the world are adopting different measure to mitigate the climatic challenge that became prominent in the recent years. Rotterdam has also taken different plans and under these, improvements of its existing water-bodies and creating new water storage are included.

In some cases, these water storage areas are placed outskirt of the main urban core due to cost (RCI, 2013) but in this case, the visual interaction between inhabitants and these expensive projects to build declines. Therefore, "Does our policy and planning truly reflects proper valuation of environment?" is an important question to ask.

The recommendations are made mainly focusing on the **structural and non-structural measures** that the **"Integrated Water Resource Management"** incorporates in its system.

In **"Structural measure"**, **"Dual-drainage concept"** is adopted to minimize the risk of urban flooding during extreme rainfall events. When conduit design capacity is exceeded the chances of flood can be mitigated by configuring urban surfaces so that they direct excessive surface runoff to areas where the damage will be minimised; like, parks or less dense populated parts of the city (Andjelkovic, 2001). Creating these drainage pockets in less populated urban areas reduces the **Human-Water-body interaction**. The decision-making processes that determine the choice for selecting these pockets through cost-benefit analysis do not internalize the unconscious aesthetic value. Proper valuation should be done to get conscious and unconscious benefits from this structural measure.

Another **"Structural measure"** is **"Water storage"**. The contemporary practice of storm-water management includes the practice of containing or detaining storm-water runoff within the areas undergoing urbanisation (Andjelkovic, 2001) by creating "Recharge and Detention basins" and "Retention basins". In **"Master Plan"** level these basins need to be located thinking maximum **Human-Water-body interaction** thus within cost increasing services.

"Low-cost structural measures" are also advocated by restoration of local urbanised waterways (uncovering urban creeks), compartmentalisation of the flood plain and encouraging the land use commensurate with the protection system (Andjelkovic, 2001) to restore **"Happiness"**.

In "**Non-structural measures"**, planning, programming, setting policies, co-ordinating, facilitating, raising awareness, assisting and strengthening should incorporate this happiness angle.

In "**Non-structural measures"**, "**Natural source control"** gets the highest prerogative. A natural undeveloped watershed represents a spatially distributed runoff control to slow down the rate of runoff following urbanisation. Small volumes of natural storages are found in pervious soil, natural depressions, wetlands and floodplains. Urbanisation changes those natural hydrological mechanisms by: increasing the impermeability of land cover, changing the land use , removing vegetation from the ground surface, transforming natural watercourses into culverts and channels , and levelling off the contoured natural ground surface (Andjelkovic, 2001). These areas of "Natural sources" need to be protected through policies, co-ordination, control and awareness for the greater benefit for **"Gratification of Unconscious Need"**.

In our planet, there will always be a shortage of resources in comparison of human aspiration to accumulate. Water-body is quantitatively utilitarian in nature, it also possess idiosyncratic quality that appeals our unconscious. Not only from hard-edged utility, should it also be understood from the angle of intangibility in urban perspective, thus maximizing its potentiality to address the resource shortage. A "city" like a canvas needs framework to withstand, to be upright but on the topmost visible layer, on the checkerboard of grey and green it needs patches of blue- cause blue is the colour of happiness.

5.5 Scope for Further Research

The model, that is structured in this study can be further developed to capture the total value of landscape service and to create applicable policy and planning related to our urban space. Not only, policy and planning, from this model the aesthetic tangible and intangible features of the landscape components can be further studied objectively. With more information and classification of the elements according to their physical properties and typologies, the research can produce specific result.

In the questionnaire (Annex-1), of the primary survey there is some attempt to extract the intangible aesthetic property. It can be further developed and conducted to clarify the way our mind response to them. Due to unavailability, the data regarding mental illness or fatigue, and age are not captured in the statistical analysis. Incorporation of those will strengthen this study by making it meticulous. “Is there any impact of aesthetic service of water-body or landscape elements with mental illness or fatigue or violence?” or “Does aesthetic preference varies with the stages of life?” - Could be other interesting researches to pursue and value to add.

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Annex 1: Data Collection Instrument for Primary Data

25 June, 2015

Dear Sir/ Madam,

This questionnaire has been prepared as an essential part for the fulfilment of the **M.Sc. degree** in **"Urban Management and Development"** in **IHS, Erasmus University Rotterdam**.

The thesis topic is, **"Happy Blue: The impact of water-bodies on happiness by visual perception of human defining landscape aesthetic in context of Rotterdam"**. Therefore, questions are related to; the locational proximity of residence to water-bodies, preference for choosing a location for residence, the financial involvement in choosing the location and happiness (affective experience) with other related questions about urban amenity.

Netherlands is a low lying country and vulnerable to flood and other environmental disasters. Already Rotterdam has taken initiatives to tackle and prepare it-self for upcoming environmental challenges. Your valuable comment will give a happiness dimension to it in integrating coping strategy in Rotterdam's urban fabric.

Any information obtained in connection with this study that can be identified with your personal details will remain confidential.

Please, post this mail by 30 June 2015. The postal Address is as follows:

……
……
……

The stamp is provided inside the envelope. Thank you for your feedback.

Best regards,

Tabassum Mahmood
M.Sc. student in Urban Management and Development
IHS (Institute of Housing and Urban Studies)
Erasmus University, Rotterdam.

Questionnaire:

1	Name of the Neighbourhood, where you live:				
2	Postcode of the Neighbourhood, where you live:				
3	Are you a:			○Man ○Woman	
4	In, which of the following age group, do you fall in?				
	○18-20	○21-29	○30-39	○40-49	○50 and over
5	Which of the following ethnic background best describes you?			○Netherlands ○Suriname ○Turkish ○Morocco ○Netherlands Antilles ○ Others	
6	What is your opinion about the population density of your Neighbourhood?				
	○Low	○Moderately low	○Reasonable	○Dense	○Highly dense
7	"The community bonding of your Neighbourhood is satisfactory"- Do you agree with this statement?				
	○Strongly agree	○Agree	○Neutral	○Disagree	○Strongly disagree
8	"The urban amenities, of your Neighbourhood are adequate (for example: parks, playgrounds, transportation, shops, schools etc.)"- Do you agree with this statement?				
	○Strongly agree	○Agree	○Neutral	○Disagree	○Strongly disagree
9	"The proportion of natural areas and built environment of your Neighbourhood is satisfactory"- Do you agree with this statement?				
	○Strongly agree	○Agree	○Neutral	○Disagree	○Strongly disagree
10	Write a percentage of, the existing land coverage area that you think it could be in, and your neighbourhood? (Altogether should add 100%)			Building area	%
				Paved open space	%
				Green open space	%
				Forest area	%
				Water-body	%
11	According to your preference, what could be the best possible land coverage area, for your neighbourhood? (Altogether should add 100%)			Building area	
				Paved open space	%
				Green open space	%
				Forest area	%
				Water-body	%
12	Status of your employment:				
	○Employed	○Self employed	○Not Employed	○Retired	
13	What is your yearly income (including salary, interest on bonds, profit on business, social benefit etc.)?			○Less than €10,000 ○€10,000 to €19,999 ○€20,000 to €29,999 ○€30,000 to €39,999 ○€40,000 to €49,999 ○€50,000 to €59,999 ○€60,000 to €69,999 ○€70,000 to €79,999 ○€150,000 or more	

14	How many hours in total do you spend on paid job, paid self-business or other paid economic activity?				Hours/week
15	In total how many hours do you spend on the road (including travelling time to work/ to bring daily supply/ to take your kids to school/to other service etc.?				Hours/week
16	How much money do you spend per week on transportation?				Euro/week
17	"The commuting to your job destination is time consuming"- Do you agree with this statement?				
	○Strongly agree	○Agree	○Neutral	○Disagree	○Strongly disagree
18	Which of the following best describes your housing status?	○ Rented ○ Self-owned ○ Other, specify:			
19	What is the total area of your living space? (Any one)		Sq. meter		
			Sq. feet		
20	How many members are in your household?		Nos.		
21	If the house (living space) is rented, how much is the rent per month?		Euro/month		
22	If the house (living space) is self-owned, how much do you think you will get if you put it on rent?		Euro/month		
23	If others, how much rent is logical for the house (living space) you are residing compared to the neighbourhood?		Euro/month		
24	If you put it on sale, how much do you think you will get for the property you are residing now?		Euro		
25	"The rent/ housing price of the property you are residing is comparatively high related to other property within your neighbourhood."- Do you agree with this statement?				
	○Strongly agree	○Agree	○Neutral	○Disagree	○Strongly disagree
26	"The locational factor has influence on it."- Do you agree with this statement?				
	○Strongly agree	○Agree	○Neutral	○Disagree	○Strongly disagree
27	Do you live in a waterfront property?	○Yes ○No			
28	If yes, what type of water-body?	○River ○Lake ○Canal ○Pond ○Other, specify:			
29	If no, what is the type of your nearest water-body?	○River ○Lake ○Canal ○Pond ○Other, specify:			
30	What is the distance to your nearest water-body?	○Within 50 m ○51-100 m ○101-150 m ○151-200 m ○201-250 m ○More than 250 m			

31	"Living next/ near to a water-body has increased your property value"- do you agree with this statement?				
	○Strongly agree	○Agree	○Neutral	○Disagree	○Strongly disagree
32	"Living next/near to a water-body has increased the quality of your living environment"- do you agree with this statement?				
	○Strongly agree	○Agree	○Neutral	○Disagree	○Strongly disagree
33	"Living next/near to a water-body has increased your happiness"- do you agree with this statement?				
	○Strongly agree	○Agree	○Neutral	○Disagree	○Strongly disagree

34	If changed (agreed), what feature of water-body is behind this reason? (Please, put tick mark)							
	Size of the water-body	Large		Medium		Small		
	Shape of the water-body	Rigid		Flexible				
	Type of the water-body	Yes		No				
	Colour of the water	Bright		Dull				
	Clarity of the water	Clear		Unclear				
	Maintenance of the water-body	High		Medium		Low		
	Movement of water	Fast	Moderate	Slow		Stagnant		
	Bio-diversity of water-body	Fish	Presence	Flora	Presence	Aquatic bird	Presence	
			Absence		Absence		Absence	
	Amount of water	Less		Moderate			High	
35	Put a value from 1-6 (where, 1=low and 6=high) according to the typology of your preferential water-body?	Type					Value	
		River						
		Lake						
		Canal						
		Pond						
		Other, specify						

36	Keeping all the other physical attributes of your neighbourhood remaining same, how much you are willing to pay for these locational attributes of your residence? Put a value from 1-6 (where, 1=low and 6=high).						
	Typology	Waterfront	Within 50m	51-100m	101-150m	151-200m	201-250m
	River						
	Lake						
	Canal						
	Pond						
	Other, specify						

37	Most of the time how do you feel when you are in your home?	○Happy ○Serene ○Enjoy ○Frustrated /Annoyed ○Depressed/Blue ○Angry /Hostile ○Worried ○Anxious

38	Most of the time how do you feel when you are in your neighbourhood?	○Happy ○Serene ○Enjoy ○Frustrated /Annoyed ○Depressed/Blue ○Angry /Hostile ○Worried ○Anxious			
39	Most of the time how do you feel?	○Happy ○Serene ○Enjoy ○Frustrated /Annoyed ○Depressed/Blue ○Angry /Hostile ○Worried ○Anxious			
40	In a scale of 1-5, how will you score the quality of your living environment?				
	○ 1 Low	○ 2	○ 3	○ 4	○ 5 Very High
41	All in all, are you happy with your life?				
	○Not at all happy	○Less Happy	○Fairly Happy	○Happy	○Very Happy

Note:

Please put a single (✓) tick mark in case of circles under the same question.

Control Number:

08 July 2015

Dear Sir/ Madam,

I am a **M.Sc.** student of **"Urban Management and Development"** in **IHS, Erasmus University Rotterdam**. An essential part for the fulfilment of the M.Sc. degree is to conduct a **Primary Survey** through **Questionnaire** related to the thesis topic.

My thesis topic is, **"Happy Blue: The impact of water-bodies on happiness by visual perception of human defining landscape aesthetic in context of Rotterdam"**. Therefore, questions are related to; the locational proximity of residence to water-bodies, preference for choosing a location for residence, the financial involvement in choosing the location and happiness (affective experience) with other related questions about urban amenity.
Netherlands is a low lying country and vulnerable to flood and other environmental disasters. Already Rotterdam has taken initiatives to tackle and prepare it-self for upcoming environmental challenges. Your valuable comment will give a happiness dimension to it in integrating coping strategy in Rotterdam's urban fabric and **will greatly help me in my Master's study**.

Please go through the following link and fill up the form by 15-07-15, It will take maximum 20 minutes.

http://goo.gl/forms/LKrZpI4gpB

Any information obtained in connection with this study that can be identified with your personal details will remain confidential.

Thank you for your feedback.
Best regards,

Tabassum Mahmood
M.Sc. student in Urban Management and Development
IHS (Institute of Housing and Urban Studies)
Erasmus University, Rotterdam.

Annex-2 Description of Primary Survey

Survey Area for Primary Data Collection

The survey area for primary data collection has been Kralingen-West and part of Struisenburg neighbourhoods' of Rotterdam. The neighbourhood proper is relatively urban and dense rather than the bordering neighbourhoods of Rotterdam with three types of water-bodies bordering the collective area. The survey area virtually has been divided into one hundred and twelve partial zones to generate valid and representative data at survey level.

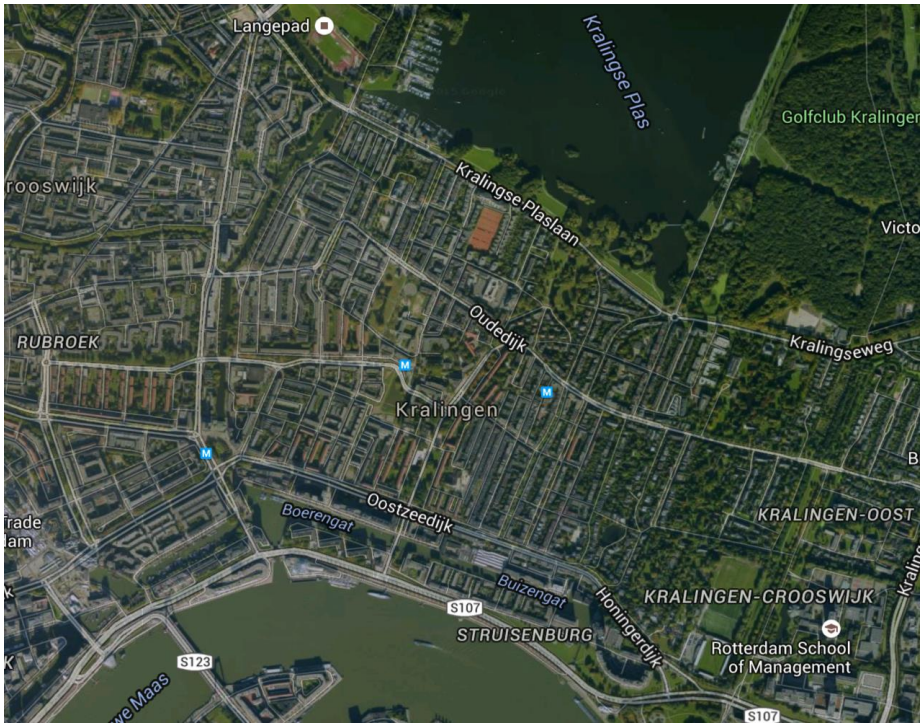


Figure 42: Map of Kralingen-West and Struisenburg, Source: Google maps, 2015.

Data Collection Instrument for Primary data

Primary data has been collected by non-personal survey. This survey has been conducted by structured survey questionnaires on stratified sample of population by mail and website. The questionnaire has both revealed and stated preference related questions to cross check the indicators for econometric analysis, but due to low response, the target sample was not fulfilled.

For, primary survey pre-testing of questionnaire has been done to remove limitation (Baars, 2015). **"Primary data"** in statistical form has been generated from **"Questionnaires"** in both Dutch and English languages (Annex-1).

Sample Size and Selection

Probable Multi-Stage sampling that combines Stratified and Simple Random-Probable sampling has been done. Yamane Formula has been used to find representative sample size.

The population of the neighbourhoods are 20,171 (Gemeente Rotterdam, 2014).

Yamane formula, $\mathbf{n = \frac{N}{1+N(e)^2}}$

Yamane formula is used for the least sampling. Here n=sample, N= population and

e (error) =0.1 at 95% confidence level.

Therefore, the total sample size is 100.

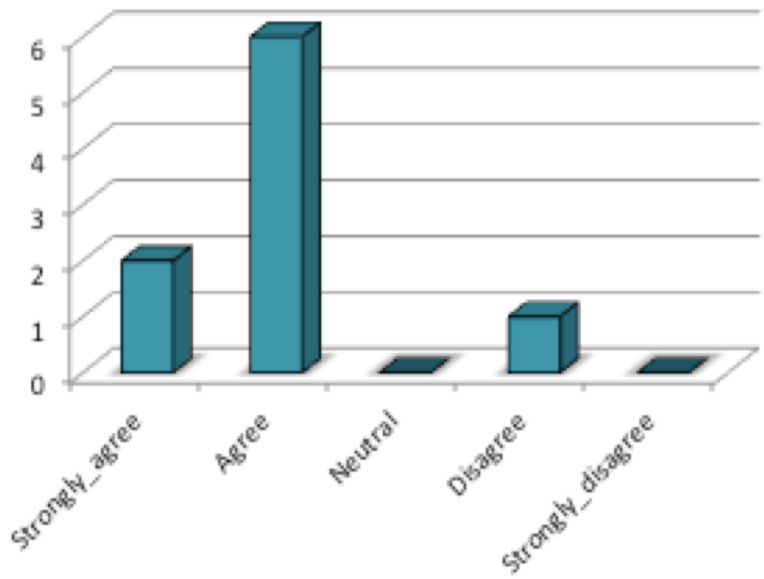
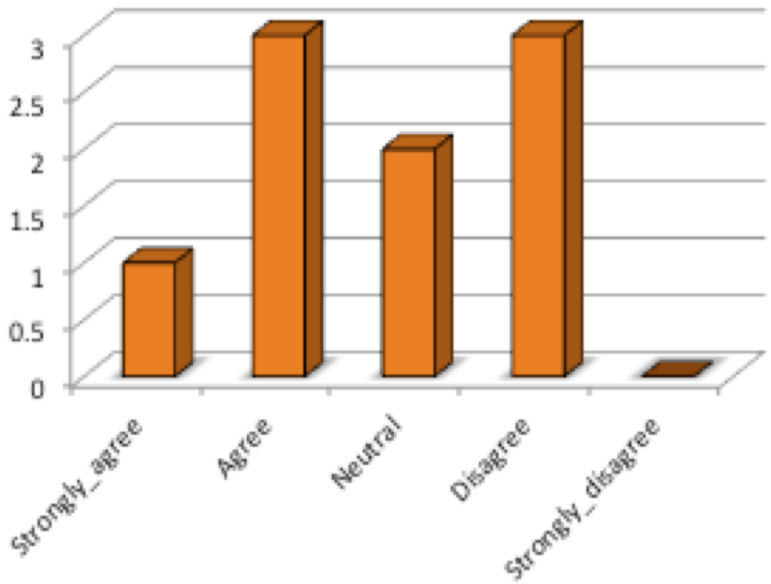
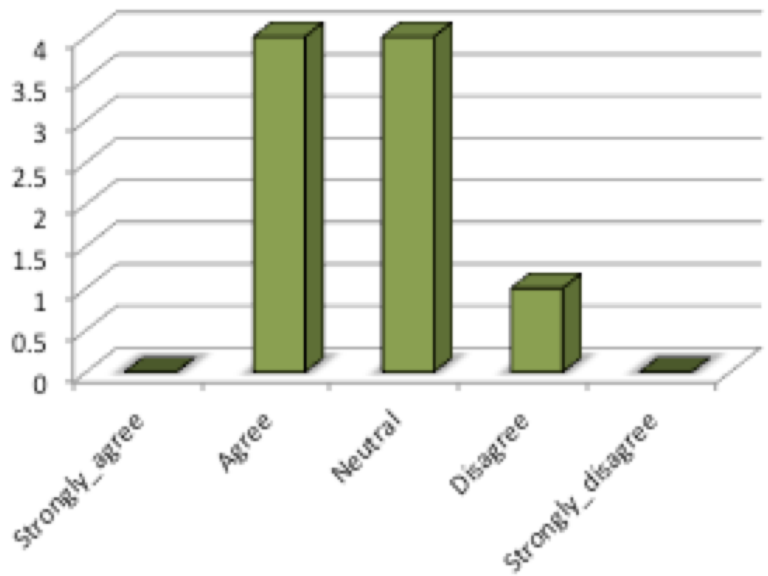
Limitation and Challenges of Data Collection Method

Primary data collected through "Questionnaire" is cost intensive and time consuming. There is always possibility for misinterpretation of questions and un-complete answers. Therefore, pre-testing of the questions has been done and the answers are formatted as close ended using dichotomous, multiple choice, and Likert scale (Annex-1).

Limited or few response can be the other major challenge. To remove it multiple data collection sources has been used, i.e. postal and web-based, also the questionnaire was in both Dutch and English language.

Although after taking these precautions the response was not representative. Therefore, this data has been discarded and attached with this paper to facilitate future research.

Chart 1: Bar Chart of Survey Answers of Nine (9) Respondents, Source: Author, 2015.

Q: "Living next/ near to a water-body has increased your property value"- do you agree with this statement?	
Q: "Living next/near to a water-body has increased the quality of your living environment"- do you agree with this statement?	
Q: "Living next/near to a water-body has increased your happiness"- do you agree with this statement?	

Annex 3: Data Sources for Secondary Data Collection

1. Official website of Government of the Netherlands
   Data has been collected from: Documents and publication.
   Web address: http://www.government.nl

2. "Centre bureau of Statistics Netherland" is a department of Dutch ministry of economic affairs. "Statline" is the electronic databank of statistics Netherlands.
   Data has been collected from: Documents and publication.
   Web address: http://www.cbs.nl
   http://statline.cbs.nl

3. The official website of the government of Rotterdam.
   Data has been collected: Maps of Rotterdam
   Web address: http://www.rotterdam.nl

4. The official website of the Municipality of Rotterdam.
   Data has been collected from: Databanks and publication.
   Web address: http://www.rotterdam.nl/gemeenterotterdam
   http://wijkprofiel.rotterdam.nl
   http://rotterdam.buurtmonitor.nl

5. "National Academic Research and Collaborations Information System" is the main national portal for those looking for information about researchers and their work. Students, journalists and people working in educational and government institutions as well as the business sector also use it.
   Data has been collected from: Documents and publication.
   Web address: http://www.narcis.nl

6. The Rotterdam Climate Initiative is a partnership between the City of Rotterdam, the Port of Rotterdam and DCMR Environmental Protection Agency.
   Data has been collected from: Documents and publication.
   Web address: http://www.rotterdamclimateinitiative.nl

7. "The Connecting Delta Cities (CDC)" is a network of C40's Water & Adaptation Initiative. The goal of "Connecting Delta Cities" is to develop a network of delta cities that are active in the field of climate change related spatial development, water management, and adaptation.
   Data has been collected from: Documents and publication.
   Web address: http://www.deltacities.com

8. Popular and authenticate Housing websites of Rotterdam.
   Web address: http://vestia.nl
   http://rotterdamapartments.com

9. 9292 is a daily source of travel information for public transport for all kinds of passenger. It is a platform of all the transport company of Rotterdam and working over 20 years.
   Web address: http://9292.nl

10. The Netherlands Water Partnership (NWP) is a comprehensive network that unites Dutch water expertise. The partnership, consisting of 200 members from private companies, government, knowledge institutes and NGOs, acts as a centre of information on water expertise, policy developments and market opportunities.
    Web address: http://www.nwp.nl
    http://www.dutchwatersector.com

11. Google is an American multinational technology company specializing in Internet-related services and products. Google Earth is a virtual globe, map and geographical information program developed by this company.
    Web address: http://www.google.com/earth/

12. Data provided by "The Municipality of Rotterdam" through IHS, Erasmus University Rotterdam.

Annex 4: Time Schedule

Chart 2: Gantt Chart for Primary Data Collection, Source: Author, 2015.

No	Task name	Duration	June 11-17, 2015							June18-24, 2015							June 25-July 01, 2015							July 01-05, 2015						
			S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
1	Primary Survey Planning and Preparation	7 days																												
2	Primary Survey and Data Collection	14 days																												
3	Data Compilation	7 days																												

Chart 3: Gantt Chart for Secondary Data Collection, Source: Author, 2015.

No	Task name	Duration	June 11-17, 2015							June18-24, 2015							June 25-July 01, 2015							July 01-05, 2015						
			S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
1	Correspondence	25 days																												
2	Data Source Exploration	14 days																												
3	Data Compilation	7 days																												

Annex 5: Table 16-Description of Variables for Model-1

Table 16: Description of Variables for Model-1, Source: Author, 2015.

Dependent Variable				
Average Happiness	Continuous	2009	Averaged on Ordinal data of Happiness. Categorical data of 5-digit postcode: Happiness - All in all, are you happy? (1 - not at all happy, 2 - not so happy, 3 - happy, 4 - very happy) Conversion: Averaged according to 5-digit postcode, later consolidated on Neighbourhood Level.	"Rotterdam Leisure Survey" by "The Municipality (Gemeente) of Rotterdam". Organization: Centre for Research and Statistics.
Independent Variable				
Total Land Area	Continuous	2013	Square Meter Total land area at Neighbourhood level.	CBS & Extracted data from Shape files provided by Centre for Research and Statistics, "The Municipality of Rotterdam".
Tidal Water Area Outer-dyke	Continuous	2013	Square Meter Total area of tidal water-body at Neighbourhood level.	CBS & Extracted data from Shape files provided by Centre for Research and Statistics, "The Municipality of Rotterdam".
Water Area In-dyke	Continuous	2013	Square Meter Total area of canal and lake, in-dyke water-body at Neighbourhood level.	CBS & Extracted data from Shape files provided by Centre for Research and Statistics, "The Municipality of Rotterdam".
Total Green Area	Continuous	2008	Percentage Share of total surface area using green at Neighbourhood level.	From TIR & Green Park File 2008, through "The Municipality of Rotterdam".
Open Space Ratio	Continuous	2010	Ratio Open Space Ratio at Neighbourhood level	From SO and R&W, through "The Municipality of Rotterdam".
Dwelling per Hectare	Continuous	2012	Number / Hectare Dwelling Number per Hectare at Neighbourhood level.	From Flat File 2013 & TIR, through "The Municipality of Rotterdam".
Average Distance from Tidal Water Outer-dyke	Continuous	2013	Average Distance Tidal water outer-dyke (where, 0-50m=1, 51-100m=2, 101-150m=3, 151-200m=4, 200-250m=5, 251m-more=6). Consolidated on Neighbourhood Level.	Extracted data from Shape files provided by Centre for Research and Statistics, "The Municipality of Rotterdam".

Independent Variable				
Average Distance from Water In-dyke	Continuous	2013	Average Distance Water and Water-loop in-dyke (where, 0-50m=1, 51-100m=2, 101-150m=3, 151-200m=4, 201-250m=5, 251m-more=6). Consolidated on Neighbourhood Level.	Extracted data from Shape files provided by Centre for Research and Statistics, "The Municipality of Rotterdam".
Average Distance from Lake In-dyke	Continuous	2013	Average Distance from Lake (where, 0-50m=1, 51-100m=2, 101-150m=3, 151-200m=4, 201-250m=5, 201m-more=6). Consolidated on Neighbourhood Level. Only four (4) major lakes are included under this.	Extracted data from Shape files provided by Centre for Research and Statistics, "The Municipality of Rotterdam".
Average House Value	Continuous	2013	Euro Average House Value from 6-digit postcode. Inflation calculated and converted for the year 2009. Consolidated on Neighbourhood Level.	From COS, Flat File 2013, through The Municipality of Rotterdam and inflation.eu.
Weekly Expense on Travel	Continuous	2012	Euro Weekly Expense for Travel at Neighbourhood Level. Inflation calculated and converted for the year 2009. Traveling time is converted into monetary unit according to average income per hour.	Google Map, inflation.eu and The Municipality of Rotterdam.
Average Working Hour per Week	Continuous	2009	Hours Average how many hours you spend per week: on paid work (employed, self-employed or working in a family business? Conversion: Averaged according to 5-digit postcode, later consolidated on Neighbourhood Level.	"Rotterdam Leisure Survey" by Municipality (Gemeente) of Rotterdam. Organization: Centre for Research and Statistics.
Income after Tax Deduction	Continuous	2012	Euro Average per capita yearly Income after tax at Neighbourhood Level. Inflation calculated and converted for the year 2009.	CBS (Statline), inflation.eu and The Municipality of Rotterdam.
Average Income Class	Continuous	2009	Average of In which class does your net household income fall? (1=less than € 1000 per month, 2=between € 1000 and € 1350 per month, 3=between € 1350 and € 1750per month, 4=between € 1750 and € 3050 per month, 5=€ 3050 or more per month) Conversion: Averaged according to 5-digit postcode, later consolidated on Neighbourhood Level.	"Rotterdam Leisure Survey" by Municipality (Gemeente) of Rotterdam. Organization: Centre for Research and Statistics.

Independent Variable				
Percentage of Household with High Income	Continuous	2008,2012	Percentage of households with high incomes at Neighbourhood Level.	CBS (Statline), inflation.eu and The Municipality of Rotterdam.
Average of Building Year	Continuous	2013	Year Average Building Year from 6-digit postcode. Consolidated on Neighbourhood Level.	From Flat File 2013 through "The Municipality of Rotterdam".
Average Area of House	Continuous	2013	Square Meter Average Area from 6-digit postcode. Consolidated on Neighbourhood Level.	From Flat File 2013 through "The Municipality of Rotterdam".
Population Density	Continuous	2009	Population per Land Area at Neighborhood Level.	Rotterdambuurtmonitor.nl, CBS (Statline).
Unemployed Labor Force	Continuous	2012	Percentage Share of the unemployed labor force at Neighbourhood Level.	From COS through "The Municipality of Rotterdam".
Ethnic Diversity	Continuous	2009	Ratio Non-indigenous population at Neighbourhood Level.	Rotterdambuurtmonitor.nl
Social Index Bonding	Continuous	2012	Social Index data on Neighborhood at Neighbourhood Level.	From COS through "The Municipality of Rotterdam".
Residence within 250m of Green Area	Continuous	2008,2011	Percentage Share of inhabitants use green <250m at Neighbourhood Level.	From TIR, Green Park File 2008 & Residents File 2011, through "The Municipality of Rotterdam".
Residence within 300m of Primary Education	Continuous	2010, 2011	Percentage Share of inhabitants with primary education within <300m at Neighbourhood Level.	From SO, R&W and COS, through "The Municipality of Rotterdam".
Residence with public transport stop within reasonable distance	Continuous	2012	Percentage Proportion of residents with a public transport stop (train, metro, and tram) within reasonable distance at Neighbourhood Level.	From V&V and COS, through "The Municipality of Rotterdam".
Residence within 300m of Daily Supply	Continuous	2011, 2012	Percentage Proportion of residents with a daily supply <300m at Neighbourhood Level.	From Residents File 2011 and Investment File 2012, through "The Municipality of Rotterdam".

Annex 6: Table 17- Description of Variables for Model-2

Table 17: Description of Variables for Model-2, Source: Author, 2015.

Dependent Variable				
Average Happiness	Continuous	2009	Averaged on Ordinal data of Happiness. Categorical data of 5-digit postcode: Happiness - All in all, are you happy? (1 - not at all happy, 2 - not so happy, 3 - happy, 4 - very happy) Conversion: Averaged according to 5-digit postcode, later projected on 6-digit postcode or on individual.	"Rotterdam Leisure Survey" by "The Municipality (Gemeente) of Rotterdam". Organization: Centre for Research and Statistics.
Independent Variable				
Total Land Area	Continuous	2013	Square Meter Total land area at Neighbourhood level. Regressed using, Sqm/10,000,000	CBS & Extracted data from Shape files provided by Centre for Research and Statistics, "The Municipality of Rotterdam".
Tidal Water Area Outer-dyke	Continuous	2013	Square Meter Total area of tidal water-body at Neighbourhood level. Regressed using, Sqm/10,000,000	CBS & Extracted data from Shape files provided by Centre for Research and Statistics, "The Municipality of Rotterdam".
Water Area In-dyke	Continuous	2013	Square Meter Total area of canal and lake, in-dyke water-body at Neighbourhood level. Regressed using, Sqm/10,000,000	CBS & Extracted data from Shape files provided by Centre for Research and Statistics, "The Municipality of Rotterdam".
Total Green Area	Continuous	2008	Percentage Share of total surface area using green at Neighbourhood level.	From TIR & Green Park File 2008, through "The Municipality of Rotterdam".
Open Space Ratio	Continuous	2010	Ratio Open Space Ratio at Neighbourhood level Regressed using, Ratio/10	From SO and R&W, through "The Municipality of Rotterdam".
Dwelling per Hectare	Continuous	2012	Number / Hectare Dwelling Number per Hectare at Neighbourhood level. Regressed using, (Number / Hectare) /10	From Flat File 2013 & TIR, through "The Municipality of Rotterdam".
Distance from Tidal Water Outer-dyke	Ordinal	2013	Distance from Tidal water-body outer-dyke (where, 0-50m=1, 51-100m=2, 101-150m=3, 151-200m=4, 200-250m=5, 251m-more=6)	Extracted data from Shape files provided by Centre for Research and Statistics, "The Municipality of Rotterdam".

Independent Variable				
Distance from Water In-dyke	Ordinal	2013	Distance from Water and Water-loop area in-dyke (where, 0-50m=1, 51-100m=2, 101-150m=3, 151-200m=4, 201-250m=5, 251m-more=6)	Extracted data from Shape files provided by Centre for Research and Statistics, "The Municipality of Rotterdam".
Distance from Lake In-dyke	Ordinal	2013	Distance from Lake (where, 0-50m=1, 51-100m=2, 101-150m=3, 151-200m=4, 201-250m=5, 201m-more=6) Only four (4) major lakes are included under this.	Extracted data from Shape files provided by Centre for Research and Statistics, "The Municipality of Rotterdam".
House Value	Continuous	2013	Euro House Value from 6-digit postcode. Inflation calculated and converted for the year 2009. Regressed using, Euro/1000,000	From COS, Flat File 2013, through The Municipality of Rotterdam and inflation.eu.
Weekly Expense on Travel	Continuous	2012	Euro Weekly Expense for Travel at Neighbourhood Level. Inflation calculated and converted for the year 2009. Traveling time is converted into monetary unit according to average income per hour. Regressed using, Euro/10	Google Map, inflation.eu and The Municipality of Rotterdam.
Working Hour per Week	Continuous	2009	Hours Average how many hours you spend per week: on paid work (employed, self-employed or working in a family business? Conversion: Averaged according to 5-digit postcode, later projected on 6-digit postcode. Regressed using, Hour/10	"Rotterdam Leisure Survey" by Municipality (Gemeente) of Rotterdam. Organization: Centre for Research and Statistics.
Income Class	Continuous	2009	Average of In which class does your net household income fall? (1=less than € 1000 per month, 2=between € 1000 and € 1350 per month, 3=between € 1350 and € 1750per month, 4=between € 1750 and € 3050 per month, 5=€ 3050 or more per month) Conversion: Averaged according to 5-digit postcode, later consolidated on Neighbourhood Level.	"Rotterdam Leisure Survey" by Municipality (Gemeente) of Rotterdam. Organization: Centre for Research and Statistics.
Percentage of Household with High Income	Continuous	2008,2012	Percentage of households with high incomes at Neighbourhood Level.	CBS (Statline), inflation.eu and The Municipality of Rotterdam.

Independent Variable				
Income after Tax Deduction	Continuous	2012	Euro Average per capita Income (yearly after tax) at Neighbourhood Level. Inflation calculated and converted for the year 2009. Regressed using, Euro/1000	CBS (Statline), inflation.eu and The Municipality of Rotterdam.
Building Year	Continuous	2013	Year Building Year from 6-digit postcode. Regressed using, Year/100	From Flat File 2013 through "The Municipality of Rotterdam".
Area of House	Continuous	2013	Square Meter Area from 6-digit postcode. Regressed using, Sqm/1000	From Flat File 2013 through "The Municipality of Rotterdam".
Population Density	Continuous	2009	Population per Land Area at Neighborhood Level.	Rotterdambuurtmonitor.nl, CBS (Statline).
Unemployed Labor Force	Continuous	2012	Percentage Share of the unemployed labor force at Neighbourhood Level.	From COS through "The Municipality of Rotterdam".
Ethnic Diversity	Continuous	2009	Ratio Non-indigenous population at Neighbourhood Level.	Rotterdambuurtmonitor.nl
Social Index Bonding	Continuous	2012	Social Index data on Neighborhood at Neighbourhood Level. Regressed using, Index/10	From COS through "The Municipality of Rotterdam".
Residence within 250m of Green Area	Continuous	2008,2011	Percentage Share of inhabitants using green <250m at Neighbourhood Level.	From TIR, Green Park File 2008 & Residents File 2011, through "The Municipality of Rotterdam".
Residence within 300m of Primary Education	Continuous	2010, 2011	Percentage Share of inhabitants with primary education within <300m at Neighbourhood Level.	From SO, R&W and COS, through "The Municipality of Rotterdam".
Residence with public transport stop within reasonable distance	Continuous	2012	Percentage Proportion of residents with a public transport stop (train, metro, and tram) within reasonable distance at Neighbourhood Level.	From V&V and COS, through "The Municipality of Rotterdam".
Residence within 300m of Daily Supply	Continuous	2011, 2012	Percentage Proportion of residents with a daily supply <300m at Neighbourhood Level.	From Residents File 2011 and Investment File 2012, through "The Municipality of Rotterdam".

Annex 7: Table 18- VIF of Multivariate Linear Regression of Model-1

Table 18: Variance Inflation Factor of Multivariate Linear Regression of Model-1, Source: Author, 2015.

Variable	VIF	1/VIF
Ethnic Diversity	7.33	0.136337
Total Green Area	6.59	0.151757
Average Distance from Water In-dyke	4.85	0.206072
Residence within 300m of Daily Supply	4.57	0.218667
Total Land Area	4.52	0.221255
Residence within 300m of Primary Education	4.41	0.226885
Population Density	4.40	0.227342
Residence with Public Transport Stop	4.11	0.243100
Average Income Class	4.11	0.243499
Average House Value	4.06	0.246111
Unemployed Labor Force	3.99	0.250736
Weekly Expense on Travel	3.49	0.286638
Water Area In-dyke	3.33	0.300295
Average of Building Year	3.27	0.305802
Average Distance from Tidal Water Outer-dyke	3.12	0.320419
Social Index Bonding	2.76	0.361960
Tidal Water Area Outer-dyke	2.32	0.430923
Average Distance from Lake In-dyke	1.82	0.548596
Average Working Hour per Week	1.69	0.590118
Residence within 250m of Green Area	1.32	0.755649
Mean VIF	3.80	

Annex 8: Table 19- VIF of Multivariate Linear Regression of Model-2, Without Cut-off Values

Table 19: Variance Inflation Factor of Multivariate Linear Regression of Model-2, Without Cut-off Values, Source: Author, 2015.

Variable	VIF	1/VIF
Weekly Expense on Travel	5.02	0.199323
Total Green Area	4.38	0.228361
Residence within 300m of Daily Supply	4.11	0.243080
Residence within 300m of Primary Education	4.06	0.246210
Ethnic Diversity	4.00	0.250021
Population Density	3.96	0.252299
Total Land Area	3.64	0.274513
Tidal Water Area Outer-dyke	2.94	0.340508
Residence with Public Transport Stop	2.51	0.397736
Unemployed Labor Force	2.42	0.414039
Social Index Bonding	2.20	0.454273
Water Area In-dyke	1.87	0.534176
Average House Value	1.77	0.564772
Average Distance from Water In-dyke	1.56	0.642829
Average Distance from Tidal Water Outer-dyke	1.55	0.644626
Residence within 250m of Green Area	1.52	0.657699
Average Income Class	1.52	0.659163
Area of House	1.44	0.694591
Average of Building Year	1.23	0.815024
Average Distance from Lake In-dyke	1.13	0.882011
Average Working Hour per Week	1.11	0.904154
Mean VIF	2.57	

Annex 9: Table 20- VIF of Multivariate Linear Regression of Model-2, With Cut-off Values

Table 20: Variance Inflation Factor of Multivariate Linear Regression of Model-2, With Cut-off Values, Source: Author, 2015.

Variable		VIF	1/VIF
Total Land Area		3.65	0.273713
Tidal Water Area Outer-dyke		2.95	0.338640
Water Area In-dyke		1.90	0.527608
Total Green Area		4.43	0.225948
Average Distance from Tidal Water Outer-dyke			
	Cut-2, 51-100m	1.72	0.581322
	Cut-3, 101-150m	1.82	0.549506
	Cut-4, 151-200m	1.70	0.587578
	Cut-5, 201-250m	1.62	0.617700
	Cut-6, >250m	4.36	0.229266
Average Distance from Water In-dyke			
	Cut-2, 51-100m	1.72	0.582323
	Cut-3, 101-150m	1.67	0.600389
	Cut-4, 151-200m	1.55	0.643728
	Cut-5, 201-250m	1.50	0.666400
	Cut-6, >250m	2.47	0.404280
Average Distance from Lake In-dyke			
	Cut-2, 51-100m	2.38	0.420121
	Cut-3, 101-150m	2.27	0.440516
	Cut-4, 151-200m	2.32	0.430640
	Cut-5, 201-250m	2.29	0.435909
	Cut-6, >250m	6.18	0.161875
Average House Value		1.79	0.558468
Weekly Expense on Travel		5.06	0.197651
Average Working Hour per Week		1.11	0.901480
Average Income Class		1.53	0.654162
Average of Building Year		1.23	0.809746
Area of House		1.44	0.693892
Population Density		3.99	0.250641
Unemployed Labor Force		2.44	0.409143
Ethnic Diversity		4.02	0.248585
Social Index Bonding		2.21	0.452400
Residence within 250m of Green Area		1.55	0.647122
Residence within 300m of Primary Education		4.11	0.243563
Residence with Public Transport Stop		2.53	0.395758
Residence within 300m of Daily Supply		4.15	0.241233
Mean VIF		2.60	

Annex 10: Table 21- Chronological Development of Landscape Studies (Part-1)

Table 21: Chronological Development of Landscape Studies (Part-1). Source: Lothian, 1999.

Types of Landscape Study (Penning-Rowsell, 1973)	**Landscape Study Techniques** (Arthur, et al., 1977)	**Landscape Study Paradigms** (Punter, 1982)	**Landscape Study Paradigms** (Zube, et al., 1982; Daniel, et al., 1983)	**Landscape-assessment models** (Daniel, et al., 1983)
Independent of Landscape user	*Descriptive Inventories:* Analysis and description of the components of landscapes.	*Landscape perception:* Deals with the mechanics of perception and its links with vision, comprehension, preference and action. The roots of this paradigm are psychology and information processing.	*Expert paradigm:* Evaluation of landscape quality by skilled and trained observers; skills derive from training in art and design, ecology or resource management.	*Ecological model:* Experts assess the environmental qualities of the landscape including its natural amenities. Naturalism is an important dimension.
Dependent on Landscape user: Preference defined by the user.	*Public preference:* Assessment based on public input on preferences.	*Landscape interpretation:* Focuses on the meanings imputed to landscape, especially its social and cultural content. Yi-Fu Tuan is the leading writer on searching for meaning in landscapes.	*Psychophysical paradigm:* Testing general public or selected sample for their evaluation of landscape aesthetic qualities or specific properties. Observer evaluations and behavior are assumed to bear a correlational or stimulus-response relationship to the external landscape.	*Formal aesthetic model:* Landscapes are analysed on the basis of their formal qualities - forms, lines, colours, textures and their interrelationships, plus elements such as variety, harmony, unity and contrast as elements.
	Economic analyses: Evaluation of non-marketable environmental goods.	*Landscape quality:* *Focuses on visual quality and the qualities of formalism apparent in a landscape. Punter considers this the weakest in terms of substantive research yet paradoxically exerting an "alarmingly strong influence" on the experience of landscape.*	*Cognitive paradigm:* This involves a search for human meaning associated with landscapes. Meaning is derived from observation, experience, future expectations and socio-cultural conditioning. *Experiential paradigm:* The experience of the human - landscape interaction is central here, with both being shaped and shaping by the process.	*Psychophysical Model:* Psychophysical methods aim at defining the functional relationships between physical stimuli and psychological responses. Mathematical equations are derived to describe these relationships. *Psychological Model:* This approach examines the feelings and perceptions derived from landscapes. The emphasis is on the cognitive and affective reactions evoked by various landscapes. High quality landscapes may result in positive feelings of happiness, security and relaxation, while low quality landscapes may be associated with negative feelings such as a sense of stress or gloom. *Phenomenological Model*: This model emphasizes the individual's "subjective feelings, expectations, and interpretations" with landscape perception regarded as an encounter between the individual and the environment.

Annex 11: Table 22- Chronological Development of Landscape Studies (Part-2)

Table 22: Chronological Development of Landscape Studies (Part-2). Source: Lothian, 1999.

Landscape-assessment Paradigms and models (Lothian, 1999)	
Objectivist (physical) paradigm: Beauty - an intrinsic quality of the landscape. Expert, Ecological and Formal Aesthetic model drops under this category.	Essentially subjective Generally lacks any theoretical framework. Seeks understanding the landscape's physical attributes, often for management purposes. Differentiates landscape quality on basis of implicit assumptions. Silent on causal factors. Empirical; application of an approach. Site and area specific; results generally cannot be extended beyond area of study. Does not seek explanation of preferences. Assessments are often field based. Relatively easy, inexpensive and rapid to undertake. Does not use respondents to evaluate landscape quality so cannot account for differences in preferences. Non-replicable and unique: application of approach by different individuals likely to result in different assessments of landscapes. Being subjective and non-replicable, the results may be of questionable value and of short-lived application. Unable to be used in a predictive sense except generally. Subjectivity presented as objectivity.
Subjectivist (psychological) paradigm: Beauty - a quality in the eye of beholder. Psychophysical, Cognitive, Experiential, Psychophysical, Psychological and Phenomenological model drops under this category.	Essentially objective. Often derives from a theoretical framework. Seeks understanding of human preferences to understand the physical components, which contribute to landscape quality. Differentiates landscape quality on basis of human preferences explicitly derived. Seeks explanation of causal factors. Experimental; tests hypotheses and extends approach. Not area or site specific; seeks results for wider application. May be applied to understand preferences in different landscapes. Mainly uses surrogates (e.g. photographs) for assessments. Relatively difficult, expensive and slow to undertake. Quantifies influence on preferences of respondent characteristics - age, gender, education, socio-economic and culture. Replicable: providing the sample is adequate, the preferences identified should be consistent across a range of studies. Being objective and replicable the results extend knowledge and are relatively permanent for given community. Capable of predicting effect of landscape change on landscape quality. Objective evaluation of subjectivity.