ASSESSING THE SUSTAINABILITY, USERS' PERCEPTION AND WILLINGNESS TO PAY FOR MANAGEMENT OF PUBLIC BEACHES OF KARACHI

By

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Signature (Dean / Principal): _____

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Table of Contents

List of Figures

List of Tables

Abstract

Beaches are an important natural resource with complex ecosystems and are also extremely popular for recreational usage. In the recent times, beach tourism is expanding rapidly and found to be reliant on sustainable management of these areas. Sustainability assessments are carried out considering factors related to social, environmental, and economic capital of the study area. Indicators related to these factors were compiled to formulate sub-indices evaluating the social (SSI), environmental (ESI), and economic (EcSI) sustainability. These sub-indices were then used to evaluate a compound beach sustainability index (BSI) depicting the overall sustainability of beaches. The assessment tool was deployed on Clifton, Hawkesbay, Sandspit, French Beach and Paradise Point beaches of Karachi, Pakistan. The beaches perform well in terms of environmental sustainability; infrastructure and services were shown to be extremely compromised in term of quality impacting the social sustainability sub-index and under-developed areas around most recreational beaches impacted the economic sustainability sub-index. User perceptions recorded from these recreational beaches showed that the public concerns are aligned with the indicators scoring low on the sustainability assessment with a special interest in provision of infrastructure and services. A large percentage of the respondents were willing to pay for better management of beaches and average reasonable charge was computed to be PKR 101 (USD 0.62).

CHAPTER 1 – INTRODUCTION

1.1. General

In the recent century, coastal areas have suffered worldwide from resource depletion, pollution, degradation of landscapes and wetlands, mining, saltwater intrusion and degradation of mangroves due to expansion of human settlements (Ariza, Pons, & Breton, 2016; IPCC, 2014). Coastal areas are being exploited increasingly for their ecosystem services, beaches in particular. Presently 67 percent of the global population is settled within 60 kilometers of the coastlines and is expected to increase to 75% by 2020 (Amyot & Grant, 2014; Schlacher et al., 2008).

Beaches are most commonly used for conventional tourism (Botero, Pereira, Tosic, & Manjarrez, 2015) and provide great economic benefit through their recreational value (Gormsen & Erdmann, 1997; Sardá, Mora, Ariza, Avila, & Jimenez, 2009) along with supporting an assortment of physical, environmental and social functions (Schlacher et al., 2008). The physical characteristics such as flora, fauna and landscapes impact the potential tourist attraction of beaches (Cabezas-Rabadán, Rodilla, Pardo-Pascual, & Herrera-Racionero, 2019; Micallef & Williams, 2002).

Within the tourism industry of the world, coastal tourism is one of the rapidly expanding areas (Chen & Bau, 2016; Hall, 2001). Beaches are one of the capital natural asset in coastal areas (Ariza et al., 2012; Brenner, Jiménez, Sardá, & Garola, 2010) that are not only the key recreational lands but also support ecological functions such as coastal protection, water filtration and sustaining animal life and local fisheries (Schlacher et al., 2007). Beach environments have been under pressure particularly due to coastal development and associated effects of tourism and recreational activities (Ariza, Lindeman, Mozumder, & Suman, 2014). The change in climatic conditions and its resultant rise in sea level are also constricting the available coastal areas (Defeo et al., 2009; Schlacher et al., 2008). As beach tourism grows, the beach environments are becoming increasingly degraded which affects the ecological and recreational value of these areas (Chen & Bau, 2016; Roca, Villares, & Ortego, 2009).

Beaches differ in their degree of development, tourism, conservation activities, geomorphological processes and human interaction with the ecosystem (Botero et al., 2015). Due to inherent multidimensional character of beaches specialized managerial strategies are required for maintaining beach quality (Chen & Teng, 2016; James, 2000a). Researches carried out for beach environments have usually been restricted to physical aspects and coastal engineering however, in recent times comprehensive efforts have been made to include the environmental, anthropogenic, and managerial aspects for development and strategic planning of these areas (Ariza et al., 2014; James, 2000a; Micallef & Williams, 2002).The fundamental principles of coastal management assume that the managerial actions reflect the best available scientific approach and fully considers the stakeholder perspectives (Ariza et al., 2010; Shipman & Stojanovic, 2007). There is a rising interest in understanding the complex processes taking place in the beach environments for better beach management (Cervantes et al., 2015).

It is observed that the prospective desirability of tourist destinations will be based on the degree of concern for sustainability of natural, cultural and economic resources

(Chen & Bau, 2016; Laws, 1995). The concept of sustainability is derived from framework of sustainable development which is defined as development that meets present needs without jeopardizing needs of future generation (WCED, 1987). Apart from understanding of complex systems and processes, another key feature of sustainability is stakeholder engagement and generation of knowledge particular to local communities (Clark & Dickson, 2003). Practically, beach management is concerned with satisfaction of users' expectations (Ariza, Jiménez, & Sardá, 2008a).

Integrated Coastal Zone Management (ICZM) is now established as a significant standard for the sustainable development of coastal zones (Bille, 2007; Koutrakis et al., 2011). ICZM is a local action that is implemented on ground by stakeholders, both public and private. ICZM is considered a very useful tool in sustainable coastal management and sustainable tourism (International Ocean Institute, 2006; Marzetti et al., 2016).

To achieve the targets of sustainable coastal management ICZM recognizes the need for policy makers for involving private stakeholders to contribute in monetary terms (Bellamy & Johnson, 2000). For sustainable coastal management contribution of beach users' as private stakeholders is considered essential (Dahm, 2003; Marzetti et al., 2016). Willingness to Pay (WTP) is an economic method used to evaluate the monetary contribution that the stakeholders are prepared to make for certain hypothetical alternatives (Baysan, 2001; Budeanu, 2007; Ramdas & Mohamed, 2014). WTP is also an important tool for evaluating the preferences of stakeholders (Matthews, Scarpa, & Marsh, 2017).

1.2. Problem Statement

Pakistan is a developing country burdened with a fragile economy and political uncertainties. Karachi is one of the largest and populous cities of Pakistan and is home to many public beaches that are an important source of recreation and revenue for the inhabitants. Public beaches in Karachi have been recognized as stressed ecosystems faced with various problems such as oil spills, litter, etc. (Akhtar, Ali, Zaidi, & Jilani, 1997; Ali & Shams, 2015). Public beaches of Karachi have not been managed well and various basic necessities and services are missing (Master Plan Department, 2018). There has been no research conducted in these areas related to various assessments and management priorities.

1.3. Research Type

A case study on beaches of Karachi has been proposed to be carried out for the given problem statement.

1.4. Research Questions

The following research questions have been derived from the problem statement:

i.   What are the practices being followed for sustainable management of recreational beaches around the globe?
ii.   What are the practices being followed for management of recreational beaches in Karachi?
iii. How recreational beaches of Karachi rank in terms of beach quality?

What are the public's opinions and perceptions about recreational beaches in Karachi?

v. What interventions might be required to introduce sustainable beach management practices in recreational beaches of Karachi?

1.5. Research Objectives

Following are the research objectives formulated to address the questions raised in this research:

i. To identify sustainability indicators for recreational beach management.
ii. To evaluate public beaches of Karachi through the lens of sustainability.
iii. To record stakeholder perception about quality and their willingness to pay for better management of Karachi beaches.
iv. To recommend strategies for sustainable beach management.

CHAPTER 2 – LITERATURE REVIEW

2.1. General

Beaches are areas of unconsolidated sediments, usually comprising of sand and pebbles, deposited at the shore of large water bodies, including intertidal and bathing zones (Basterretxea-Iribar, Sotés, & Maruri, 2019; Zacarias, Williams, & Newton, 2011). These are complex natural ecosystems (Ariza et al., 2012; James, 2000b), of great importance to coastal population, supporting an assortment of physical, environmental, social, economic services and goods (Schlacher et al., 2008).

Conventionally, the studies related to beach environments have focused on recreation and coastal defenses (Ariza et al., 2008a; Micallef & Williams, 2002). Due to the multidimensional and complex nature of beach ecosystems integrated management approach is required for beaches (Ariza et al., 2008a; James, 2000b).

2.2. Beach Management

2.2.1. General

Beach management has been defined as the process that manages various natural functions, construction and maintenance coastal structures by monitoring and intervention in such a way that achieves an acceptable compromise between social, environmental and economic objectives based on available finances (Micallef & Williams, 2002; Simms, Beech, & John, 1995). Beach management has also been defined as process for maintaining and improving the recreational and coastal protection aspects of beach environments by providing services catering to beach users (Bird, 1996; Micallef & Williams, 2002).

2.2.2. Need for Beach Management

Beaches are a host to numerous social, environmental and economic activities (Schlacher et al., 2008). It is needful for the policy makers to prioritize the management of issues according to the socio-economic and environmental interests in these areas (Micallef & Williams, 2002).

In recent decades, beach tourism has grown at an accelerated pace (Chen & Bau, 2016; Hall, 2001). Rising global temperatures and resultant sea level rises also pose new challenges for beach managers (Defeo et al., 2009; Schlacher et al., 2008).

2.2.3. Principles of Beach Management

Beach management practice adheres to the following principles for formulation of effective beach management plans (Micallef & Williams, 2002):

i. A complete understanding of coastal processes such as sedimentation, erosion and transport paths, along with compilation and maintenance of long-term data related to these processes.
ii. Identification of local characteristics and issues related to infrastructure and services for potential management solutions.
iii. Identification of economic value of beach resources for potential optimization.
iv. Application of suitable techniques to examine coastal problems and their cost-effective resolution through expert opinion.

v. Development of effective legislative and enforcement instruments defining jurisdiction, roles and responsibilities of various institutional bodies.

2.2.4. Beach Management Approach

For effective beach management formulation the following strategic approach is adopted (Micallef & Williams, 2002):

i. Analysis – involves the determination of current situation, identification of problems and potential solutions.
ii. Planning – involves the identification of planning strategy for implementation of potential solutions and techniques to be followed.
iii. Management – involves the complete implementation of the planning strategy identified in the previous step through a management plan.
iv. Monitoring – involves the assessment and monitoring of objectives achieved and progress made by implementation of the management plan through set milestones.
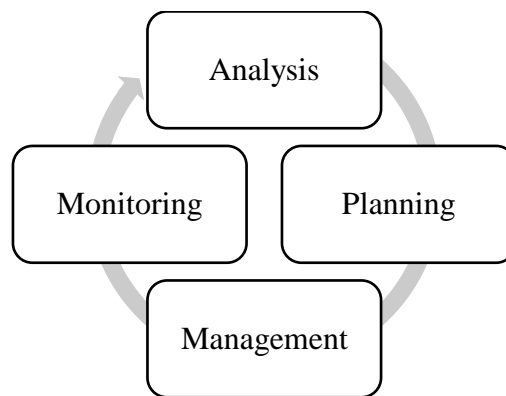
Figure 1. Strategic Approach to Beach Management

2.2.5. Techniques in Beach Management

The following techniques have been employed in various studies for the effective beach management around the world:

Sr. #	Technique	Reference
1	Geomorphological Assessment	(Abbott, 2013; Abreu et al., 2016; Al Bakri, 1996; Dissanayake, Brown, Wisse, & Karunarathna, 2015; Karunarathna, Brown, Chatzirodou, Dissanayake, & Wisse, 2018; López, Baeza-Brotons, López, Tenza-Abril, & Aragonés, 2018; Rodella, Corbau, Simeoni, & Utizi, 2017; Soomere, Kask, Kask, & Healy, 2008; Thom et al., 2018).
2	Sediment Transport Assessment	(Abbott, 2013; Abreu et al., 2016; Al Bakri, 1996; Dissanayake et al., 2015; Karunarathna et al., 2018; López et al., 2018; Soomere et al., 2008; Thom et al., 2018)
3	Assessment of impacts of natural processes (climate	(Alexandrakis, Manasakis, & Kampanis, 2015; Cervantes et al., 2015; Cooper & Lemckert, 2012; Daniel, 2001; Dissanayake et al., 2015;

	change, storms, floods, wave dynamics, etc.)	Gopalakrishnan, Smith, Slott, & Murray, 2011; Jiménez, Gracia, Valdemoro, Mendoza, & Sánchez-Arcilla, 2011; M. R. Phillips & Jones, 2006; Pikelj, Ružić, Ilić, James, & Kordić, 2018; Semeoshenkova & Newton, 2015; Soomere et al., 2008; Wiggins, Scott, Masselink, Russell, & McCarroll, 2019)
4	Water Quality Assessment	(Bedri et al., 2016; Buer et al., 2018; Keswani, Oliver, Gutierrez, & Quilliam, 2016; M. C. Phillips, Solo-Gabriele, Piggot, Klaus, & Zhang, 2011)
5	Scenic Assessment	(Anfuso, Williams, Cabrera Hernández, & Pranzini, 2014; Anfuso et al., 2017)
6	Environmental Assessment	(Amyot & Grant, 2014; Ariza, Jiménez, & Sardá, 2008b; Ashbolt, Schoen, Soller, & Roser, 2010; Calado, Bragagnolo, Silva, & Vergílio, 2016; Dickerson, Hagedorn, & Hassall, 2007; Gonçalves & Marques, 2017; González & Holtmann-Ahumada, 2017; Palomino de Dios, Cabrera Salvat, Martinez Garrido, & Sanchez-Cabeza, 2012; Pereira, Jiménez, Medeiros, & Da Costa, 2003; Psuty, 1988; Ramdas & Mohamed, 2014)
7	Ecosystem Services Assessment	(Marshall, Banks, & Cook, 2014; Sardá et al., 2015)
8	Beach Users' Perception Assessment	(Ariza et al., 2010; Cervantes & Espejel, 2008; Chen & Teng, 2016; Enriquez-Acevedo, Botero, Cantero-Rodelo, Pertuz, & Suarez, 2018; Espejel et al., 2007; Gore, 2007; Leatherman, 1997; Lozoya, Sardá, & Jiménez, 2014; Lucrezi, Saayman, & Van der Merwe, 2016; Marin, Palmisani, Ivaldi, Dursi, & Fabiano, 2009; Marzetti et al., 2016; Morgan, 1999a, 1999b)

Table 1. Techniques in Beach Management

2.2.6. Results of Beach Management

Implementation of effect beach management strategies is considered to help achieve the following (Micallef & Williams, 2002):

i. Higher financial gains through increased beach use and reduction in maintenance costs.
ii. Increase in aesthetic quality and conservation value of beach ecosystem.
iii. Increase in the socio-economic value of the beach locality.

2.3. Sustainable Beach Management

2.3.1. General

The concept of sustainability is derived from framework of sustainable development which is defined as development that meets present needs without jeopardizing needs of future generation (WCED, 1987). The dynamic relationship of nature and society is the primary focus of sustainability science (Clark & Dickson, 2003). In view of this

focus, sustainability has been defined in terms of three dimensions namely Social Sustainability, Economic Sustainability and Environmental Sustainability (Dyllick & Hockerts, 2002).

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                              ┌──────────────┐
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│Sustainability│─────────┼────│   Economic   │
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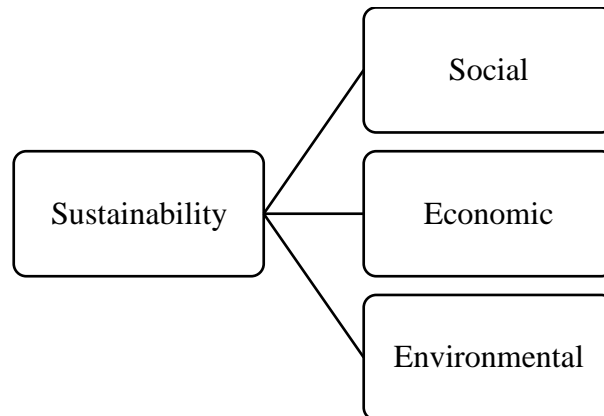
Figure 2. Dimensions of Sustainability

2.3.2. Principles of Sustainable Coastal Management

Sustainability science does not have a definite set of principles for implementation pertaining to various disciplines. However, following principles for sustainable management of coastal areas have been extracted through literature (Clark & Dickson, 2003; Cummins & McKenna, 2010):

   i.   Utilization of problem driven agenda for resolution of sustainable development policy issues.
  ii.   Coproduction and enhancement of knowledge through stakeholder engagement.
 iii.   Employment of interdisciplinary approach.
  iv.   Accounting for the earth system complexity.
   v.   Focusing the research and communication activities at the local level.
  vi.   Enabling the process of social learning instead of providing conclusive answers.

2.3.3. Techniques in Sustainable Beach Management

According to the principles of sustainable coastal management, following are some additional techniques to quality assessments that have been developed for sustainable beach management:

   i.   Willingness to pay (WTP) for services.
  ii.   Integrated coastal zone management (ICZM)

2.3.3.1. Willingness to Pay (WTP)

Willingness to Pay (WTP) is an economic method used to evaluate the monetary contribution that the stakeholders are prepared to make for certain hypothetical alternatives (Baysan, 2001; Budeanu, 2007; Ramdas & Mohamed, 2014). WTP is also an important tool for evaluating the preferences of stakeholders (Matthews et al., 2017). To achieve the targets of sustainable coastal management the need for policy makers to involve private stakeholders to contribute in monetary terms has been recognized (Bellamy & Johnson, 2000). For sustainable coastal management contribution of beach users' as private stakeholders is considered essential (Dahm, 2003; Marzetti et al., 2016).

2.3.3.2. Integrated Coastal Zone Management (ICZM)

Integrated coastal zone management (ICZM) is a strategy for integration of all policies, sectors and interests for better management and planning of coastal areas. It involves the engagement of all coastal stakeholders, good communication among the governing institutions and addresses all three dimensions of sustainability. Therefore, ICZM delivers instruments for comprehensive and inclusive management of coastal resources (International Ocean Institute, 2006).

Integrated Coastal Zone Management (ICZM) is now established as a significant standard for the sustainable development of coastal zones (Bille, 2007; Koutrakis et al., 2011). ICZM is a local action that is implemented on ground by stakeholders, both public and private. ICZM is considered a very useful tool in sustainable coastal management and sustainable tourism (International Ocean Institute, 2006; Marzetti et al., 2016).

2.3.3.2.1. Principles of Integrated Coastal Zone Management

The following principles of integrated coastal zone management have been identified for efficient ICZM as applied in Europe (International Ocean Institute, 2006):

i. Development of an overall perspective addressing the interdependence and difference between natural systems and their interaction with anthropogenic activities.

ii. Development of a long-term perspective addressing the precautionary principle and preservation of present and future needs.

iii. Assistance in adaptive management enabling adjustment for problems emerging with evolution of coastal areas and development of body of knowledge.

iv. Addressing the local conditions and diversity of coastal areas for provision of practical and explicit solutions and flexible procedures.

v. Accounting for the carrying capacity of coastal ecosystems and natural processes to prevent overexploitation of coastal areas.

vi. Development of stakeholder engagement through processes of agreements and shared responsibility.

vii. Development of effective coordination, communication and partnership between institutions and administrative bodies at local, regional and national level through revision of existing policies.

viii. Employment of a combination of various instruments designed to enable the coherence between policy objectives, planning and management.

CHAPTER 3 – METHODOLOGY

3.1. General

This chapter will highlight the research progression that is being followed for the conduct of this study. Description of study area, tools and instruments to be used is also included in this chapter.

3.2. Research Design

This research is planned to be carried out in the sequence portrayed in Figure 3. Research Flow Diagram.

3.3. Study Area

3.3.1. General

Karachi is the largest metropolis of Pakistan having a population of over 16 million inhabitants (Pakistan Bureau of Statistics, 2017). The city is located between 24°45′ N to 25°37′ N and 66°42′ E to 67°34 E. It is bordered by 27 km of shoreline containing numerous public beaches, some of which are Clifton, Paradise Point, Hawkesbay, Sandspit and French Beach (Ali & Shams, 2015). Karachi is located in the arid hot desert environment characterized by low annual precipitation (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006).

3.3.2. Public Beaches of Karachi

Following are the public beaches of Karachi and their brief descriptions:

3.3.2.1. Clifton Beach

Clifton beach is the most popular recreational beach of Karachi. Also known as Sea View, Clifton beach extends 5 km along the shoreline and is close to the city center. It experiences a huge influx of visitors every day (Ali & Shams, 2015; Hasan, 2012). In 2003, the beach was affected by an oil spill disaster which is considered the largest ecological disaster in the history of Pakistan (Hassan & Javed, 2011).

3.3.2.2. Hawkesbay and Sandspit Beaches

Hawkesbay and Sandspit beaches are located at the southern limits of Karachi. Both these beaches are protected nesting areas for the Green and Olive Ridley Turtles (Firdous, 2001). These are also prime recreational public beaches of Karachi (Durranee, Hasnain, & Ahmad, 2008).

3.3.2.3. Paradise Point

The paradise point beach attracts visitors due to presence of a sandstone rock promontory that forms a natural arch which has eroded over time. In 1986, a picnic area was established by the Karachi Development Authority (KDA) which is now nonoperational (Master Plan Department, 2018).

3.3.2.4. French Beach

French beach is located between Hawkesbay and Paradise Point Beaches. It is a relatively clean beach and is frequented by foreigners and high-income population.

Start

Research Papers → Initial Literature Review ← Reports

Research Gap

Problem Statement

Research Questions

Research Objectives

Research Papers → Comprehensive Literature Review ← Reports

Study Area Description   Methodologies Adopted   Instruments / Tools

Secondary Data   Method Statement ← Selection of Indicators

Data Collection

Data Analysis

Results

Conclusions / Recommendations

Draft Report Writing

Review of Report by GEC Members → Not Accepted

Accepted

Publication of Thesis / Research Paper

Thesis / Research Paper

End

Figure 3. Research Flow Diagram

3.3.3. Administrative Setup

Currently, the Sindh Local Government Act of 2013 (SLGA 2013) defines the local government setup of Karachi. Following are the government authorities, having the jurisdiction of planning and development functions, currently working in Karachi:

3.3.3.1. Karachi Development Authority (KDA)

The Karachi Development Authority (KDA) was first established in 1957 by merging Karachi Improvement Trust (KIT) and Karachi Joint Water Board. In 2002, KDA was merged in the City District Government Karachi (CDGK). In 2016, KDA was again restored and is now controlled by provincial government Department of Local Government, Housing and Town Planning. Following are the functions of KDA (Karachi Development Authority, 2016):

i. Land use planning, development, redevelopment, coordination and providing planning advice.
ii. Housing development.
iii. Maintenance of roads and bridges.
iv. Implementation of anti-encroachment regulations
v. Resettlement of displaced populations.
vi. Carrying out research and its publication.
vii. Managing and maintenance of horticulture.
viii. Digitization of land records.
ix. Implementation of an accounting system.
x. Filing of land records.
xi. Acquisition of land.
xii. Managing and maintenance of charged parking.

3.3.3.2. Karachi Metropolitan Corporation (KMC)

Established as Karachi Conservancy Board in 1846, it was upgraded to Karachi Municipal Commission in 1856, then turned to Karachi Municipal Corporation in 1933 and then to Karachi Metropolitan Corporation in 1976. Karachi Metropolitan Corporation (KMC) is a governing body that provides the municipal services to the residents of Karachi (Karachi Metropolitan Corporation, 2012a). Following are the functions of KMC (Karachi Metropolitan Corporation, 2012b):

i. Planning, development and maintenance of roads and bridges.
ii. Special Development Program.
iii. Provision, supervision, coordination, monitoring and maintenance of municipal services such as streetlights, storm water drains, solid waste management, firefighting, and milk supply schemes, etc.
iv. Maintenance of abattoir and cattle colonies.
v. Maintenance of specialized hospitals and medical colleges.
vi. Culture (art galleries, libraries and museums), sports (complexes and stadiums), parks and recreation (Beaches, aquariums, zoos) services.
vii. Traffic Engineering.
viii. Managing and maintenance of charged parking.

3.3.3.3. Beach Administration

From 1952, the beaches were under the jurisdiction of KDA development of which was being done through the Karachi Improvement Trust (KIT). In 1985, Governor Sindh established the Beach Development Board (BDB) whose objective was to formulate the immediate actions required for developing beaches as well as conceiving the long-term master plan for beach development and recreation. The Master Plan and Environmental Control Department (MPECD) of the KDA was designated as the executing agency of BDB (UNDP, 1991).

In 2002, with the merging of KDA with the CDGK, the coastal development came under the umbrella of CDGK. In 2016, with the implementation of the Sindh Local Government Act of 2013 (SLGA 2013), KDA was restored, but the development, maintenance and control of beaches was given to the KMC.

3.3.4. Development Plans

Following are the development plans of Karachi and their position on the development of beaches and recreation:

3.3.4.1. Greater Karachi Plan 1952

In this plan the Karachi Improvement Trust (KIT) was given the control of the development of beaches. The plan suggested practically the whole strip of shore from Hawkesbay along Sandspit to Manora and Clifton Beach be protected and open for recreational purposes. Clifton beach has been identified with the potential for development of bathing resorts, sports facilities, etc. The plan states that the major portion of developmental budget is set to be expended on industries and harbour development showing that the beaches may be neglected. Private partnerships are identified as a potential source of funding in this plan (Master Plan Department, 1967).

3.3.4.2. Karachi Development Plan 1974-1985

In this plan the KDA has been given designated for development of beaches. This plan focuses on providing recreational facilities to target groups that are the low-income families, adult females and preschoolers, providing adequate public facilities in all the recreational areas and ensuring proper usage of these facilities for improved recreational planning, land use planning and control. It is stated in the plan that the resources are deficient which is aggravated by the imbalances existing between program management and implementation. Annual plan 1972-73 shows that, for the distribution of the government resources, production and physical infrastructure are ranked very high. It has also been shown that the resource expenditure gap for execution of development plan requires supplemental financing (Master Plan Department, 1974).

3.3.4.3. Karachi Development Plan 2000

In this plan the KDA and KMC share the responsibility of developing the beaches. This plan focuses on the adoption of Coastal Recreation Plan for Karachi made with aid from UNCHS. It identifies the nature of development at coastal areas as well as the areas that can be utilized for recreational uses. Resource deficiency is again highlighted, and it has been shown that the revenues of KDA have depleted. A major portion of these revenues are expended on land development schemes. There is an increase in

expenditure and developmental activities are financed by borrowing and plot sales. Cost recovery from public use of services has been highlighted for financing the plan (Master Plan Department, 2000).

3.3.4.4. Karachi Strategic Development Plan 2020

This plan was made during the time when local government system of Karachi comprised of the CDGK, due to which the KDA and KMC again shared the responsibility of managing beaches and coastal areas. This plan states that:

i. Equitable recreation facilities should be provided to the general public.
ii. For the development along the coast, Karachi Coastal Recreation Development Plan 1990-2000 shall be followed.
iii. The beaches and seaside shall be conserved and treated as public properties.
iv. The access to the beaches shall be kept unhindered and free for recreational purposes for the citizens.
v. Development shall not be allowed in shore area up to 150 meters from the high-water mark.
vi. The recreational development shall be self-sufficient, demand oriented and profit generating.

According to the plan the local government needs to move from reliance on provincial budget to self-dependence. Revenues should be generated through suitable taxation and collection. The processes by which the city funds its development needs to be changed. Debt financing of feasible investment projects is essential. Utility services need to be priced cautiously and collect proceeds more efficiently. The Federal and Provincial Governments shall continue to provide special financial bundles.

3.3.5. Reports of NGOs Related to Beach Management in Karachi

Following are some reports and their findings by NGOs on plans drafted for development of Karachi:

3.3.5.1. Evaluation of Karachi Master Plan 1986-2000

This evaluation was conducted by the UNDP (PAK/86/029). The report findings show that This plan does not sufficiently deal with the environment related issues and does not consider various social and political factors for development. The report also notes that organizational structure of KDA needs to be re-evaluated for better management and governance. There is no formal setup of monitoring that adversely affects the planning process. KDA itself did not execute the development plan strategies that were in its jurisdiction.

3.3.5.2. Evaluation of Karachi Coastal Management and Planning Project

This evaluation was conducted by the UNDP (PAK/88/001). The report concludes that the project has been satisfactorily completed and for implementation the recommendations need to be taken under consideration. A beach development board (BDB) has been formed and recreation plans will be approved by the said board.

3.3.6. ICZM in Pakistan

ICZM plan for Pakistan was developed in 2010 with the help of International Union for Conservation of Nature (IUCN) (Qureshi, 2011). The focus of this plan is on the following objectives (Qureshi, 2011):

  i. Improvement in sectoral management through legislative interventions and training.
 ii. Conservation of coastal areas by protecting the biodiversity and productivity from pollution, destruction and overexploitation.
iii. Promoting sustainable development of coastal areas.

The ICZMP outlines a Five Year Implementation Plan for the successful achievement of the above mentioned objectives (Qureshi, 2011).

3.4. Method Statement

3.4.1. General

In order to achieve the objectives defined for this research, following generalized steps are to be carried out:

  i. Scrutinizing and organizing indicators related to beach management.
 ii. Selection of indicators for evaluation of beaches and their management.
iii. Evaluation of selected indicators for sustainability assessment of recreational beaches of Karachi.
 iv. Formulation and implementation of a questionnaire survey to record the user perception about quality of public beaches and their management.

3.4.2. Instruments and Tools

3.4.2.1. Beach Sustainability Index (SI)

Sustainability assessments are conducted considering the social, environmental, and economic dimensions and their relevant indicators. These indicators are reflective of natural, social, and built capital and grouped under indices or systems (Da Silva, Fernandes, Limont, & Rauen, 2020).

For formulation of index to evaluate the sustainability of beaches, a comprehensive literature review was carried out of the research available regarding beach assessment tools. 84 indicators were selected from the literature review based on their relevance to the objective of the research and ease of incorporation of local standards for evaluation. These indicators were then organized and classified into social, environmental, and economic categories and were assigned scoring from $0 - 1$, with 0 being worst performing or unavailable service and 1 being best performing or available service. After scoring, the indicators were evaluated based on their value, with $0 - 0.4$ as requiring immediate attention, $0.41 - 0.7$ as stable or in need of moderate attention and $0.71 - 1$ as requiring minimal attention. A comprehensive checklist was prepared using these indicators for evaluation of Beach Sustainability Index (BSI). The compound beach sustainability index is given by Equation 1.

$$BSI = \frac{Sum\ of\ Sub\ Indices}{Number\ of\ Sub\ Indices}$$

Equation 1. Beach Sustainability Index (BSI)

3.4.2.1.1. Sub-Index # 1 – Social Sustainability (SSI)

This sub-index provides the criteria for evaluating the beaches in terms of how they perform on social indicators. The indicators selected to be included in this sub index relate to social services, infrastructure, safety, socioeconomic and socioenvironmental facilities as well, making it quite comprehensive. It is calculated as shown in Equation 2.

$$SSI = \sum_{i=1}^{n} \frac{S_i}{n}$$

Equation 2. Social Sustainability Sub Index

The indicators included in this sub index are as follows:

a) **Beach Area** (Ariza et al., 2010; Leatherman, 1997; Morgan, 1999a)

Intensity of beach usage changes according to the habits of the beach users. Holiday seasons see increase in the number of visitors that come to beaches. Adequate area is required to meet the recreational needs of the users. Beach area per user (m^2/user) has been used as an indicator to assess the availability of adequate area to fulfill the recreational needs of beach users.

b) **General Information** (Lucrezi et al., 2016)

General information regarding beaches is usually displayed at the accesses. These include rules, regulations, and fines for violating the set regulations. Display of this information is necessary and is used as an indicator for this index as it facilitates comfortable visit.

c) **Public Restrooms** (Leatherman, 1997; Morgan, 1999a)

Public restrooms are considered an important basic service to be provided at recreational beaches and is highly demanded by users (Morgan, 1999b). It is included in all beach certification processes (Nelson, Morgan, Williams, & Wood, 2000). The availability, spacing and cleanliness of restrooms have been included as indicators for assessing the level of services provided at the beach.

d) **Litter Bins** (Leatherman, 1997; Morgan, 1999a)

Litter bins are required at beaches for proper disposal of garbage. Litter bins are required to be designed and spaced to prevent escape of garbage through wind and animal action (Lucrezi et al., 2016). Availability and spacing have been taken as indicators to highlight the presence and efficiency of waste management process.

e) **Drinking Water** (Leatherman, 1997; Morgan, 1999a)

Safe and potable water provision is an essential service to be provided in public areas. Studies have shown priority given by users to the availability of drinking water (Morgan, 1999b).

f) Refreshment and Shopping (Leatherman, 1997; Morgan, 1999a)

Refreshments make up an essential part of a tour. Availability of restaurants and cafes has been identified as a service that must be present at recreational beaches even at a small scale. Provision of shops and markets has also been identified as services to be provided near beaches (Morgan, 1999b).

g) Rentals (Leatherman, 1997; Morgan, 1999a)

Huts, sunbeds, and hammocks etc. are included in rentals. Rentals may be provided by public or private sector. Studies show that the priority given to rentals by users is usually low but is still considered an essential service to be provided at recreational beaches (Morgan, 1999b).

h) Accommodation (Lucrezi et al., 2016)

Recreational beaches see influx of visitors from distant areas who require accommodation near the coast. Although the demand for accommodation increases during holiday seasons, the availability is still considered an essential service to be provided for the use of tourists.

i) Grounds and Promenades (Leatherman, 1997; Lucrezi et al., 2016)

Well-kept grounds and promenades not only add to the aesthetic quality of beaches but also provide areas for activities such as picnics, walking and jogging etc. Availability of these have been included in the evaluation of services.

j) Illumination (Lucrezi et al., 2016)

Illumination at the beach adds to the aesthetic of the area as well as providing comfort and facilitation to the visitors after sunset. Availability of illumination is considered important and is included as an indicator.

k) Artificial and Natural Shades (Lucrezi et al., 2016)

Shaded areas are required for relaxing by the beach visitors. Shades are given importance as an essential facility to be provided (Lucrezi et al., 2016). Availability of artificial shades such as umbrellas and natural shades such as trees have been included as an indicator based on the importance given by the visitors.

l) Beach Sports (Lucrezi et al., 2016)

Beach sports are most enjoyed activities by the visitors (Lucrezi et al., 2016; Morgan, 1999b). Due to the importance of beach sports, availability of these facilities is included as an indicator.

m) Facilities for Children (Lucrezi et al., 2016)

Numerous studies in different parts of the work shows that the beaches are frequented by families including small children (Cervantes, Espejel, Arellano, & Delhumeau, 2008; Rodella et al., 2019). Child specific recreational facilities must be provided at these areas in form of amusement parks and pools etc.

n) Facilities for Differently Abled People (Lucrezi et al., 2016)

The 2030 agenda for sustainable development promotes inclusivity and focuses on removing inequalities (United Nations, 2019) Public spaces must be inclusive and cater

for the differently abled people therefore the availability of these facilities (ramps, etc.) is taken as an indicator.

o) Lifeguards and Security Personnel (Leatherman, 1997; Morgan, 1999a)

According to literature, the lifeguard provisions get high priority in the list of services to be provided at beaches (Morgan, 1999b). Therefore, availability of lifeguards and security personnel have been included in the services to be assessed.

p) First Aid and Emergency Response (Lucrezi et al., 2016)

Beaches may or may not be close to urban areas. In case of emergency or accident it is important to have first aid facilities at the beaches and emergency response units close by.

q) Vendors (Lucrezi et al., 2016)

According to studies, beach users have different response to vendors. Some people see the need for the services these vendors provide, others do not (Lucrezi et al., 2016). However, availability of vendors has been included as an indicator as they are an important source of economic activity.

r) Unleashed Animals (Ariza et al., 2010; Leatherman, 1997; Lucrezi et al., 2016)

It is customary for many people to bring their pets to public places such as parks and beaches. But some people find presence of unleashed animals uncomfortable and unsafe. Therefore, presence of unleashed animals is included as an indicator that impacts experience of beach users.

s) Off-Road Vehicles (Ariza et al., 2010; Cervantes & Espejel, 2008; Leatherman, 1997; Lucrezi et al., 2016; Morgan, 1999a)

Off-road vehicles are considered a nuisance in public places, especially beaches. In developing countries there is an abundance of smaller vehicles such as motorcycles that have relatively easier access to beaches. Therefore, presence of off-road vehicles is taken as indicator that affects the beach users' overall experience.

t) Criminal / Offensive Activities (Ariza et al., 2010; Leatherman, 1997; Lucrezi et al., 2016)

Crime levels and other law infringing activities can impact perceptions of public safety at beaches. Therefore, presence of these activities is taken as an indicator as they can seriously impact the number of visitors that visit these areas.

u) General Access (Ariza et al., 2010; Cervantes & Espejel, 2008; Leatherman, 1997; Lucrezi et al., 2016; Morgan, 1999a)

The condition of the general access to beaches impacts the decision of public to visit a certain area. It contributes to ease of access of such places. A well-constructed access is a public asset and is taken as an indicator.

v) Signposting (Ariza et al., 2010; Morgan, 1999a)

Signposts are an important contributor to accessibility. Therefore, presence of signposting is taken as an indicator as it impacts ease of access.

w) Public Transport (Ariza et al., 2010; Lucrezi et al., 2016)

The presence of public transport is a contributing factor to the accessibility of a public beach. Therefore, it is included as an indicator.

x) Parking Areas (Ariza et al., 2010; Cervantes & Espejel, 2008; Lucrezi et al., 2016; Morgan, 1999a)

Safe and accessible parking spaces are the need of every public space. Therefore, availability and distance of these areas from the public beaches are included as indicators.

y) Pedestrian Accesses (Ariza et al., 2010; Lucrezi et al., 2016)

Pedestrian access to the beaches plays an important role in the decision to visit for the public. Easy and safe accesses need to be provided to the public. Therefore, the availability, state and distances of these accesses have been included as indicators.

z) Beach Safety (Ariza et al., 2010; Leatherman, 1997; Lucrezi et al., 2016; Morgan, 1999a)

Safety is a very important consideration in public spaces. Not only do the public need to be protected from criminal elements but from natural hazards as well. Therefore, availability of a safety plan, buoys, warning systems, rescue facilities and demarcation of unsafe areas are included as indicators.

The indicators included in the social sustainability (SSI) along with the scoring criteria are shown in the *Table 2*.

3.4.2.1.2.   Sub-Index # 2 – Environmental Sustainability (ESI)

This sub-index provides the criteria for evaluating the sustainability of beach ecosystems in terms of environmental integrity. Some indicators are scored as per standards established by the public institutions. It is calculated as shown in Equation 3.

$$ESI = \sum_{i=1}^{n} \frac{E_i}{n}$$

Equation 3. Environmental Sustainability Index (ESI)

This sub-index consists of the following indicators:

a) Fecal Coliform (Ariza et al., 2010; Nelson et al., 2000)

Fecal coliform is a pathogenic bacterium that is usually found in the feces of warm-blooded animals. Fecal coliform is easy to detect, and tests are considered reliable. It is used as an indicator of water quality as it points to the presence of other pathogenic bacteria.

b) Total Coliforms (Ariza et al., 2010; Nelson et al., 2000)

The total coliform count comprises of all types of coliforms that are found in the water and gives the overall contamination of water. These coliforms maybe transported to the water through animal fecal matter or through soil.

The standards proposed for water quality in Pakistan suggest that the amount of fecal coliforms should be limited to 1000 CFU/100 ml and that of total coliforms to 5000 CFU/100 ml for recreational waters (WWF Pakistan, 2007).

c) Turbidity (Leatherman, 1997; Morgan, 1999a)

Turbidity is a measure of transparency of water. Turbidity indicates the presence of suspended particles in the water which are an important source of surface water pollution (Bilotta & Brazier, 2008). Therefore, it is used as an indicator for environmental quality as it points to the degradation of beach in terms of water quality.

d) Colour of Water (Leatherman, 1997; Morgan, 1999a)

The colour of water plays an important role in the recreational quality of beaches. It is used as an indicator as it points to the hygienic quality of beach water.

e) Colour of Sand (Leatherman, 1997; Morgan, 1999a)

The colour of sand holds importance as discoloured sand indicates to the presence of pollutants in the sand matrix. Therefore, it is used as an indicator to assess level of pollution in the beach sand.

f) Organic Waste (Leatherman, 1997; Morgan, 1999a)

Organic waste floating in the sea water is not only a bad sight but also is hazardous for health of the visitors of the beach. The presence of floating organic waste is used as an indicator of environmental quality as it has implications on ecological integrity of the beach systems.

g) Algae (Leatherman, 1997; Morgan, 1999a)

Algal blooms can be harmful not just for the marine mammals, but they are also a cause of different diseases in human beings on ingestion. Algal blooms also deprive water columns of their oxygen presenting a hazardous situation (Zhang, Lee, Liang, & Shum, 2015). Therefore, presence of algae is used as indicator for environmental quality of beaches.

h) Red Tide (Leatherman, 1997)

Red tides are also associated with algal blooms in the sea. Red tides are caused by increase in number of algal blooms which discolour the water and release toxins that are harmful to humans and animals (Anderson, 1994). Occurrence of red tide is used as an indicator as it is an environmental hazard.

i) Odours (Leatherman, 1997; Morgan, 1999a)

Odours and smells contribute to some extent to air pollution. They may be due to cooking, rotting fish and seaweeds, etc. As beaches are recreational grounds, presence of odours is used as an indicator for air quality of these environments.

j) Noise (Leatherman, 1997; Morgan, 1999a)

Noise is undesirable sound contributing factor of environmental pollution and is a form of air pollution (Goines & Hagler, 2015). Sources of noise pollution at beaches is usually due to overcrowding, motor vehicles and nearby industry if any. Therefore, presence of noise is used as an indicator for environmental quality.

k) Wildlife (Leatherman, 1997)

Wildlife is found in area that are environmentally viable for the species. Abundance or dearth of wildlife in different areas indicates whether an area is environmentally safe or unsafe for species to exist. Wildlife also contributes to the long term stability of ecosystems (Zeppel, 2010).

l) Pests (Leatherman, 1997; Morgan, 1999a)

Flies and mosquitoes are vectors of many pathogenic diseases in humans and animals. Pests such as these breed in filth such as garbage heaps and excrement etc. (Graczyk, Knight, Gilman, & Cranfield, 2001; Tolle, 2009). Presence of these pests is therefore used as an indicator of environmental quality.

m) Harmful Animals (Lucrezi et al., 2016; Morgan, 1999a)

There are numerous factors that impact the recreational quality of beaches. Presence of harmful animals is one of the factors that impacts the favourability of beaches from recreational point of view (Lucrezi et al., 2016). This indicator is included to assess the bio-environmental quality of the beaches.

n) Plantation (Lucrezi et al., 2016)

Plantation refers to the plants and trees planted by authorities to improve the environmental quality in the beach areas such as along walkways and promenades etc. This indicator is included to reflect the activities done to preserve the environmental quality of beaches.

o) Trash and Litter (Leatherman, 1997; Morgan, 1999a)

Trash and litter found in beaches are not only hazardous to health but also affect the aesthetics of these areas (Amyot & Grant, 2014). Presence of trash and litter is used as an ecological indicator that points to the environmental pollution.

p) Oil and Tar Balls (Leatherman, 1997; Morgan, 1999a)

Oil and tar balls are usually the consequence of an oil spill event. Offshore oil spills have negative impacts on the marine and coastal environments not only to humans but also killing fish eggs, larvae and birds etc. (Teal & Howarth, 1984). Presence of oil and tar balls is used as an indicator of pollution.

q) Glass and Rubble (Leatherman, 1997)

Glass and rubble are solid wastes that can cause injury to beach visitors. Presence of these wastes is included as an indicator of environmental quality as it points to the failure of solid waste management process.

r) Animal Conservation (Lucrezi et al., 2016)

With the exploitation of coastal areas, the proper functioning of beach ecosystems will depend heavily on conservation efforts undertaken (Schlacher et al., 2007). Therefore, the conservation activities undertaken at beaches is used as an indicator of environment quality.

s) Educational Activities (Lucrezi et al., 2016)

Educational activities at beaches usually involve talks given by tour guides and officials. It is also done through visitor centers, signs, displays and brochures. These activities result in better conservational outcomes from the public (Zeppel, 2010). This is used as an indicator as it promotes environmental conservation.

t) Beach Cleaning Process (Lucrezi et al., 2016)

Beach cleaning processes are of two types that are mechanical and manual. The mechanical cleaning process is intensive and causes harm to the natural environments while manual is less intensive and does not cause harm to the environment (Lucrezi et al., 2016).

u) Beach Morphology (Ariza et al., 2010; Cervantes & Espejel, 2008; Leatherman, 1997; Lucrezi et al., 2016; Morgan, 1999a)

Beach morphology plays an important role in the ecology of the system. It not only contributes the comfort of the public visiting the beach but may also be a source of environmental concerns. Therefore, beach width, condition, slope, sand profile and changes in the past 10 years are included as indicators of environmental sustainability.

v) Beach Meteorology (Ariza et al., 2010; Leatherman, 1997; Lucrezi et al., 2016; Morgan, 1999a)

Atmospheric changes have a significant impact on the environment of a beach system. Therefore, water and air temperature, amount of rain, number of sunny days, wind speeds and change in wave regime are included as indicators of the environment.

w) Beach Ecosystem (Ariza et al., 2010; Cervantes & Espejel, 2008; Leatherman, 1997; Lucrezi et al., 2016; Morgan, 1999a)

Beaches are complex ecosystems where multiple biological and physicals factors interact. Disturbance in the beach ecosystems directly translates to the disturbance in the environmental quality of these areas. Therefore, ecosystem indicators like urbanism, built up areas, beach closure, natural vegetation, reefs, dunes, etc. are included in the environmental sustainability sub-index.

The scoring criteria for the environmental sustainability sub-index (ESI) is shown in the *Table 3*.

Sr. #	Sub-Index # 1: Social Sustainability (SSI)	1	0.75	0.5	0.25	0
				Scores		
1	Beach Area / User (m²/user)	8 m²/user	6 m²/user	5 m²/user	4 m²/user	< 4 m²/user
2	General Information (Rules, Facts, etc.)	Present				Absent
3	Availability of Public Rest Rooms	>3 / Gender	2-3 / Gender		1 / Gender	Absent
4	Cleanliness of Rest Rooms	Clean		Usable		Filthy
5	Spacing Between Rest Rooms	≤ 300 m		300m - 500 m		≥ 500 m
6	Availability of Litter Bins	Present				Absent
7	Spacing Between Litter Bins	<50 m		50 m to 100 m		>100 m
8	Availability of Drinking Water	Taps				None
9	Availability of Restaurants / Cafes	Many		Some		None
10	Availability of Shops / Markets	Many		Some		None
11	Availability of Rentals (Huts, Sunbeds, etc.)	Many		Some		None
12	Availability of Accommodation (Hotels, Resorts, etc.)	Many		Some		None
13	Availability of Well-kept grounds / promenades	Yes				No
14	Availability of Illumination	Present				Absent
15	Availability of Artificial and Natural Shade	Present				Absent
16	Availability of Beach Sports (Surfing, Scuba Diving etc.)	Present				Absent
17	Availability of Facilities for Children	Present				Absent
18	Availability of Facilities for Differently Abled People	Present				Absent
19	Availability of Lifeguards	Permanent		Punctual		Absent
20	Availability of Security Personnel	Permanent		Punctual		Absent
21	Availability of First Aid / Emergency Response	Present				Absent
22	Availability of Vendors	Present				Absent
23	Presence of Unleashed Animals	None		Some		Many

Adapted from Leatherman S.P. (1997), Morgan R. (1999), Cervantes & Espejel, 2008, Ariza E. et al (2010) and Lucrezi S. et al (2016)

24	Presence of Off-Road Vehicles	None	Some	Many
25	Presence of Criminal / Offensive Activities	None	Some	Many
26	Condition of General Access	Well Asphalted	Asphalted with irregularities	Not Asphalted
27	Presence of Signposting	Further than 200 m	Within 200 m	None
28	Availability of Public Transport	Present		Absent
29	Presence of Parking Areas	Present		Absent
30	Presence of Parking Areas for Bikes	Present		Absent
31	Distance of Parking Areas from Beach	< 200 m	200 m - 300 m	≥ 300 m
32	Presence of Pedestrian Accesses	Absent		Present
33	Distance Between Pedestrian Accesses	< 50 m	50 m - 100 m	≥ 100 m
34	State of Accesses	Safe, Easy	Safe, Not Easy	Not Safe, Not Easy
35	Presence of Beach Safety Plan	Present		Absent
36	Presence of Buoys	Present		Absent
37	Presence of Emergency Warning Systems	Present		Absent
38	Demarcation of Unsafe Areas	Present		Absent
39	Availability of Rescue Facilities	Present		Absent

Table 2. Scoring Criteria for Social Sustainability Sub-Index (SSI)

3.4.2.1.3.   Sub-Index # 3 – Economic Sustainability (EcSI)

This sub-index provides the criteria for evaluating the impacts of beach on economic indicators as defined by public and private interests. It is calculated as shown in *Equation 4*.

$$EcSI = \sum_{i=1}^{n} \frac{C_i}{n}$$

Equation 4. Economic Sustainability Index (EcSI)

This sub-index consists of the following indicators:

a) Property Tax (Cervantes & Espejel, 2008; Lucrezi et al., 2016)

The areas 200 meters inward from the physical limits of the beach have been selected for the evaluation of property tax. This indicator will indicate how proximity to beaches effect the land taxation policies.

b) Real Estate Market (Cervantes & Espejel, 2008; Lucrezi et al., 2016)

The areas to be evaluated are similar as the above indicator. For this indicator price per square meter will be taken to observe how beachfront property is valued in the real estate market.

c) Accommodation Charges (Cervantes & Espejel, 2008; Lucrezi et al., 2016)

Accommodation charges are dependent on various factors. To create a semblance of uniformity, three-star hotels are selected for evaluation of this indicator. Accommodation charges will vary depending on the proximity to tourist attractions like beaches.

3.4.2.2.   Questionnaire Survey

A questionnaire survey has been proposed to be carried out to assess the users' perceptions about the recreational beaches of Karachi. The questionnaire consists of 21 questions. After a few general questions related to demographics, respondents are asked questions related to their attitudes towards the beaches. They are also asked to rate beach attributes on a scale of 1 to 5, with 3 being the acceptance level.

Sr. #	Sub-Index # 2: Environmental Sustainability (ESI)	1	0.75	0.5	0.25	0
		Scores				
1	Total Coliforms	≤ 500	≤ 5,000	≤ 10,000	≤ 100,000	≥ 100,000
2	Faecal Coliforms	≤ 100	≤ 1000	≤ 2,000	≤ 20,000	≥ 20,000
3	Turbidity of Beach Water	Clear		Relatively Clear		Turbid
4	Colour of Beach Water	Aqua Blue	Blue	Sea Green	Slate	Grey
5	Colour of Sand	White / Pink	Light Tan	Brown	Grey	Black
6	Presence of Floating Organic Waste	None		Moderate		Plentiful
7	Presence of Algae in Beach Water	Absent		Moderate		Infested
8	Occurrence of Red Tide	None				Common
9	Presence of Odours (Cooking, Rotting Fish, etc.)	None		Detectable		Bad Odours
10	Presence of Noise (Crowd, Vehicles, etc.)	Little		Moderate		Extensive
11	Presence of Wild-Life (Fishes, etc.)	Plentiful		Moderate		None
12	Presence of Pests (Mosquitos, Flies, etc.)	Absent		Moderate		Common
13	Presence of Harmful Animals (Jellyfish, etc.)	None		Moderate		Many
14	Presence of Plantation	Plentiful		Moderate		None
15	Presence of Trash and Litter	Rare		Moderate		Common
16	Presence of Oil and Tar Balls	None		Moderate		Common
17	Presence of Glass and Rubble	None		Moderate		Common
18	Animal Conservation on Beach	Extensive		Moderate		Little
19	Environmental Education Activities	Some				Absent
20	Beach Cleaning Procedure	Mechanical				Manual
21	Beach Width	>100 m, Wide	60 m - 100 m	30 m - 60 m	10 m - 30 m	Narrow, <10 m
22	Beach Material	Fine Sand		Coarse Sand	Cobbles & Sand	Cobbles
23	Beach Condition	Depositional		Stable		Erosional
24	Sand Softness	Soft		Neutral		Hard

25	Water Temperature	Warm (21ºC - 26ºC)					Cold / Hot
26	Air Temperature (Midday)	26ºC - 32ºC					<15ºC & >37ºC
27	No. of Sunny Days	Many					Few
28	Amount of Rain	Small		Moderate			Large
29	Wind Speeds	Low		Moderate			High
30	Size of Breaking Waves	Low / Safe					High / Dangerous
31	Beach Slope	Gentle Slope		Moderate			Steep Slope
32	Bathing Area Bottom Conditions	Fine Sand					Rock, Cobbles
33	Quality of Views (Local Scene)	Unobstructed					Obstructed
34	Quality of Views (Far Vista)	Unconfined					Confined
35	Presence of Seawalls, Riprap, etc.	None		Some			Many
36	Presence of Built-up Area (Urbanism)	Pristine / Wild		Moderate			Overdeveloped
37	Presence of Natural Vegetation	Plentiful		Moderate			None
38	Presence of Dune Belt	Present					Absent
39	Presence of Reefs	Present					Absent
40	Events of Beach Closure	None		Partial Closure			Complete Closure
41	Changes in Beach Morphodynamics in the Last 10 Years	Small		Moderate			Severe
42	Changes in Wave Regime in the Last 10 Years	Small		Moderate			Severe

Table 3. Scoring Criteria for Environmental Sustainability Sub-Index (ESI)

Adapted from Espejel (2007)		Scores				
Sr. #	Sub-Index # 3: Economic (EcSI)	1	0.75	0.5	0.25	0
1	Property Tax Per Square Yard (PKR)	Above Average		Average		Below Average
2	Value Per Square Yard of Land in Real Estate Market (PKR)	Above Average		Average		Below Average
3	Accomodation Charges per day (PKR)	Above Average		Average		Below Average

Table 4. Scoring Criteria for Economic Sub-Index (EcSI)

CHAPTER 4 – DATA COLLECTION

4.1. General

For assessment of beaches, a two-way approach has been adopted. A checklist of indicators, shown in the previous chapter, will be evaluated according to the scores given. A questionnaire has also been drawn up and distributed to public for filling. Both these approaches are important for evaluation of beaches in terms of sustainability.

4.2. Sample Size

Karachi is one of the biggest metropolitans of Pakistan with ever increasing population. For populations that are dynamic and cannot be known, sample size with the required confidence levels is usually taken using the Cochran Formula.

$$N_0 = \frac{Z^2 pq}{e^2}$$

Equation 5. Cochran's Formula for Sample Size Calculation

Here,

e is the level of precision required,

p is the estimated population in possession of attribute in question,

Z is taken from standard normal z-table,

$q = 1 - p$

For calculating the sample size, it is assumed that at least half the population of the said metropolitan frequent beaches making **p = 0.5** and **q = 0.5**. The desired confidence level is **95%** with **5%** error margin. The corresponding **Z** value is **1.96**. Inputting the values in the Cochran formula, we get:

$$N_0 = \frac{(1.96)^2 (0.5)(0.5)}{(0.05)^2}$$

$$N_0 = 385$$

4.3. Checklist Data

The checklist was rated according to visual inspection and data extracted through research carried out on beaches of Karachi. The values and scoring for checklists prepared for all three sub-indices are shown in *Table 5*, *Table 6*, and *Table 7*.

Code	Sub-Index # 1: Social Sustainability (SSI)	Clifton		Hawkesbay		Sandspit		French Beach		Paradise Point	
	Indicators	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
S-01	Beach Area / User (m^2/user)	< 4 m^2/user	0	5 m^2/user	0.5	5 m^2/user	0.5	8 m^2/user	1	8 m^2/user	1
S-02	General Information (Rules, Facts, etc.)	Absent	0	Absent	0	Absent	0	Present	1	Present	1
S-03	Availability of Public Rest Rooms	2-3 / Gender	0.75	Absent	0	Absent	0	Absent	0	Absent	0
S-04	Cleanliness of Rest Rooms	Usable	0.5	Absent	0	Absent	0	Absent	0	Absent	0
S-05	Spacing Between Rest Rooms	≤ 300 m	0.5	Absent	0	Absent	0	Absent	0	Absent	0
S-06	Availability of Litter Bins	Absent	0	Absent	0	Absent	0	Absent	0	Absent	0
S-07	Spacing Between Litter Bins	Absent	0	Absent	0	Absent	0	Absent	0	Absent	0
S-08	Availability of Drinking Water	None	0	None	0	None	0	None	0	None	0
S-09	Availability of Restaurants / Cafes	Many	1	Some	0.5	Some	0.5	Some	0.5	Some	0.5
S-10	Availability of Shops / Markets	Some	0.5	None	0	None	0	None	0	None	0
S-11	Availability of Rentals (Huts, Sunbeds, etc.)	None	0	Some	0.5	Some	0.5	Some	0.5	Some	0.5
S-12	Availability of Accommodation (Hotels, Resorts, etc.)	Some	0.5	None	0	None	0	None	0	None	0
S-13	Availability of Well-kept grounds / promenades	No	0	No	0	No	0	No	0	No	0
S-14	Availability of Illumination	Present	1	Absent	0	Absent	0	Absent	0	Absent	0
S-15	Availability of Artificial and Natural Shade	Absent	0	Absent	0	Absent	0	Present	1	Present	1
S-16	Availability of Beach Sports (Surfing, Scuba Diving etc.)	Absent	0	Present	1	Present	1	Present	1	Present	1
S-17	Availability of Facilities for Children	Absent	0	Absent	0	Absent	0	Absent	0	Absent	0

S-18	Availability of Facilities for Differently Abled People	Absent	0	Absent	0	Absent	0	Absent	0	Absent	0
S-19	Availability of Lifeguards	Absent	0	Absent	0	Absent	0	Absent	0	Absent	0
S-20	Availability of Security Personnel	Punctual	0.5	Absent	0	Absent	0	Absent	0	Absent	0
S-21	Availability of First Aid / Emergency Response	Absent	0	Absent	0	Absent	0	Absent	0	Absent	0
S-22	Availability of Vendors	Present	1	Present	1	Present	1	Present	1	Present	1
S-23	Presence of Unleashed Animals	Some	0.5	Many	0	Many	0	Some	0.5	Some	0.5
S-24	Presence of Off-Road Vehicles	Some	0.5	None	1	None	1	Some	0.5	Many	0
S-25	Presence of Criminal / Offensive Activities	Some	0.5	Some	0.5	Some	0.5	Some	0.5	Many	1
S-26	Condition of General Access	Well Asphalted	1	Asphalted with irregularities	0.5	Asphalted with irregularities	0.5	Asphalted with irregularities	0.5	Asphalted with irregularities	0.5
S-27	Presence of Signposting	Within 200 m	0.5	Further than 200 m	1	Further than 200 m	1	Further than 200 m	1	Further than 200 m	1
S-28	Availability of Public Transport	Present	1	Absent	0	Absent	0	Absent	0	Absent	0
S-29	Presence of Parking Areas	Present	1	Present	1	Present	1	Present	1	Present	1
S-30	Presence of Parking Areas for Bikes	Present	1	Present	1	Present	1	Present	1	Present	1
S-31	Distance of Parking Areas from Beach	< 200 m	1	200 m - 300 m	0.5	200 m - 300 m	0.5	< 200 m	1	< 200 m	1
S-32	Presence of Pedestrian Accesses	Absent	1	Present	1	Present	1	Present	1	Present	1
S-33	Distance Between Pedestrian Accesses	50 m - 100 m	0.5	$\geq$ 100 m	0	$\geq$ 100 m	0	$\geq$ 100 m	0	$\geq$ 100 m	0
S-34	State of Accesses	Safe, Easy	1	Safe, Not Easy	0.5	Safe, Not Easy	0.5	Safe, Not Easy	0.5	Safe, Not Easy	0.5
S-35	Presence of Beach Safety Plan	Absent	0	Absent	0	Absent	0	Absent	0	Absent	0
S-36	Presence of Buoys	Absent	0	Absent	0	Absent	0	Absent	0	Absent	0

Code		Clifton		Hawkesbay		Sandspit		French Beach		Paradise Point	
S-37	Presence of Emergency Warning Systems	Absent	0	Absent	0	Absent	0	Absent	0	Absent	0
S-38	Demarcation of Unsafe Areas	Absent	0	Absent	0	Absent	0	Absent	0	Absent	0
S-39	Availability of Rescue Facilities	Absent	0	Absent	0	Absent	0	Absent	0	Absent	0

Table 5. Values and scoring for Social Sustainability Sub-Index (SSI)

Code	Sub-Index # 2: Environmental Sustainability (ESI)	Clifton		Hawkesbay		Sandspit		French Beach		Paradise Point	
	Indictors	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
E-01	Total Coliforms	≤ 500	1	≤ 500	1	≤ 500	1	≤ 500	1	≤ 500	1
E-02	Faecal Coliforms	≤ 100		≤ 100	1	≤ 100	1	≤ 100	1	≤ 100	1
E-03	Turbidity of Beach Water	Turbid	0	Relatively Clear	0.5	Relatively Clear	0.5	Relatively Clear	0.5	Turbid	0.5
E-04	Colour of Beach Water	Grey	0	Sea Green	0.5	Sea Green	0.5	Sea Green	0.5	Sea Green	0.5
E-05	Colour of Sand	Grey	0.25	Brown	0.5	Brown	0.5	Light Tan	0.75	Light Tan	0.75
E-06	Presence of Floating Organic Waste	Moderate	0.5	Moderate	0.5	Moderate	0.5	Moderate	0.5	Moderate	0.5
E-07	Presence of Algae in Beach Water	Moderate	0.5	Moderate	0.5	Moderate	0.5	Moderate	0.5	Moderate	0.5
E-08	Occurrence of Red Tide	None	1	None	1	None	1	None	1	None	1
E-09	Presence of Odours (Cooking, Rotting Fish, etc.)	Detectable	0.5	Detectable	0.5	Detectable	0.5	Detectable	0.5	Detectable	0.5
E-10	Presence of Noise (Crowd, Vehicles, etc.)	Moderate	0.5	Little	1	Little	1	Little	1	Little	1
E-11	Presence of Wild-Life (Fishes, etc.)	None	0	Plentiful	1	Plentiful	1	Plentiful	1	Plentiful	1
E-12	Presence of Pests (Mosquitos, Flies, etc.)	Common	0	Common	0	Moderate	0	Common	0	Common	0

E-13	Presence of Harmful Animals (Jellyfish, etc.)	None	1	Many	0	Many	0	Many	0	Many	0
E-14	Presence of Plantation	None	0	None	0	None	0	None	0	None	0
E-15	Presence of Trash and Litter	Moderate	0.5	None	1	None	1	None	1	Moderate	0.5
E-16	Presence of Oil and Tar Balls	Moderate	0.5	None	1	None	1	None	1	None	1
E-17	Presence of Glass and Rubble	None	1	None	1	None	1	None	1	None	1
E-18	Animal Conservation on Beach	Little	0	Extensive	1	Extensive	1	Moderate	0.5	Moderate	0.5
E-19	Environmental Education Activities	Some	1	Some	1	Some	1	Some	1	Some	1
E-20	Beach Cleaning Procedure	Mechanical	1	Mechanical	1	Mechanical	1	Mechanical	1	Mechanical	1
E-21	Beach Width	>100 m, Wide	1	>100 m, Wide	1	>100 m, Wide	1	>100 m, Wide	1	>100 m, Wide	1
E-22	Beach Material	Coarse Sand	0.5	Cobbles & Sand	0.25	Cobbles & Sand	0.25	Fine Sand	1	Fine Sand	1
E-23	Beach Condition	Stable	0.5	Stable	0.5	Stable	0.5	Stable	0.5	Stable	0.5
E-24	Sand Softness	Neutral	0.5	Neutral	0.5	Neutral	0.5	Neutral	0.5	Neutral	0.5
E-25	Water Temperature	Warm (21ºC - 26ºC)	1	Warm (21ºC - 26ºC)	1	Warm (21ºC - 26ºC)	1	Warm (21ºC - 26ºC)	1	Warm (21ºC - 26ºC)	1
E-26	Air Temperature (Midday)	26ºC - 32ºC	1	26ºC - 32ºC	1	26ºC - 32ºC	1	26ºC - 32ºC	1	26ºC - 32ºC	1
E-27	No. of Sunny Days	Many	1	Many	1	Many	1	Many	1	Many	1
E-28	Amount of Rain	Small	1	Small	1	Small	1	Small	1	Small	1
E-29	Wind Speeds	Moderate	0.5	Moderate	0.5	Moderate	0.5	Moderate	0.5	Moderate	0.5
E-30	Size of Breaking Waves	Low / Safe	1	Low / Safe	1	Low / Safe	1	Low / Safe	1	Low / Safe	1
E-31	Beach Slope	Gentle Slope	1	Steep Slope	0	Steep Slope	0	Steep Slope	0	Steep Slope	0
E-32	Bathing Area Bottom Conditions	Fine Sand	1	Fine Sand	1	Fine Sand	1	Fine Sand	1	Fine Sand	1
E-33	Quality of Views (Local Scene)	Unobstructed	1	Unobstructed	1	Unobstructed	1	Unobstructed	1	Unobstructed	1
E-34	Quality of Views (Far Vista)	Unconfined	1	Unconfined	1	Unconfined	1	Unconfined	1	Unconfined	1
E-35	Presence of Seawalls, Riprap, etc.	None	1	None	1	None	1	None	1	None	1

Code	Indicators	Values	Score	Values	Score	Values	Score	Values	Score	Values	Score
E-36	Presence of Built-up Area (Urbanism)	Moderate	1	Moderate	1	Moderate	1	Moderate	1	Moderate	1
E-37	Presence of Natural Vegetation	None	0	None	0	None	0	None	0	None	0
E-38	Presence of Dune Belt	Present	1	Present	1	Present	1	Present	1	Present	1
E-39	Presence of Reefs	Absent	0	Absent	0	Absent	0	Present	1	Present	1
E-40	Events of Beach Closure	Partial Closure	0.5	None	1	None	1	None	1	None	1
E-41	Changes in Beach Morphodynamics in the Last 10 Years	Moderate	0.5	Moderate	0.5	Moderate	0.5	Moderate	0.5	Moderate	0.5
E-42	Changes in Wave Regime in the Last 10 Years	Moderate	0.5	Moderate	0.5	Moderate	0.5	Moderate	0.5	Moderate	0.5

Table 6. Values and scoring for Environmental Sustainability Sub-Index (ESI)

Code	Sub-Index # 3: Economic (EcSI)	Clifton		Hawkesbay		Sandspit		French Beach		Paradise Point	
	Indicators	**Values**	**Score**	**Values**	**Score**	**Values**	**Score**	**Values**	**Score**	**Values**	**Score**
C-01	Property Tax Per Square Yard (PKR)	Above Average	1	Average	0.5	Below Average	0	Average	0.5	Average	0.5
C-02	Value Per Square Yard of Land in Real Estate Market (PKR)	Above Average	1	Below Average	0	Below Average	0	Below Average	0	Below Average	0
C-03	Accommodation Charges per day (PKR)	Above Average	1	Below Average	0	Below Average	0	Below Average	0	Below Average	0

Table 7. Values and scoring for Economic Sustainability Sub-Index (EcSI)

CHAPTER 5 – RESULTS

5.1. Social Sustainability Sub-Index (SSI)

5.1.1. Clifton Beach

The values and scores for the indicators under the social sustainability category are shown in the checklist presented in the *Table 5*. According to indicator scores as shown in *Figure 4,* 18 out of 39 indicators are scored the lowest and require immediate attention from beach managers. These indicators include beach crowding, availability of general information, litter bins, drinking water, rentals, grounds and promenades, shades, facilities for children and differently abled people, beach sports, lifeguards, first aid or emergency response, rescue facilities, beach safety plans, early warning system, buoys, and demarcation of unsafe areas. 10 indicators have been scored as stable and require moderate attention. These relate to cleanliness and spacing of rest rooms, availability of shops, accommodations, security personnel, presence of unleashed animals, off road vehicles, criminal activities, signposting, and distances between pedestrian accesses. 11 indicators have been scored highest and require minimal to no attention. These indicators include availability of restrooms, restaurants, vendors, illumination, condition of general access, availability of public transport, parking areas, pedestrian accesses, and their state.
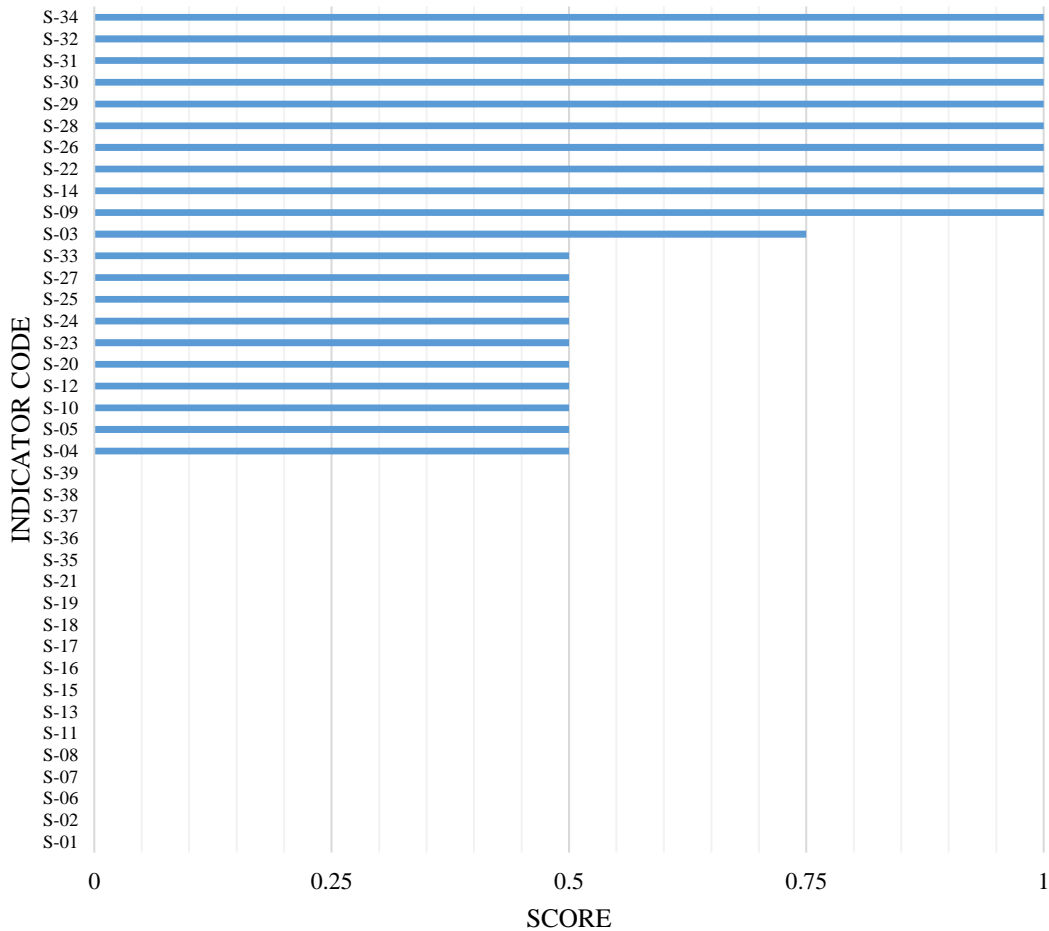

Figure 4. Performance of Clifton Beach on Social Indicators

5.1.2. Hawkesbay Beach

The values and scores for the indicators under the social sustainability category are shown in the checklist presented in the *Table 5*. According to indicator scores as shown in *Figure 5*, 25 out of 39 indicators are scored the lowest and need immediate managerial attention. These include availability of general information, restrooms, drinking water, litter bins, shops, accommodations, grounds and promenades, illumination, shades, facilities for children and differently abled people, lifeguards, first aid or emergency response, security personnel, presence of unleashed animals, public transport, distance between pedestrian accesses, presence of rescue facilities, beach safety plans, early warning system, buoys, and demarcation of unsafe areas. 7 indicators are scored as stable and require moderate attention. These include beach crowding, availability of restaurants, rentals, presence of criminal activities, condition of general access, distance of parking areas from beach, and state of accesses. 7 indicators are scored high and require minimal to no attention. These include availability of beach sports, vendors, presence of off-road vehicles, signposting, parking areas, and pedestrian accesses.
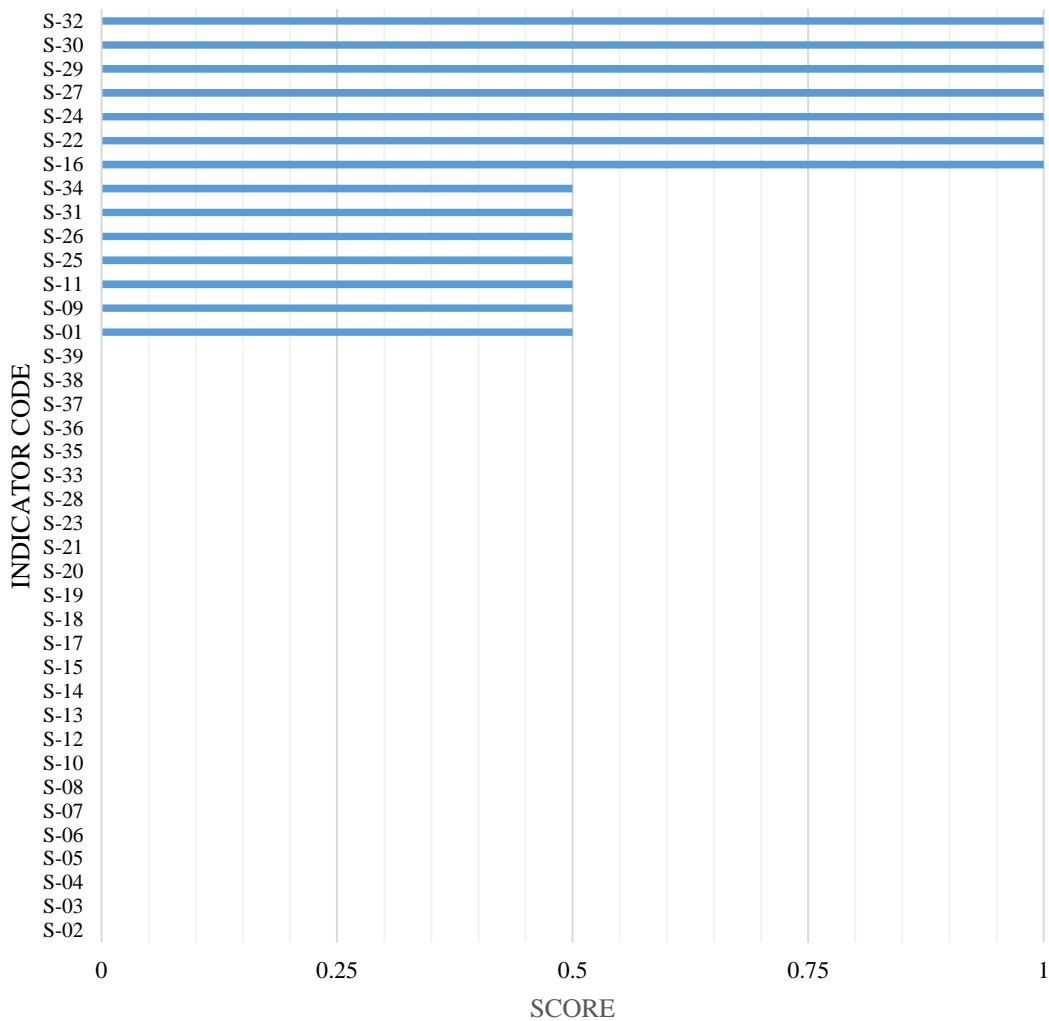

Figure 5. Performance of Hawkesbay Beach on Social Indicators

5.1.3. Sandspit Beach

The values and scores for the indicators under the social sustainability category are shown in the checklist presented in the *Table 5*. According to indicator scores as shown in *Figure 6*, 25 out of 39 indicators are scored the lowest and need immediate managerial attention. These include availability of general information, restrooms, drinking water, litter bins, shops, accommodations, grounds and promenades, illumination, shades, facilities for children and differently abled people, lifeguards, first aid or emergency response, security personnel, presence of unleashed animals, public transport, distance between pedestrian accesses, presence of rescue facilities, beach safety plans, early warning system, buoys, and demarcation of unsafe areas. 7 indicators are scored as stable and require moderate attention. These include beach crowding, availability of restaurants, rentals, presence of criminal activities, condition of general access, distance of parking areas from beach, and state of accesses. 7 indicators are scored high and require minimal to no attention. These include availability of beach sports, vendors, presence of off-road vehicles, signposting, parking areas, and pedestrian accesses.
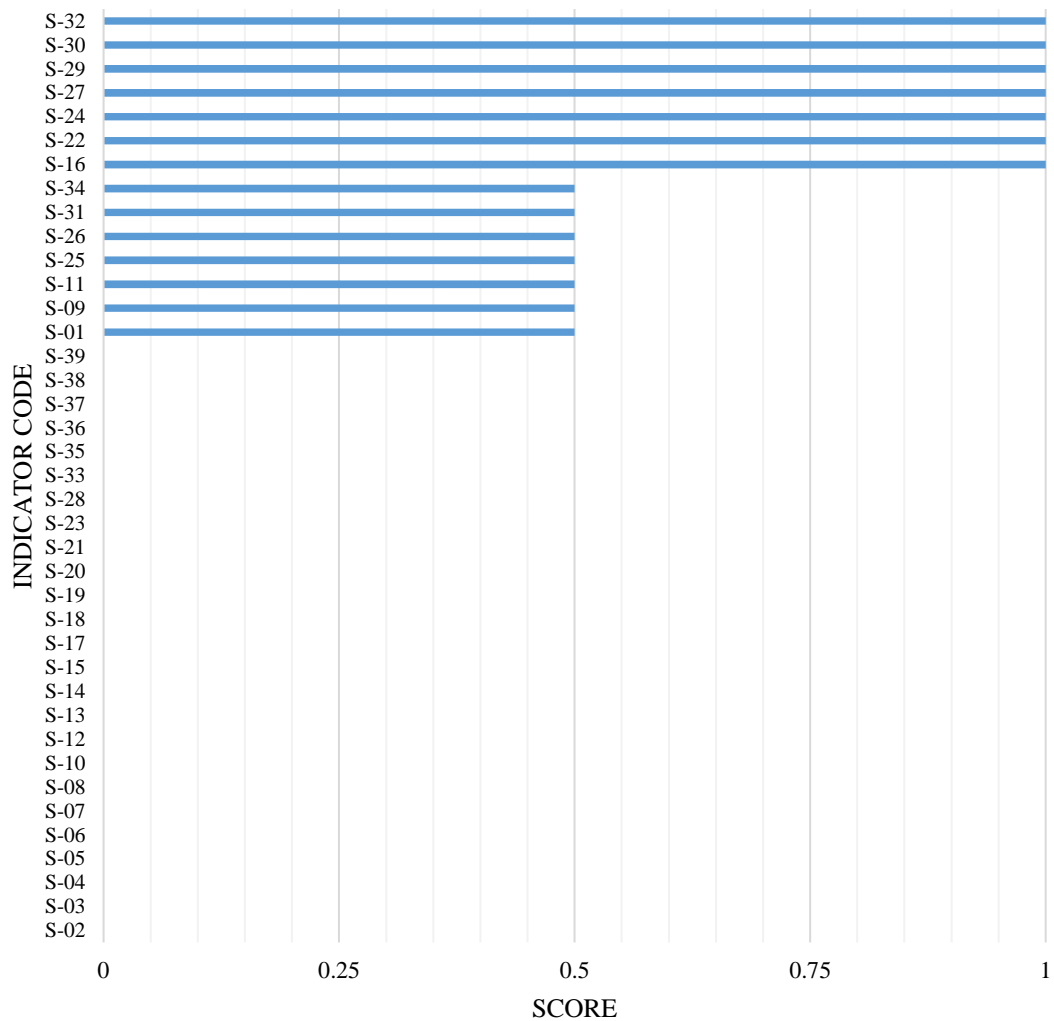

Figure 6. Performance of Sandspit Beach on Social Indicators

5.1.4. French Beach

The values and scores for the indicators under the social sustainability category are shown in the checklist presented in the *Table 5*. According to indicator scores as shown in *Figure 7*, 22 out of 39 indicators score low and require immediate managerial attention. These include availability of restrooms, drinking water, litter bins, shops, illumination, grounds and promenades, accommodations, facilities for children and differently abled people, lifeguards, security personnel, first aid or emergency response, public transport, distance between pedestrian accesses, presence of rescue facilities, beach safety plans, early warning system, buoys, and demarcation of unsafe areas. 7 indicators present as stable and require moderate attention. These include availability of restaurants, rentals, presence of unleashed animals, off-road vehicles, criminal activities, condition of general accesses, and state of pedestrian accesses. 10 indicators score highest and require minimal to no attention. These include beach crowding, availability of general information, shades, beach sports, vendors, signposting, parking areas, and pedestrian accesses.
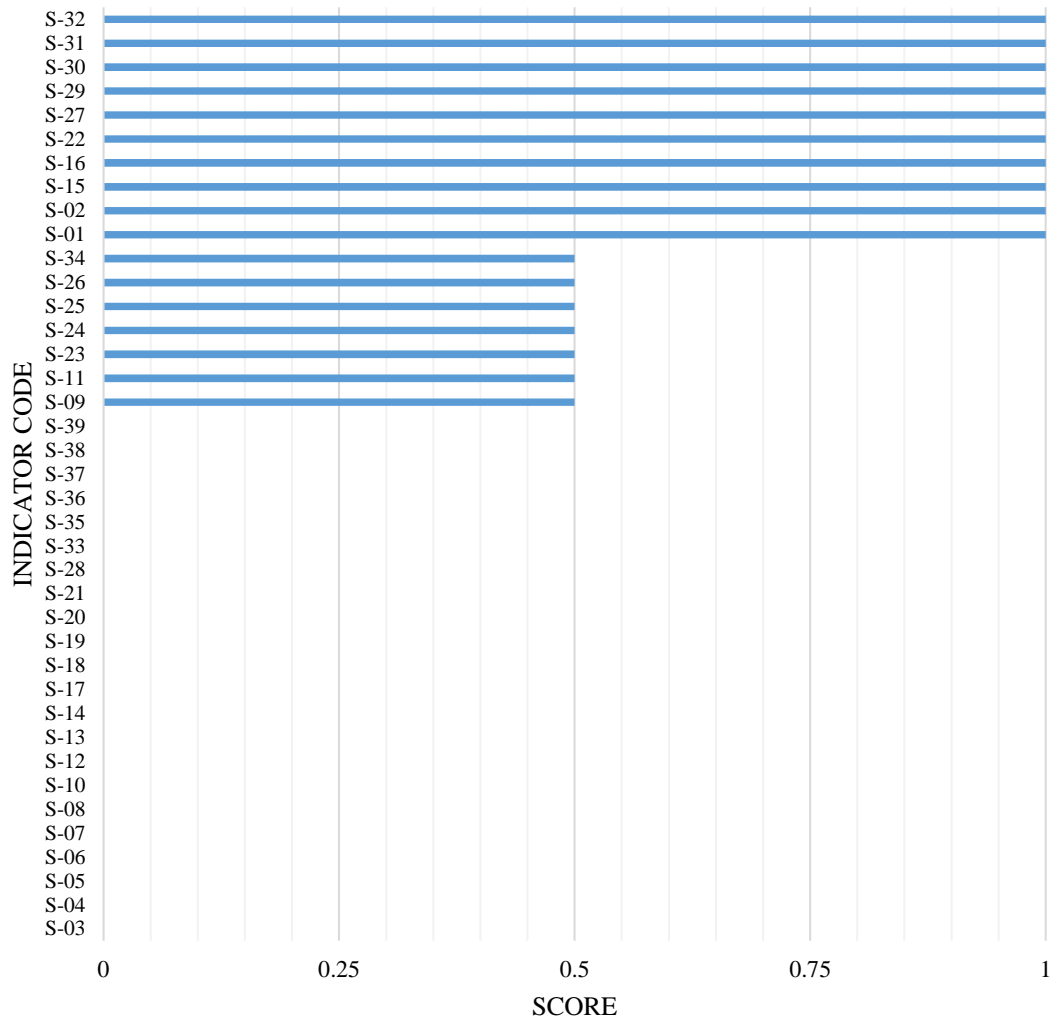

Figure 7. Performance of French Beach on Social Indicators

5.1.5. Paradise Point

The values and scores for the indicators under the social sustainability category are shown in the checklist presented in the *Table 5*. According to indicator scores as shown in *Figure 8*, 23 out of 39 indicators score low and require immediate managerial attention. These include availability of restrooms, drinking water, litter bins, shops, illumination, grounds and promenades, accommodations, facilities for children and differently abled people, lifeguards, security personnel, first aid or emergency response, public transport, distance between pedestrian accesses, presence of off-road vehicles, rescue facilities, beach safety plans, early warning system, buoys, and demarcation of unsafe areas. 5 indicators present as stable and require moderate attention. These include availability of restaurants, rentals, presence of unleashed animals, condition of general accesses, and state of pedestrian accesses. 11 indicators score highest and require minimal to no attention. These include beach crowding, availability of general information, shades, beach sports, vendors, presence of criminal activities, signposting, parking areas, and pedestrian accesses.
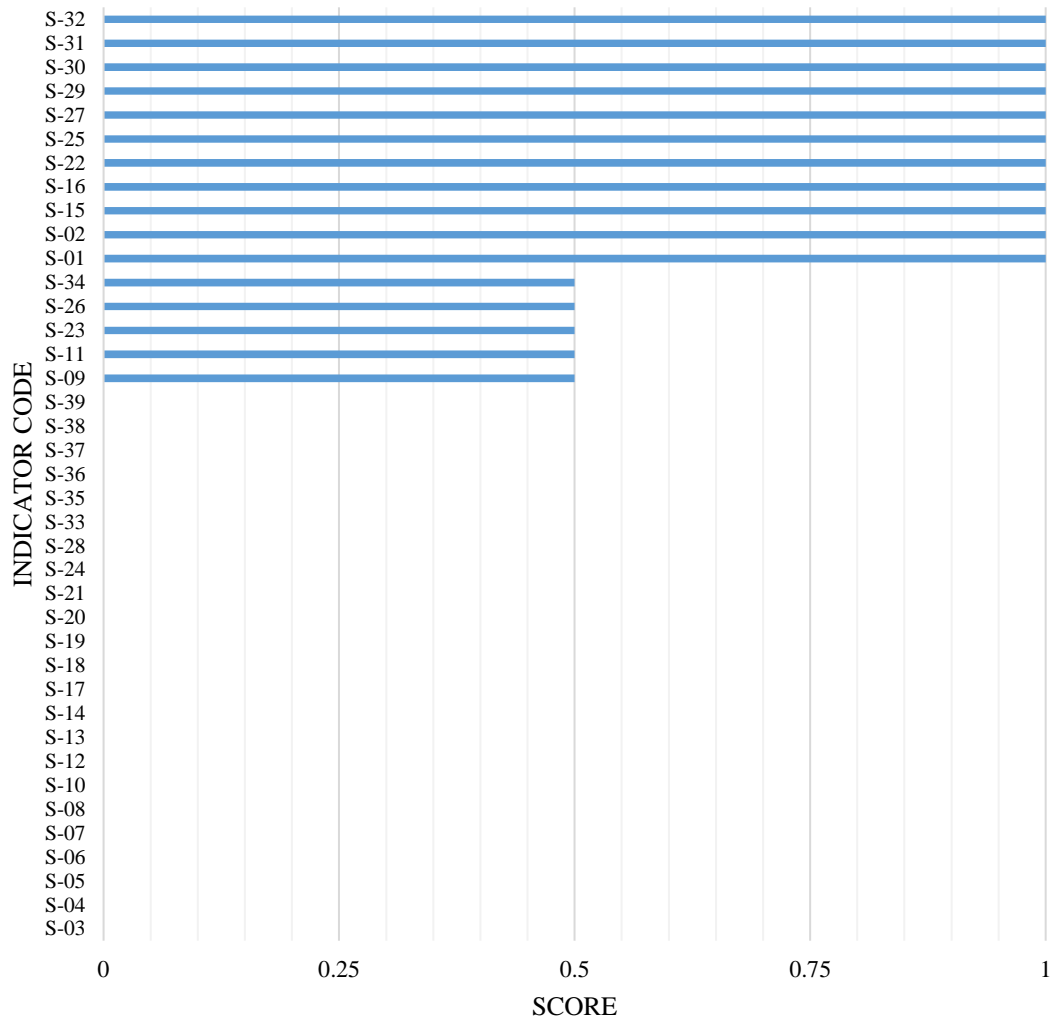

Figure 8. Performance of Paradise Point on Social Indicators

5.2. Environmental Sustainability Sub-Index (ESI)

5.2.1. Clifton Beach

The values and scores for the indicators under the environmental sustainability category is shown in the checklist presented in the *Table 6*. According to the indicator scores shown in *Figure 9*, 8 out of 42 indicators are scored low and require immediate attention. These include quality of beach water, presence of wildlife, pests, plantation, animal conservation, natural vegetation, and reefs. However, it must be noted that some indicators can not necessarily be altered but they do impact the quality of recreational beaches. 15 indicators are scored as stable and require moderate attention. These include colour of sand and softness, beach material and condition, windspeeds, events of beach closure, morphodynamics, wave regime, presence of built-up areas, floating wastes, algae, odours, noise, trash, oil and tar balls. 19 indicators score high and require minimal to no attention. These include biological water quality, occurrence of red tides, presence of harmful animals, glass and rubble, environmental education activities, beach cleaning procedure, beach width, water and air temperature, meteorological conditions, bathing area condition and slopes, quality of views, dune belts, and presence of seawalls.
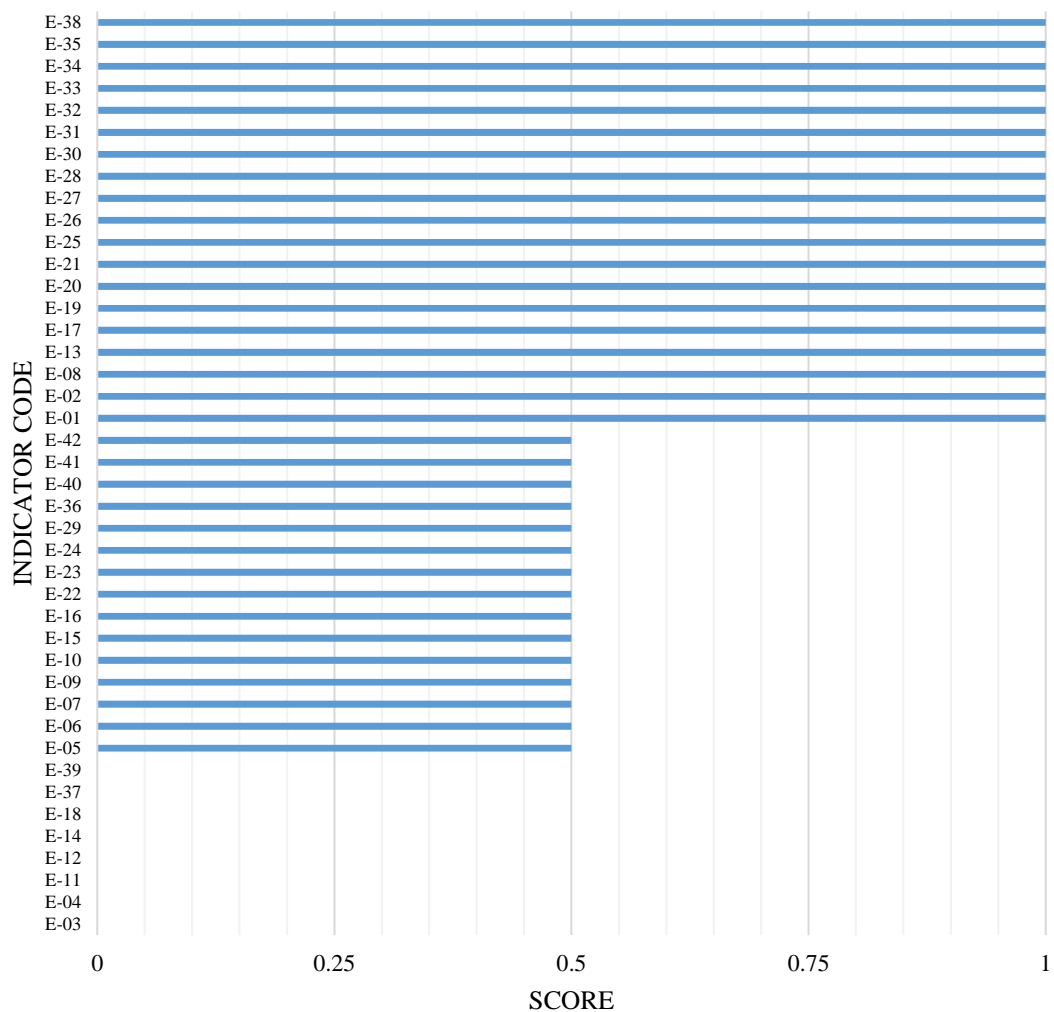

Figure 9. Performance of Clifton Beach on Environmental Indicators

5.2.2. Hawkesbay Beach

The values and scores for the indicators under the environmental sustainability category is shown in the checklist presented in the *Table 6*. According to the indicator scores shown in *Figure 10*, 6 out of 42 indicators score low and require immediate managerial attention. These include presence of pests, harmful animals, plantation, natural vegetation, reefs, and beach slope. However, it must be noted that some indicators can not necessarily be altered but they do impact the quality of recreational beaches. 13 indicators present as stable and require moderate attention. These include beach water quality, colour of sand and softness, beach material and condition, windspeeds, morphodynamics, wave regime, presence of built-up areas, floating wastes, algae, and odours. 23 indicators score high and require minimal to no attention. These include These include biological water quality, occurrence of red tides, presence of noise, wildlife, trash, oil or tar balls, glass and rubble, animal conservation, events of beach closure, environmental education activities, beach cleaning procedure, beach width, water and air temperature, meteorological conditions, bathing area condition, quality of views, dune belts, and presence of seawalls.
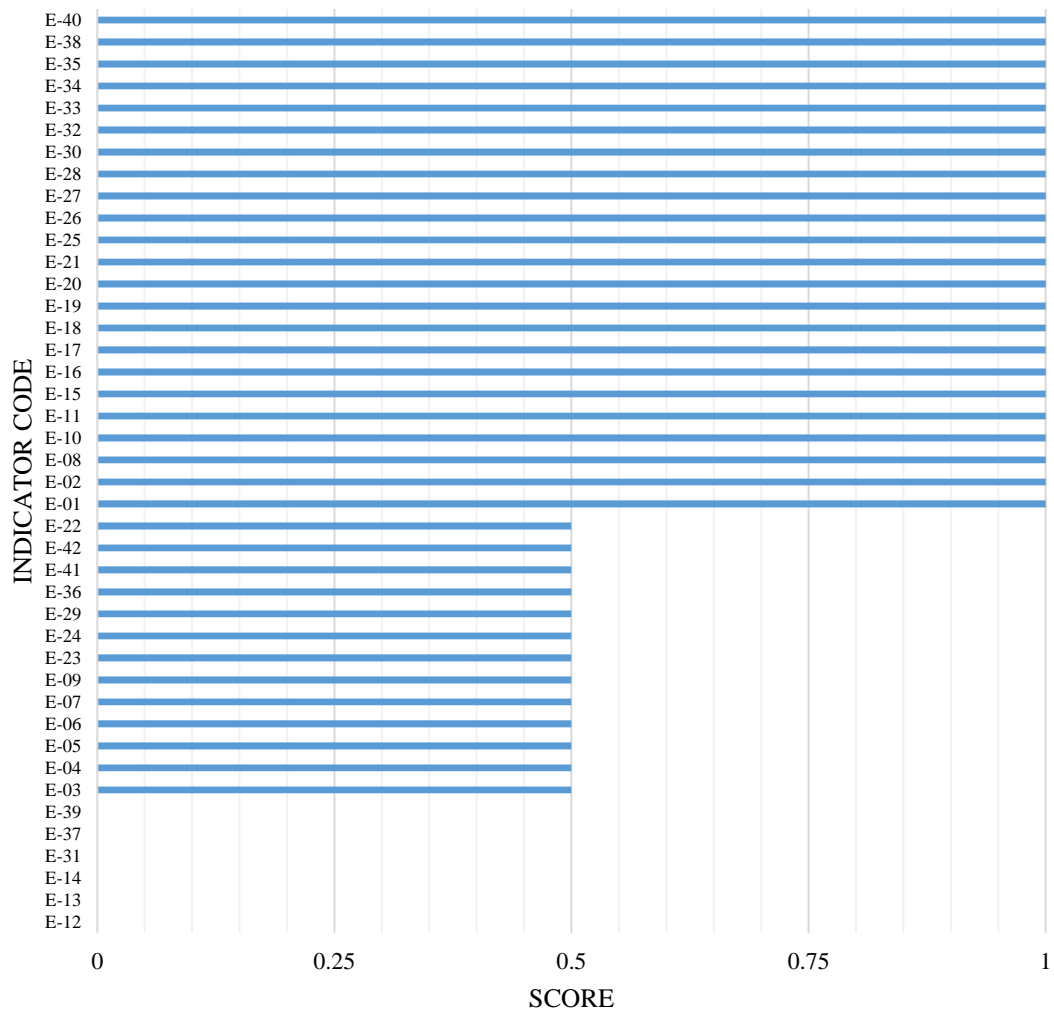

Figure 10. Performance of Hawkesbay Beach on Environmental Indicators

5.2.3. Sandspit Beach

The values and scores for the indicators under the environmental sustainability category is shown in the checklist presented in the *Table 6*. According to the indicator scores shown in *Figure 11*, 6 out of 42 indicators score low and require immediate managerial attention. These include presence of pests, harmful animals, plantation, natural vegetation, reefs, and beach slope. However, it must be noted that some indicators can not necessarily be altered but they do impact the quality of recreational beaches. 13 indicators present as stable and require moderate attention. These include beach water quality, colour of sand and softness, beach material and condition, windspeeds, morphodynamics, wave regime, presence of built-up areas, floating wastes, algae, and odours. 23 indicators score high and require minimal to no attention. These include These include biological water quality, occurrence of red tides, presence of noise, wildlife, trash, oil or tar balls, glass and rubble, animal conservation, events of beach closure, environmental education activities, beach cleaning procedure, beach width, water and air temperature, meteorological conditions, bathing area condition, quality of views, dune belts, and presence of seawalls.
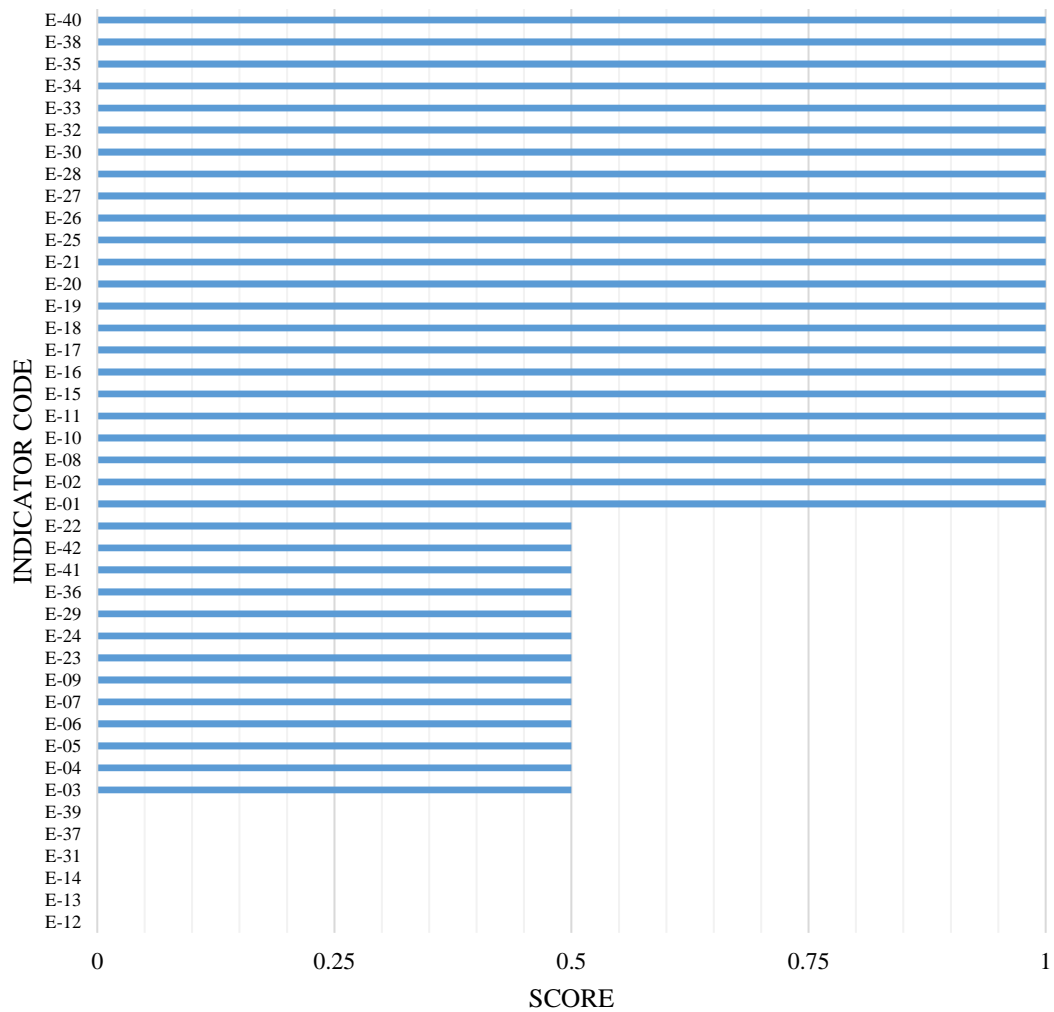

Figure 11. Performance of Sandspit Beach on Environmental Indicators

5.2.4. French Beach

The values and scores for the indicators under the environmental sustainability category is shown in the checklist presented in the *Table 6*. According to the indicator scores shown in *Figure 12*, 5 out of 42 indicators score low and require immediate attention. These include presence of pests, harmful animals, plantation, natural vegetation, and beach slope. However, it must be noted that some indicators can not necessarily be altered but they do impact the quality of recreational beaches. 12 indicators present as stable and require moderate attention. These include beach water quality, beach material and softness, windspeeds, morphodynamics, wave regime, animal conservation, presence of built-up areas, floating wastes, algae, and odours. 25 indicators score high and require minimal to no attention. These include biological water quality, occurrence of red tides, colour of sand and beach water, presence of noise, wildlife, trash, oil or tar balls, glass and rubble, environmental education activities, beach cleaning procedure, beach material and width, water and air temperature, meteorological conditions, bathing area condition, quality of views, dune belts, presence of seawalls, and reefs.
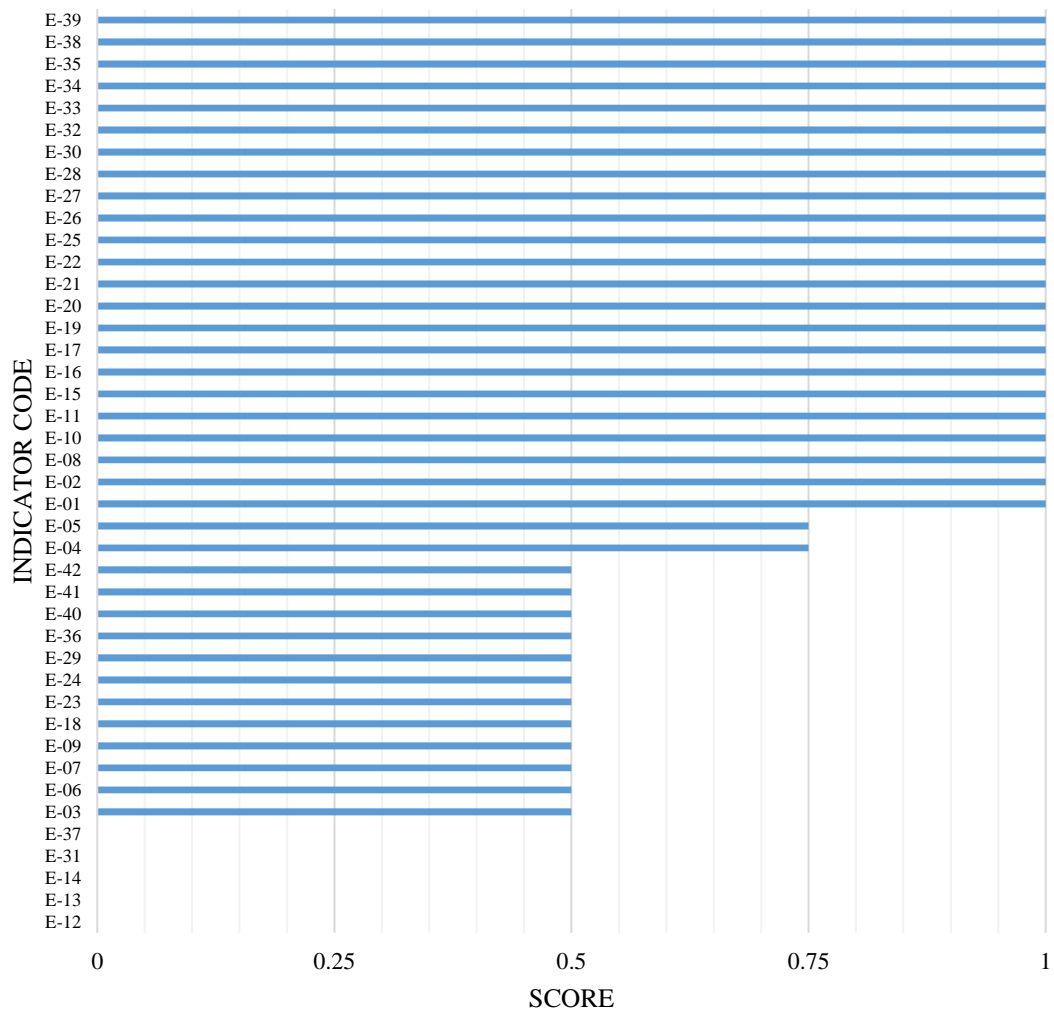

Figure 12. Performance of French Beach on Environmental Indicators

5.2.5. Paradise Point

The values and scores for the indicators under the environmental sustainability category is shown in the checklist presented in the *Table 6*. According to the indicator scores shown in *Figure 13*, 5 out of 42 indicators score low and require immediate attention. These include presence of pests, harmful animals, plantation, natural vegetation, and beach slope. However, it must be noted that some indicators can not necessarily be altered but they do impact the quality of recreational beaches. 13 indicators present as stable and require moderate attention. These include beach water quality, beach material and softness, windspeeds, morphodynamics, wave regime, animal conservation, presence of built-up areas, trash and litter, floating wastes, algae, and odours. 24 indicators score high and require minimal to no attention. These include biological water quality, occurrence of red tides, colour of sand and beach water, presence of noise, wildlife, oil or tar balls, glass and rubble, environmental education activities, beach cleaning procedure, beach material and width, water and air temperature, meteorological conditions, bathing area condition, quality of views, dune belts, presence of seawalls, and reefs.
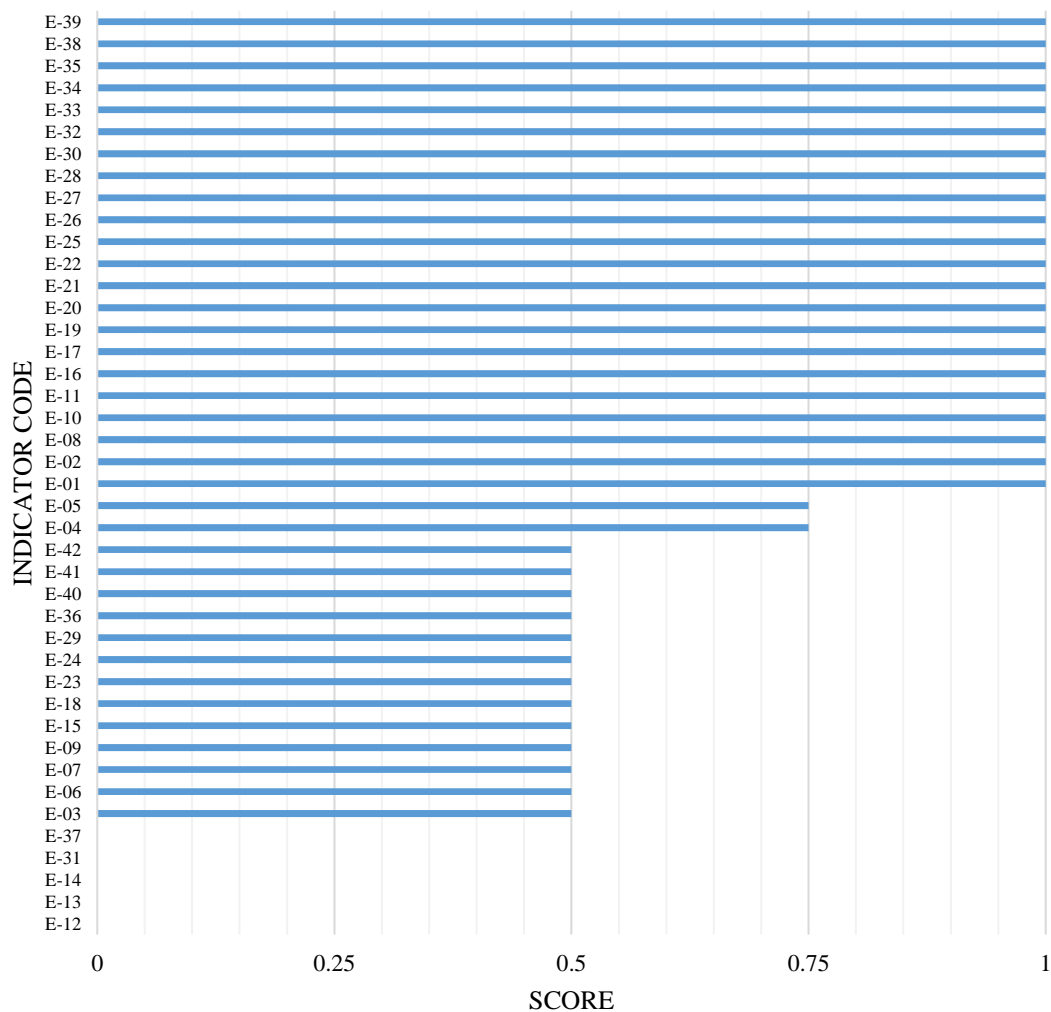

Figure 13. Performance of Paradise Point on Environmental Indicators

5.3. Economic Sustainability Sub-Index (EcSI)

5.3.1. Clifton Beach

The values and scores for the indicators under the economic sustainability category are shown in the *Table 7*. According to the indicator scoring, shown in *Figure 14*, all indicators score high and require minimal to no attention.
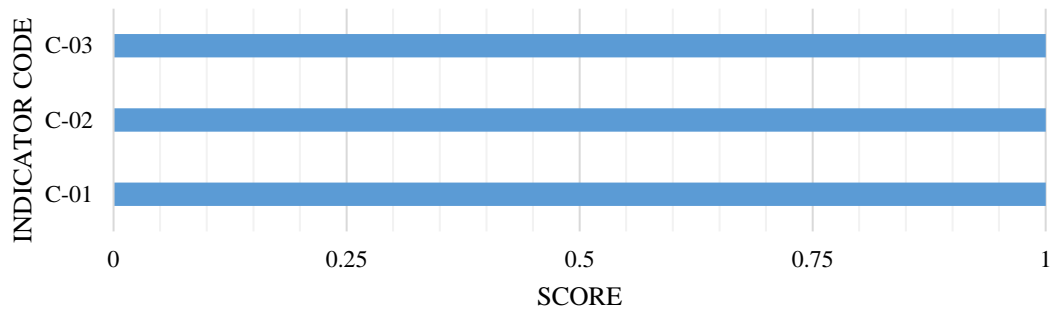

Figure 14. Performance of Clifton Beach on Economic Indicators

5.3.2. Hawkesbay Beach

The values and scores for the indicators under the economic sustainability category are shown in the *Table 7*. According to the indicator scoring, shown in *Figure 15*, property tax per square yard is found average and requires moderate attention, however, land value per square yard and accommodation charges score below average and require immediate attention.

Figure 15. Performance of Hawkesbay Beach on Economic Indicators

5.3.3. Sandspit Beach

The values and scores for the indicators under the economic sustainability category are shown in the *Table 7*. According to the indicator scoring, shown in *Figure 16*, all indicators are scored low and require immediate attention.

Figure 16. Performance of Sandspit Beach on Economic Indicators

5.3.4. French Beach

The values and scores for the indicators under the economic sustainability category are shown in the *Table 7*. According to the indicator scoring, shown in *Figure 17*, property tax per square yard is found average and requires moderate attention, however, land value per square yard and accommodation charges score below average and require immediate attention.
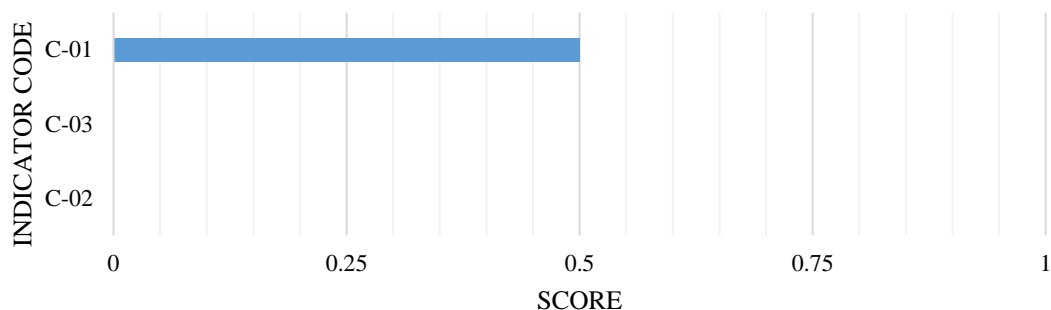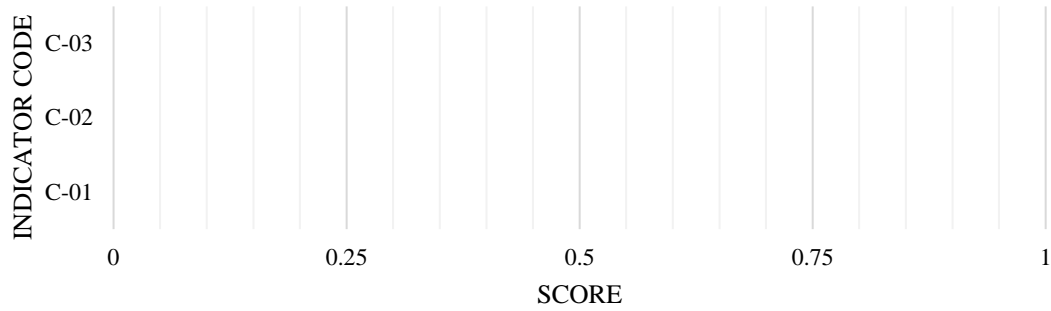

Figure 17. Performance of French Beach on Economic Indicators

5.3.5. Paradise Point

The values and scores for the indicators under the economic sustainability category are shown in the *Table 7*. According to the indicator scoring, shown in *Figure 18*, property tax per square yard is found average and requires moderate attention, however, land value per square yard and accommodation charges score below average and require immediate attention.
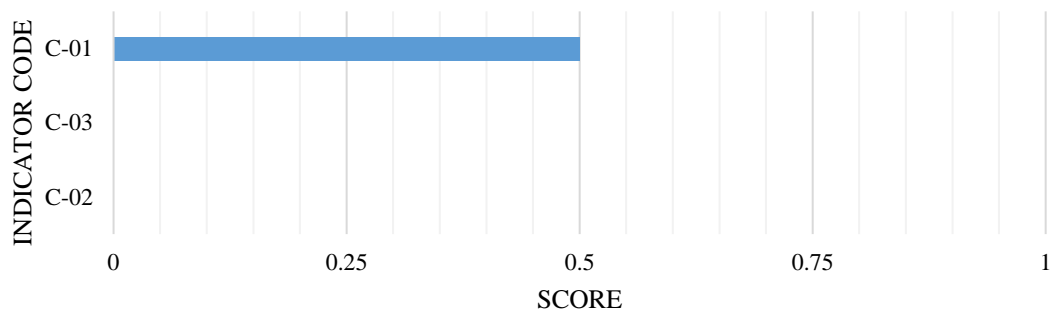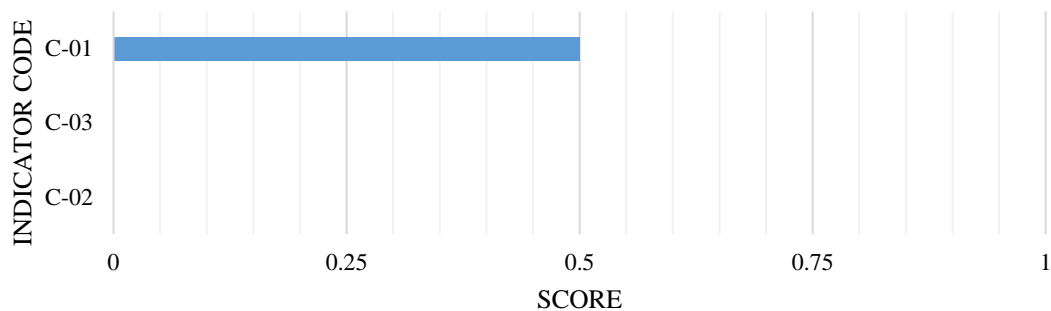

Figure 18. Performance of Paradise Point on Economic Indicators

5.4. Beach Sustainability Index (BSI)

The sub-indices computed were used to calculate the beach sustainability index (BSI) for the beaches of the study area and is shown in *Table 8*.

5.4.1. Clifton Beach

In terms of social sustainability, Clifton beach performs better than most public beaches. The area around the beach is highly developed. However, many services are severely compromised, and security personnel are known to pester visitors with unauthorized questioning. In terms of environmental sustainability, the beach performs lesser as compared to other beaches. As this beach is located near a heavily populated area and has a history of oil spill, the environmental indicators score lesser, particularly in water quality, wildlife presence and sand quality. In terms of economic sustainability, Clifton performs exceptionally well with above average value of land per square yard at PKR 48,000 (USD 301) and property tax per square yard at PKR 12,000 (USD 75.24). It is the only beach in Karachi with accommodation available within proximity of the beach.

Overall sustainability index calculated for Clifton reflects a value of 0.66. Economic and environmental sustainability have a greater impact on this value. It is seen that although the infrastructure and services are available, but the quantity and quality of these services needs to be improved.

5.4.2. Hawkesbay and Sandspit Beach

In terms of social sustainability, Hawkesbay and sandspit beaches perform lesser than other public beaches. The area around the beaches is under-developed. Basic social services such as availability of restrooms etc. are missing and requires attention. In terms of environmental sustainability, the beaches perform better as compared to Clifton beach. As this beach is located near sparsely populated area, the environmental indicators score better, particularly in wildlife presence and environmental education activities as these beaches are conservation areas of Olive Ridley Turtles. In terms of economic sustainability, Hawkesbay beach performs lesser with below average value of land per square yard at PKR 7,200 (USD 45.14) and average property tax per square yard at PKR 1,800 (USD 11.29). Sandspit beach performs worst with below average value of land per square yard at PKR 4,800 (USD 30.09) and below average property tax per square yard at PKR 1,200 (USD 7.52). Accommodation is not available near these beaches.

Overall sustainability index calculated for Hawkesbay reflects a value of 0.37. Environmental sustainability has a greater impact on this value. Lower values for social and economic sub-indices render the sustainability for this beach low. Sandspit Beach reflects a value of 0.32. Similar to Hawkesbay, this beach has a higher environmental sustainability and lower values for social and economic sustainability rendering the overall sustainability index low.

5.4.3. French Beach

In terms of social sustainability, French beach performs similar to Clifton beach. The area around the beach is under-developed. Many services such as rentals etc. are available. However, this beach also requires attention on social services in terms of

availability and quality. In terms of environmental sustainability, the beach performs better as compared to other beaches. As this beach is located near a sparsely populated area, the environmental indicators score better, particularly in water quality, wildlife presence and sand quality. In terms of economic sustainability, French beach performs lesser with below average value of land per square yard at PKR 7,200 (USD 45.14) and average property tax per square yard at PKR 1,800 (USD 11.29). Accommodation is not available near this beach.

Overall sustainability index calculated for French Beach reflects a value of 0.42. Environmental sustainability has a greater impact on this value. Services and infrastructure are available however, requires improvement in quantity and quality. Economic sustainability is low as the area around the beach is under-developed hence rendering the overall sustainability of the beach low.

5.4.4. Paradise Point

In terms of social sustainability, Paradise Point performs similar to Clifton and French beaches. The area around the beach is under-developed. Many social services are available as the beach was promoted and managed by the local government as a tourist attraction. However, this beach also requires attention on social services in terms of availability and quality. In terms of environmental sustainability, the beach performs similar to French beach. As this beach is located near a sparsely populated area, the environmental indicators score better, particularly in water quality, wildlife presence and sand quality. In terms of economic sustainability, French beach performs lesser with below average value of land per square yard at PKR 7,200 (USD 45.14) and average property tax per square yard at PKR 1,800 (USD 11.29). Accommodation is not available near this beach.

Overall sustainability index calculated for French Beach reflects a value of 0.42. Environmental sustainability has a greater impact on this value. Services and infrastructure are available however, requires improvement in quantity and quality. Economic sustainability is low as the area around the beach is under-developed hence rendering the overall sustainability of the beach low.

5.5. Comparison of Beach Sustainability Index (BSI)

Comparison of all sub-indices and BSI for the beaches is depicted in Figure 19. As seen in the figure, Clifton beach performs relatively well in terms of sustainability than the other beaches. French Beach and Paradise Point perform similarly while Hawkesbay and Sandspit beaches perform lower than the other study areas.

Sr. #	Indices	Clifton	Hawkesbay	Sandspit	French Beach	Paradise Point
1	Social Sustainability Sub-Index (SSI)	0.38	0.28	0.28	0.38	0.37
2	Environmental Sustainability Sub-Index (ESI)	0.60	0.67	0.67	0.71	0.71
3	Economic Sustainability Sub-Index (EcSI)	1	0.17	0.00	0.17	0.17
	Beach Sustainability Index (BSI)	**0.66**	**0.37**	**0.32**	**0.42**	**0.42**

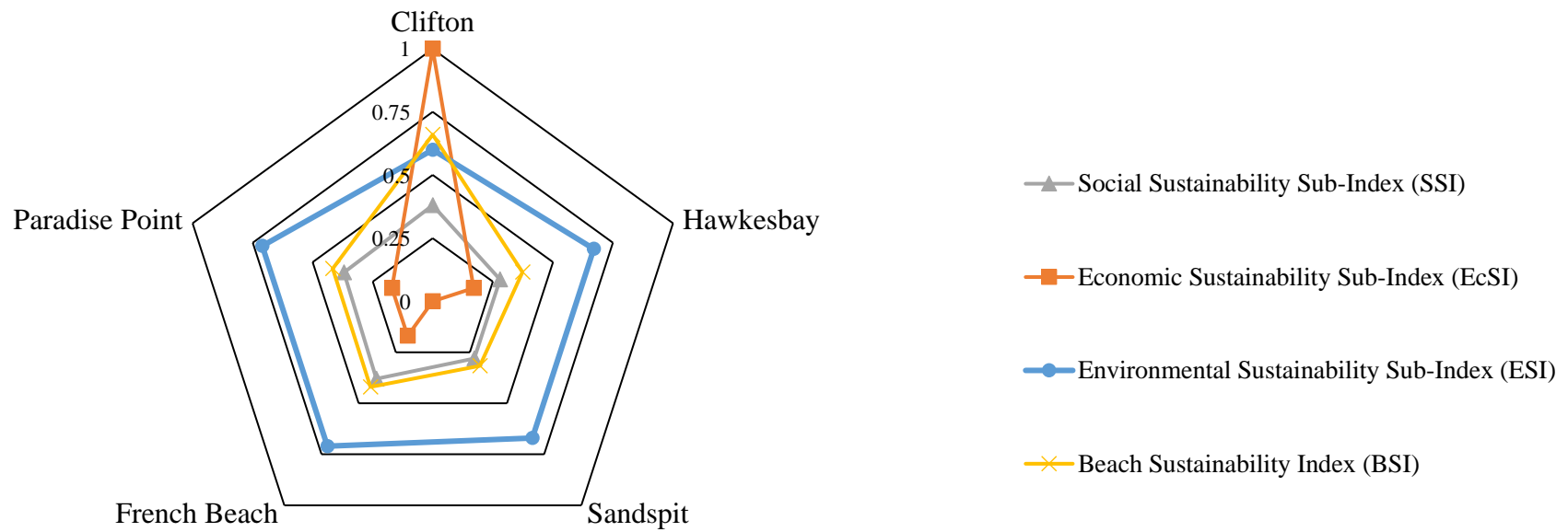Table 8. Evaluated Sub-Indices and Beach Sustainability Index

Figure 19. Performance of Sustainability Indices

5.6. Beach User Perceptions

5.6.1. Demographics

The respondents were 46.3% males and 53.7% females. 14.9% of the respondents were in the 20-25 years age bracket, 23.9% in 26-30 years, 14.9% in 31-35 years, 22.4% in 36-40 years, 16.4% in 41-45 years, 1.5% in 46-50 years, 4.5% in 51-55 years and 1.5 in 55-60 years age bracket. Most of the respondents were highly educated, 55.2% having 18 years of education and 37.3% having 16 years of education, with an average income of PKR 117,164 (USD 735)/month. The respondents were 62.7% residents and 37.31% non-residents.
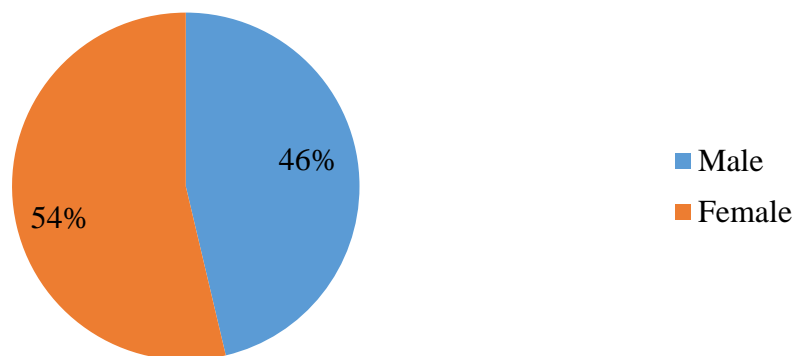

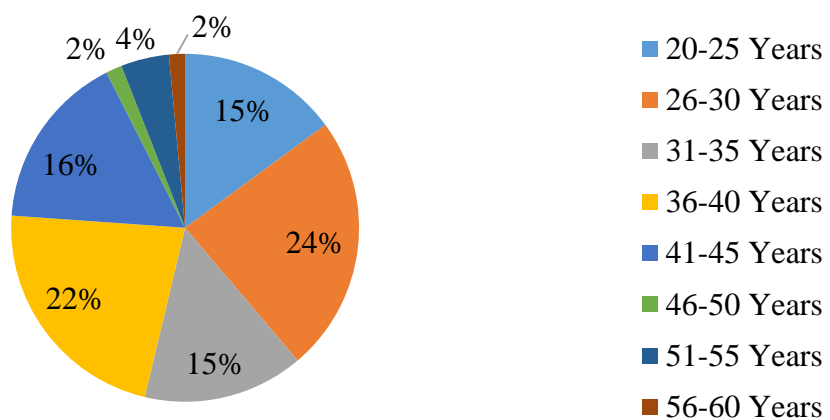Figure 20. Gender Distribution of Respondents
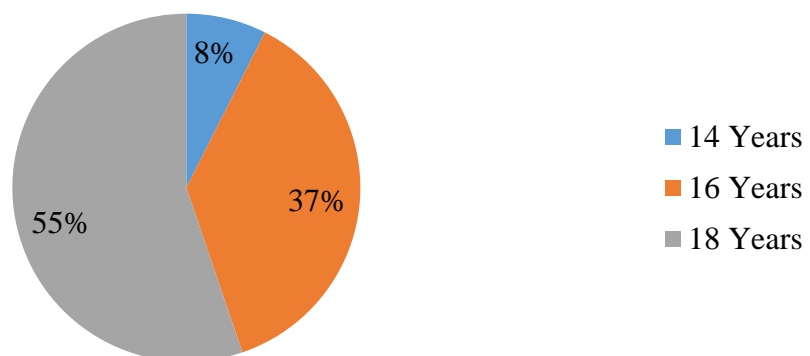

Figure 21. Age Distribution of Respondents

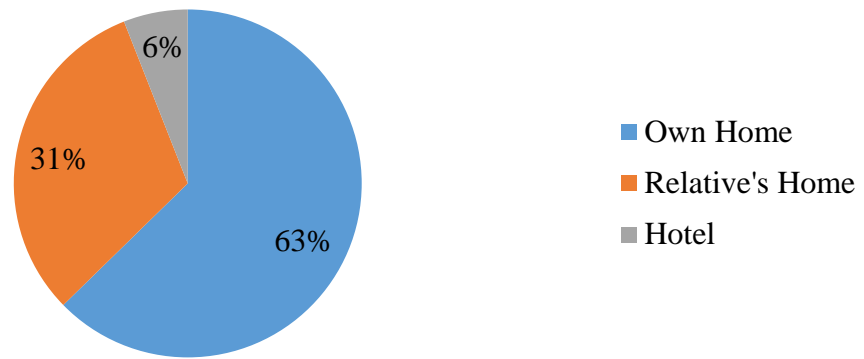Figure 22. Educational Level of Respondents

Figure 23. Place of Stay of the Respondents

5.6.2. Attitudes

Out of the beaches studied, it was seen that the respondents favoured Clifton Beach (49.3%) over all the other beaches citing economical activities and availability of infrastructure and services. Most respondents travel by car or motorcycle (92.5%) to the beach and are mostly accompanied by family (73.1%).

The respondents claimed to visit the beaches quite infrequently but at least once a year (83.6%) while some of the residents claimed to visit once every week or on weekends. The respondents spend 2.5 hours on average on the beach and expend nearly PKR 720 / person (USD 5) on the beach. The main reason cited for visiting the Hawkesbay and Sandspit beaches was close to nature and quiet and relaxed environment. Respondents prioritizing cleanliness and nature preferred French Beach. Paradise Point was chosen by respondents that prioritized good views and landscapes.
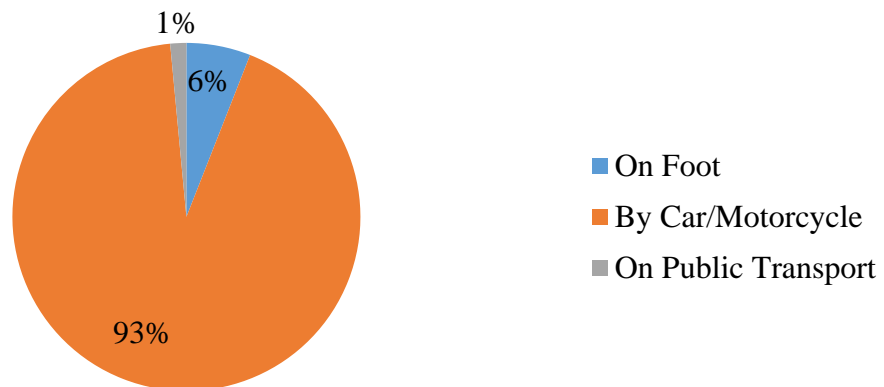
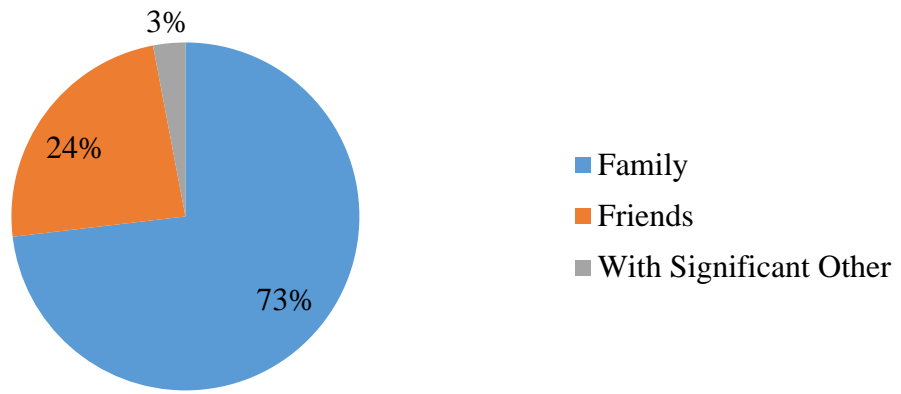

Figure 24. Mode of Travel of the Respondents

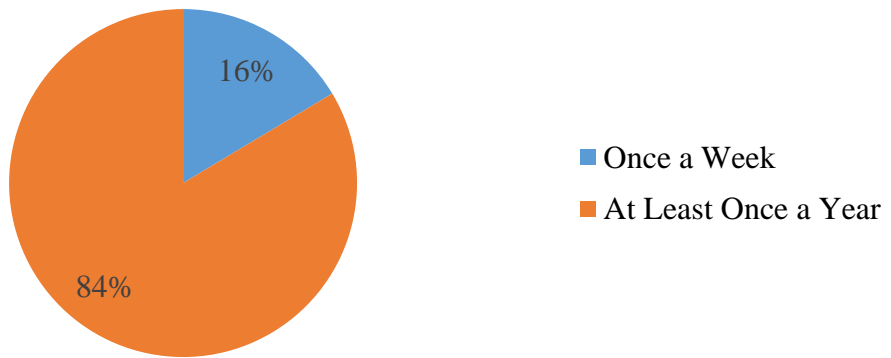Figure 25. Company of the Respondents

Figure 26. Frequency of Visits by the Respondents
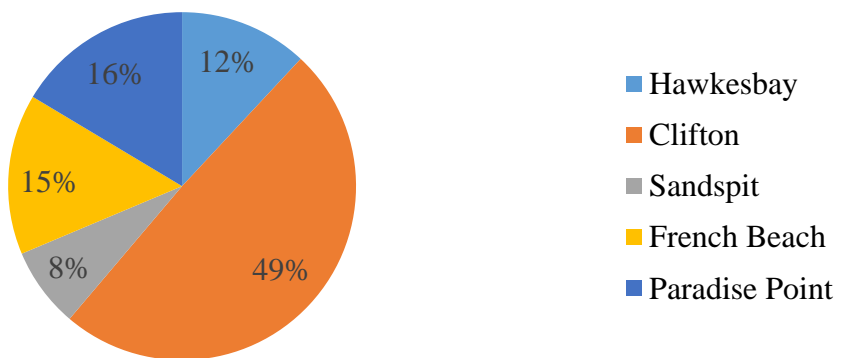
Figure 27. Beaches Frequented by Respondents
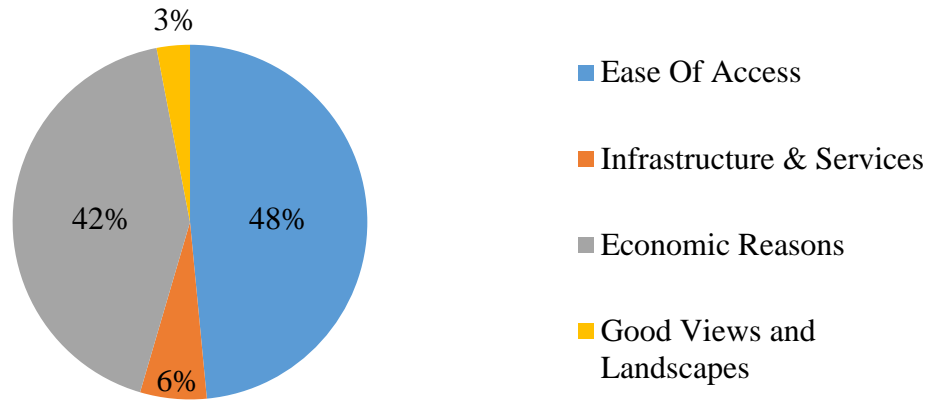
Figure 28. Reasons for Choice of Clifton Beach
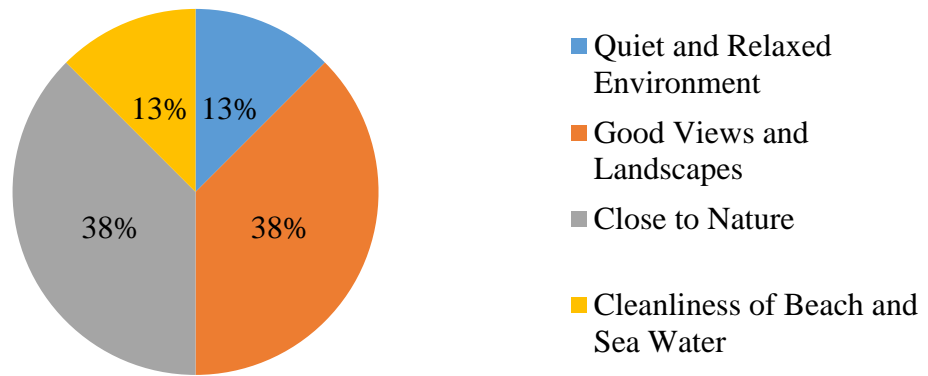
Figure 29. Reasons for Choice of Hawkesbay Beach
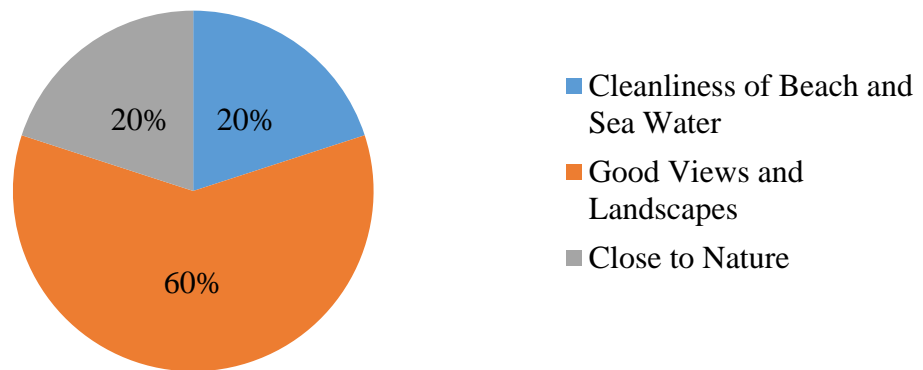
Figure 30. Reasons for Choice of Sandspit Beach
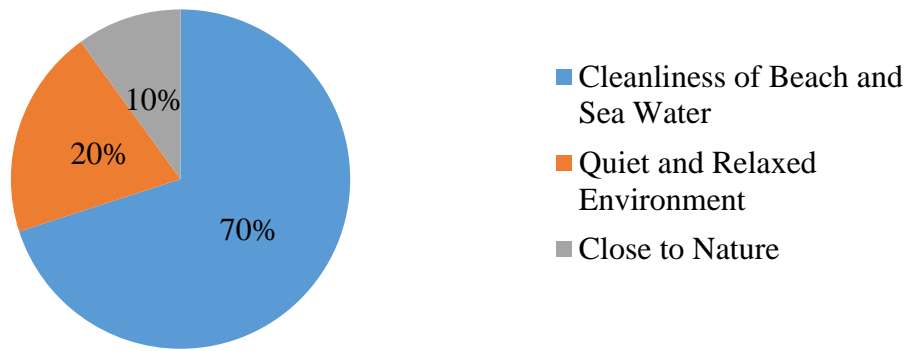
Figure 31. Reasons for Choice of French Beach
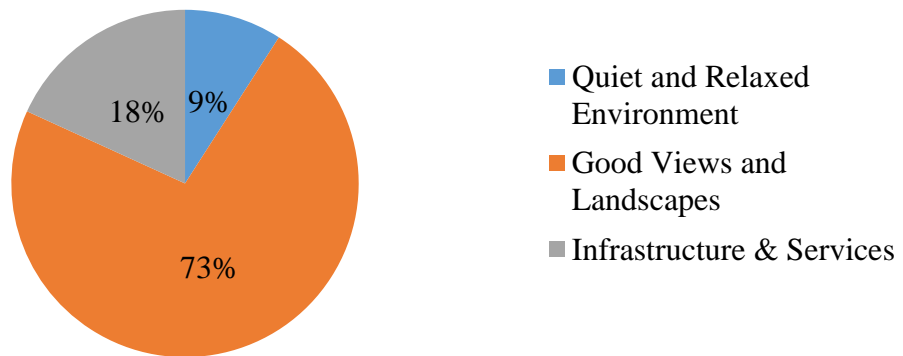
Figure 32. Reasons for Choice of Paradise Point

5.6.3. Opinions

The results presented in this section relate to the opinion of the beach goers of the beaches that they visit. The users were asked to rate the features presented on a scale of 1 – 5 with 3 being the acceptance level. The features were divided into 3 broad categories: physical, environmental and infrastructure and services. In the infrastructure and services, a value of 0 was added to reflect the non-availability of the said service.

In terms of physical features, in general, the scores were at or above the acceptance level as shown in *Figure 33*. However, for Clifton and Paradise Point beaches, the users scored the bathing area condition to be lower than the acceptance level. The environmental features received mixed scoring from the users with vegetation levels, pest infestations, noise pollution and trash and litter below the acceptance level for all beaches and animal conservation low for Clifton, French and Paradise Point beaches as shown in *Figure 34*.
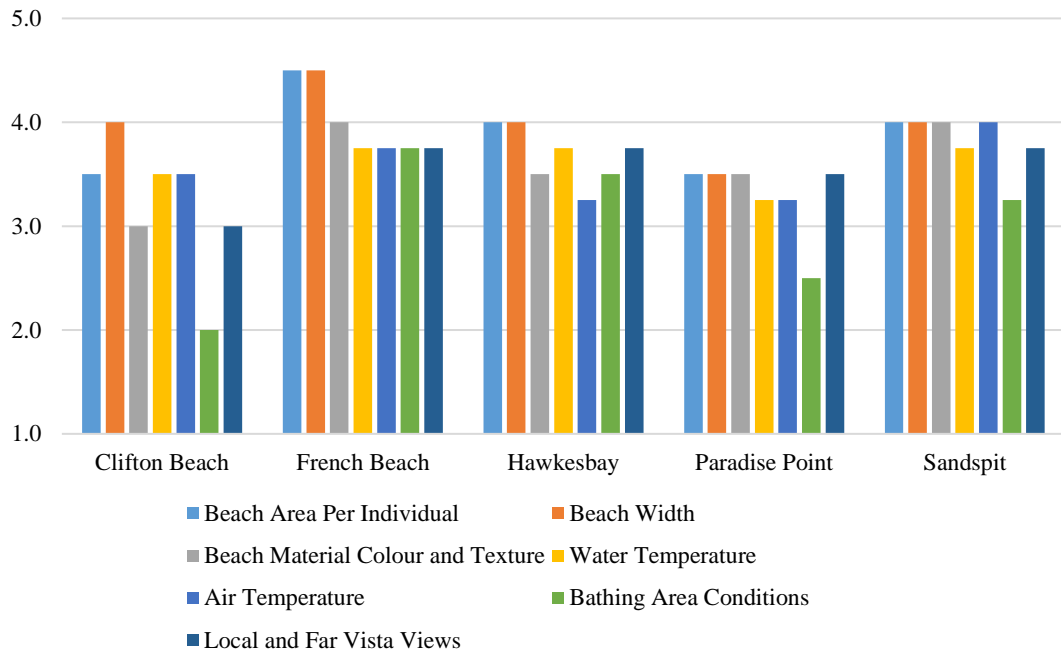
Figure 33. Users' Scoring for Physical Features of Beaches
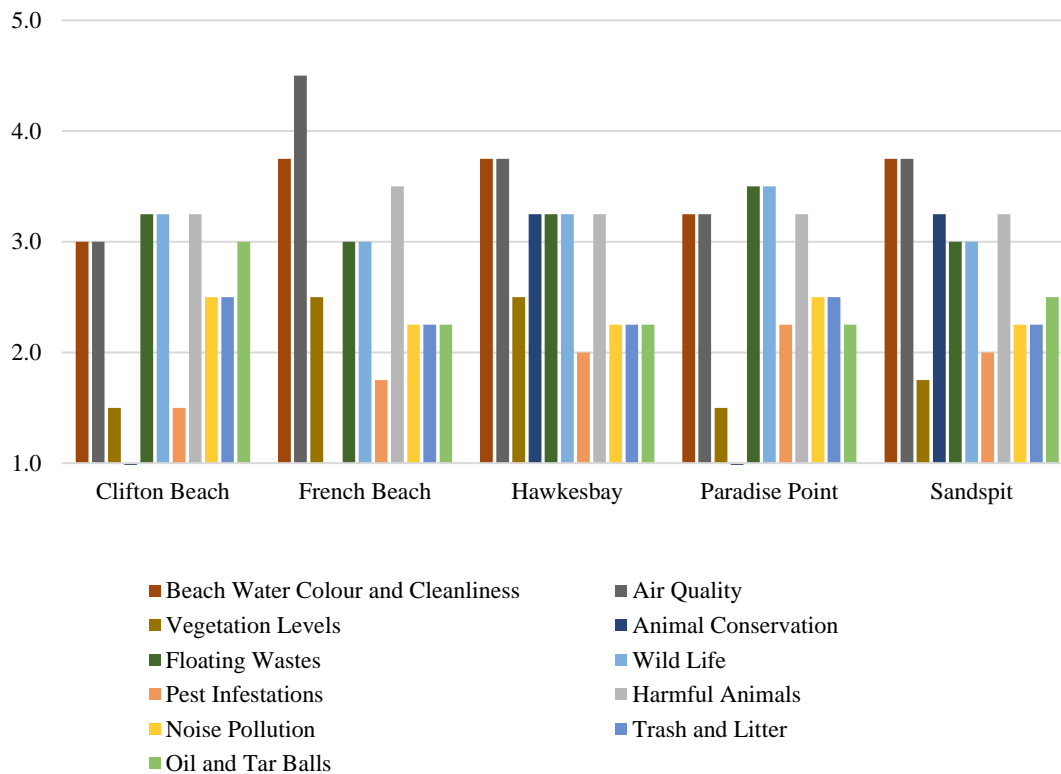
Figure 34. Users' Scoring for Environmental Features of Beaches

The infrastructure and services for the beaches received mixed scoring from the users with most services at or below the acceptance level as shown in the *Figure 35*. General access to the beaches is scored above the level of acceptance for Clifton and Paradise Point beaches. Many of the services were completely missing at the beaches. These include rest rooms, litter bins, illumination, beach sports, artificial shades, exclusive

facilities for children and differently abled people and lifeguards. Clifton beach had 8 services scored at or above the acceptance level, French beach had 4 services scored at the acceptance level while Paradise Point, Hawkesbay and Sandspit beaches each had 5 services at the acceptance level. In general, the users were unsatisfied with the availability and quality of services at the beaches.

5.6.4. Likelihood of Visiting Again

The users were asked to score the likelihood of their visiting the beach again on a likert scale from 1 – 5 with 1 being not likely and 5 being most likely. The users scored Clifton, Paradise Point and French beaches as likely to visit again and Hawkesbay and Sandspit beaches as moderately likely as shown in *Figure 36*.

5.7. Willingness to Pay for Better Beach Management

In the questionnaire presented to the beach users, they were asked if they would be willing to pay for better management of beaches they frequent. If they were willing, they were asked their preferred mode of payment and if they were unwilling, they were asked the reason for it. The participants were also asked what they think is a reasonable charge per person for visiting the beaches.

It was found that 74.6% of the beach users were willing to pay for better management of the beaches and 25.4% were unwilling, as shown in Figure 37. From the percentage willing to pay, 42% opted charged parking, 52% opted entrance fee and 6% opted for private sector organization for beach services as the preferred modes of payment, as shown in *Figure 38*. From the percentage that was unwilling to pay, 88.2% cited their mistrust of the institutions and funds not being utilized for beach management as a reason for the unwillingness, 5.9% cited already paying taxes and 5.9% cited government's responsibility of managing funds for beach management as shown in *Figure 39*. The average reasonable charge per person per visit came out to be PKR 101 (USD 0.62).

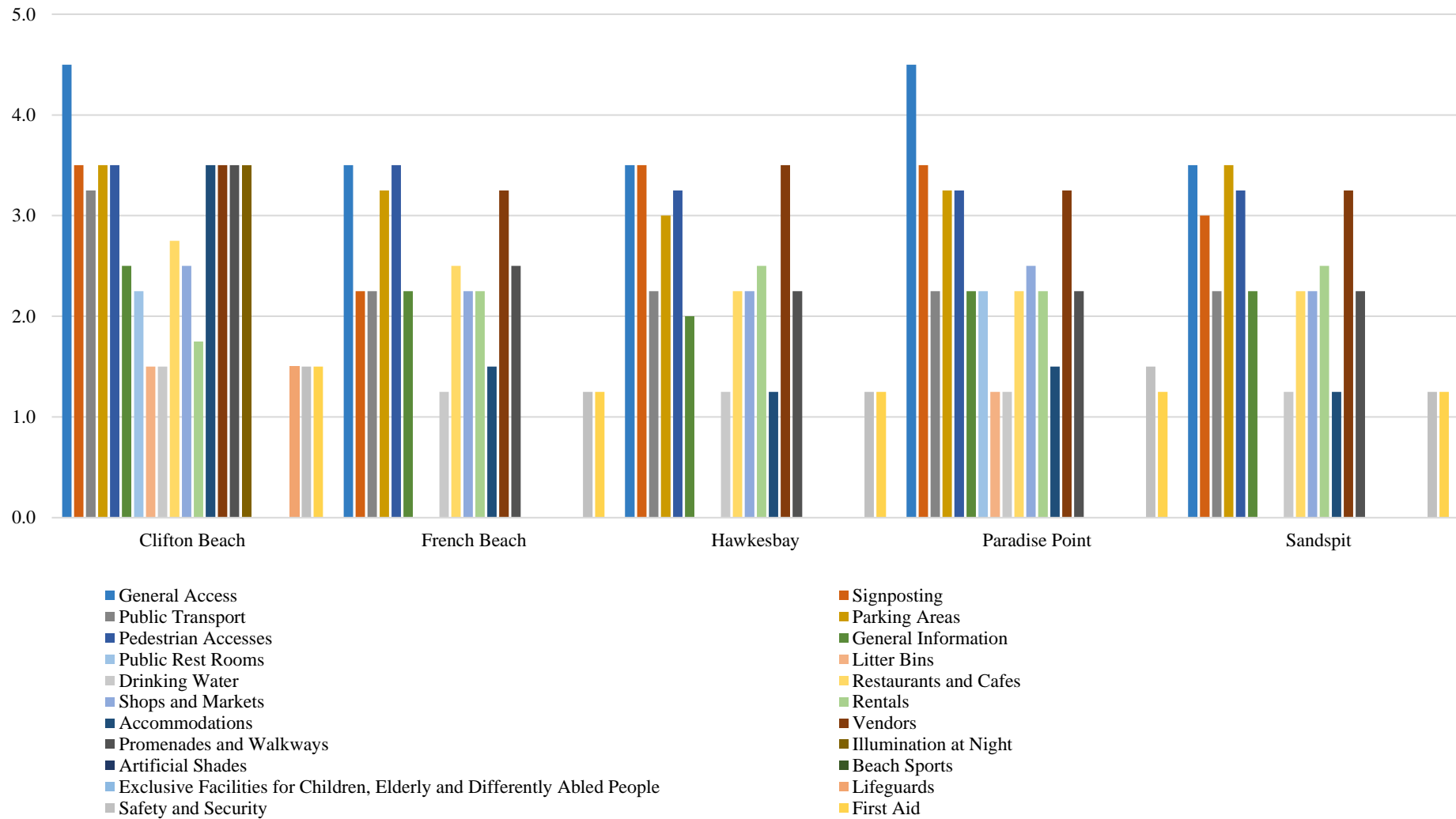Figure 35. Users' Scoring for Infrastructure and Services of Beaches
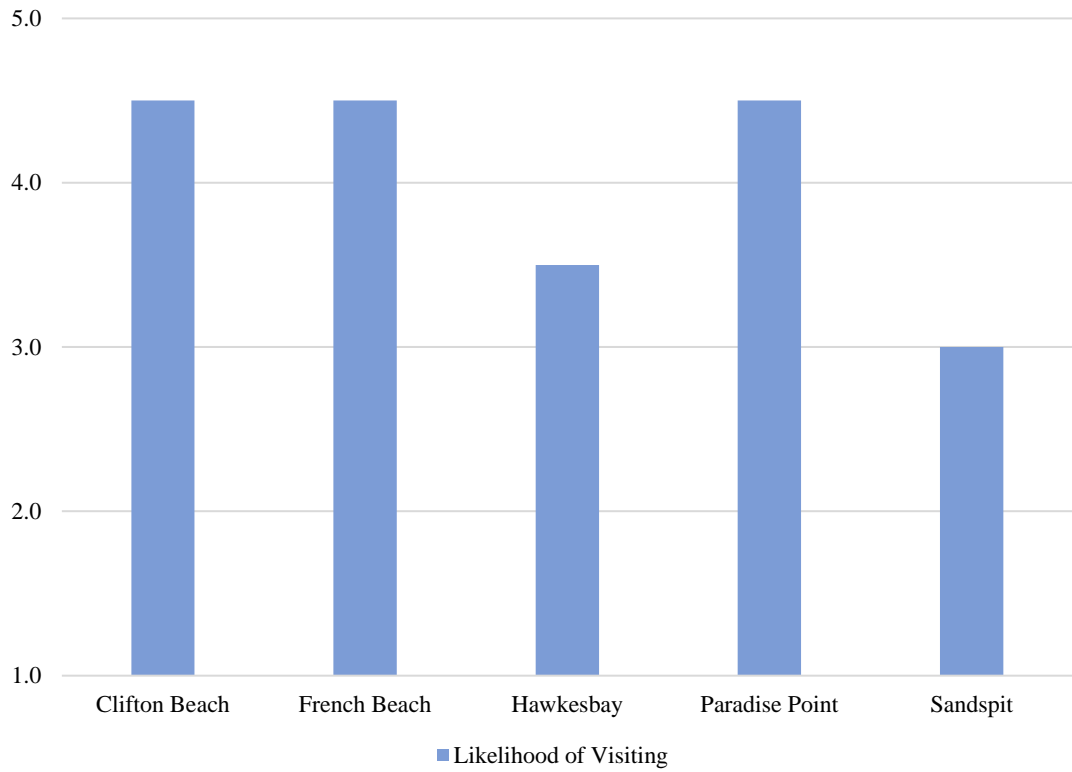
Figure 36. Users' Likelihood of Visiting the Beaches Again
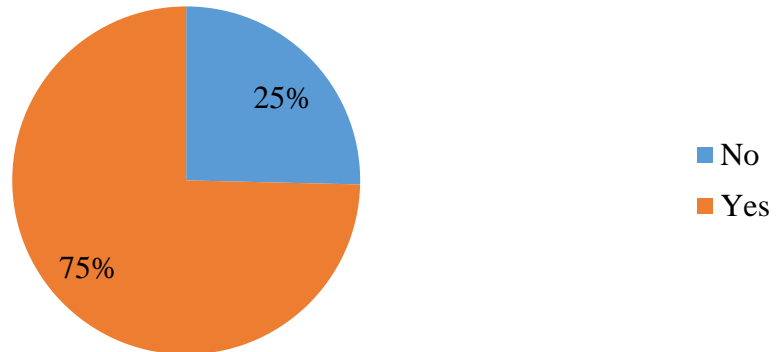

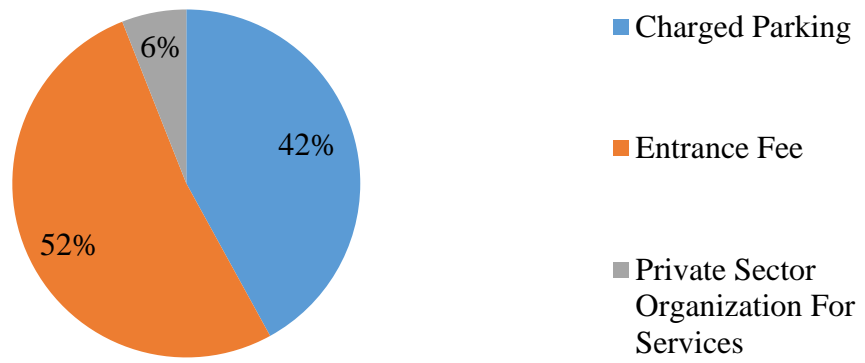Figure 37. Users' Willingness to Pay for Better Beach Management
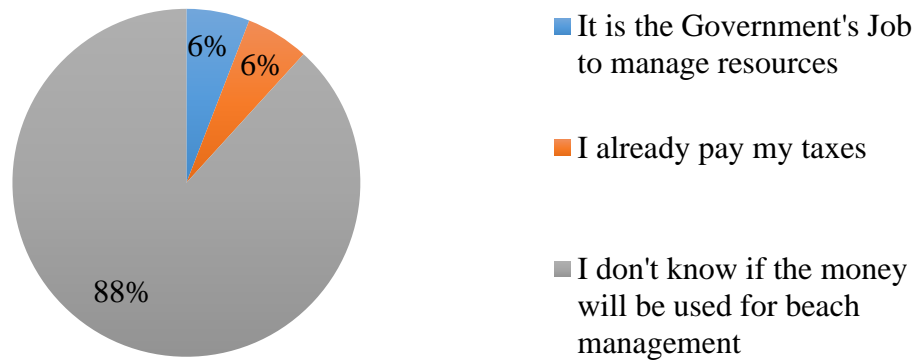
Figure 38. Preferred Mode of Payment of Willing Users

Figure 39. Reason for Unwillingness

CHAPTER 6 – DISCUSSION

6.1. Sustainability Assessment of Beaches

The aim of this research was to conduct an integrated yet simple sustainability assessment of recreational beaches of Karachi. The assessment used multiple parameters to try and capture the beach environments as complex systems. For this, recommendations from multiple studies such as Ariza et al., 2010; Cervantes & Espejel, 2008; Leatherman, 1997; Lucrezi et al., 2016; Morgan, 1999a were incorporated. Using this assessment tool, a baseline data was obtained regarding the beaches' sustainability, allowing them to be compared and priority management concerns that need intervention.

The data regarding the parameters selected was collected from the field, however some parameters such as coliform count and wave regime were extracted through recent research on water quality and meteorological publications. The collection did not incorporate the time-based change in the parameters. This method of data collection did have some associated risks but were deemed acceptable in favour of a simple assessment as carried out in Lucrezi et al., 2016.

The study pointed out some potential high priority management concerns. In the study area, it was seen that the infrastructure and services at the recreational beaches needs immediate attention. Basic services of rest rooms and drinking water are missing in many beaches. Local government and beach managers need to prioritize these services especially in the current era when tourism is being promoted throughout the country. In the Karachi Strategic Development Plan 2020 (Master Plan Department, 2018), public private partnership is identified as a potential financing mechanism for provision of services. Another concern is the solid waste management at the recreational beaches. Community led collection campaigns have been carried out at these areas. However, it has been noted that lack of litter bins and collection mechanism has promoted accumulation of waste at the beaches. Vegetation along the beach has been found to be very less. With the government's vision of Clean Green Pakistan and Billion trees Tsunami, it is concerning that the local government and managers have not paid attention to this matter. Under these programs, funding for plantation drives is available and it is imperative that the initiative is taken in these areas as well. Another important aspect related to environmental sustainability is conservation activities. Hawkesbay and Sandspit are designated Olive Ridley Turtle conservation areas. The turtles bury their eggs in the sand of these beaches. These turtles are classified as vulnerable by the international union for conservation of nature and natural resources (IUCN). These beaches are also frequented by strays and other animals that eat the eggs of these turtles. It is imperative that collaboration with NGOs is done to preserve these areas for vulnerable species.

Another feature of the assessment was that the beaches could be compared. However, it must be considered that the beaches must be compared keeping same boundary conditions. Therefore, the study area in this assessment was purposefully chosen to be recreational beaches within the same city, having the same biosphere, climate and time as done by Lucrezi et al., 2016. When comparing beaches in terms of a compound index, it may be highly affected by a single sub-index, like in Clifton it is dictated by

high economic sustainability value. In this study, individual performance of indicators was investigated to get a broader and clearer picture rather than just relying on the sub-indices.

6.2.   Users' Perceptions of Beaches

Users' relationship with environment are found to be complex. The attitudes and opinions of people is dependent on the quality of the environment, and it directly affects the recreational activities of the users. Therefore, it is advised that user perception surveys must be used cautiously when translating into management practices (Roca & Villares, 2008).

An interesting finding of the perception survey was that the indicators relating to services, physical and environmental aspects in the sustainability assessment which scored less were also scored negatively by the users. It showed that the attributes requiring immediate management attention were also the cause of public concern. In terms of physical features of the beaches, it is seen that the public is overall satisfied, however it must be noted that these physical features occur naturally such as beach width, condition, air and water temperature etc., and cannot be modified by human means and change spontaneously over a long period of time.

In terms of environmental features, public is found to be concerned about the vegetation levels, animal conservation, pest infestations, noise pollution and trash and litter levels. These issues primarily concern the local government departments such as municipal corporations, waste management companies and environment protection department. Proper implementation of the policies by these departments is imperative to improve the environmental quality of the beaches.

In terms of infrastructure and services, the beaches have been scored low by the public. It is seen that many essential services such as litter bins and rest rooms have been found to be absent at the beaches. In the study, it has already been shown that availability of services and facilities is the most opted reason for the choice of beach to be visited by the public and Clifton is the most frequented beach because of this reason. The improvement of beaches in terms of infrastructure and services is the responsibility of municipal corporations and development authorities through proper allocation of annual development budgets.

Similar studies carried out globally show that the perceptions of the public vary according to the development of the beaches as well as different beach user profiles (Lucrezi et al., 2016; Roca & Villares, 2008). These studies are important for producing bottom-up information that can be used to adapt beach management plans according to the preferences of the users.

6.3.   Willingness to Pay for Better Management

Willingness to pay is a very important tool for sustainable management of beaches. However, in this study, the tool is deployed only to see the attitude of public towards beaches and their sustainable management. A large portion of the public involved in the questionnaire survey were willing to pay for better management.

CHAPTER 7 – CONCLUSIONS AND RECOMMENDATIONS

7.1.   Conclusions

The assessments carried out in this study are first of their nature in the study area and can be very helpful for the local managers for effectively managing priority concerns and promoting tourism in these beaches. The sustainability assessment tool used is simple but it very useful for obtaining baseline data that can be used by beach managers for adapting management plans according to the shortcomings observed. The study area beaches have been shown to have an overall low sustainability score and need attention especially in terms of social and economic development.

User perceptions were studied so that recreational experience of the beach goers might be assessed and used for improving the beach quality and management. Overall, the beach users were satisfied with their experience in terms of physical and environmental characteristics. A lower score was observed in terms of infrastructure and services at the beaches. These concerns were also brought up in the sustainability assessment and shows that the public concerns align with the actual situation of the study area. With the public willing to pay for better management, there is scope of improvement in the beach management plans and provision of services to the study area.

In the light of these conclusions, future research can be carried out incorporating the temporal changes that take place in beach environments by carrying out assessments in different seasons. Public perception studies can be carried out to explore impact of user profile on preferences.

7.2.   Recommendations

From the assessments carried out and results obtained, following recommendations have been proposed for sustainable beach management:

i.   The coastal area of Karachi has the potential of becoming sites of commercial importance and tourism. These sites should be managed by ministry of culture and tourism irrespective of ownership. Legislative support must be provided for all the organizational structuring at federal, provincial, district, public, and private levels for smooth management and operation of these sites.

ii.   Pakistan has several organizations and departments working in coastal areas on international, federal, provincial, and local levels. Coordination of these bodies has been found to be weak. There is an immediate need to improve the technical and professional capacities at all levels for better coastal resource management, research, development, and enforcement of environmental policies. There is an immediate need to strengthen the linkages of existing bodies managing the coasts and a continued investment in modern equipment and physical structure is required.

iii.   There is a lack of awareness and education regarding the sustainable use of coastal areas. There have been no concrete steps taken for creating awareness about environment and pollution in the public. Concentrated efforts are required

for educating and raising awareness among not only the public but also policy makers, opinion leaders and media institutions.

iv. Unplanned development of coastal areas has major environmental implication for sustainable management. There is a need to improve the coordination between development authorities, strengthening institutions and developing legislation in line with sustainable development and conservation of coastal areas.

v. The capacity to enforce laws, rules and regulations and implementation of development plans and policies is severely compromised in the organizations responsible for management of coastal resources and areas. It is important to build capacities of the existing institutions for effective implementation and enforcement of plans and regulations. An effective oversight and feedback mechanism is also required to oversee the implementation and enforcement activities.

vi. The public beaches in the coastal area of Karachi are severely compromised when it comes to infrastructure and services. Overlapping jurisdictions of different departments hinders smooth operation and service delivery of these areas. There is a need to carry out a proper survey to delimitate the boundaries of these departments so that responsibilities may be assigned accordingly.

vii. Financial capacity of the departments responsible for the beaches and coastal resources is compromised. Adoption of self-financing methods is recommended for financing the smooth operation and management of beaches. Private sector must also play its role in better management of beaches through public private partnerships.

Appendix A – Questionnaire Survey

This questionnaire is a part of research being carried out at National University of Sciences and Technology (NUST) for assessing and improving the beach management on Karachi Coast leading to an integrated and sustainable beach management. Your responses and participation are important and will be appreciated.

IMPORTANT: THIS QUESTIONNAIRE IS CONFIDENTIAL AND WILL BE USED FOR RESEARCH PURPOSE ONLY.

1. Age

   _____

2. Gender

Male	
Female	
Prefer Not to Say	

3. What is your educational qualification?
   In Terms of Years

   _____

4. What is your household size including children?

   _____

5. What is your average household income (including other adults)?
   In PKR/Month

   _____

6. Where are you staying these days?

Own Home	
Relatives' Home	
Hotel	
Other	

   _____

7. How do you travel to the beach?

On Foot	
By Bicycle	
By Car/Motorcycle	
By Public Transport	
Other	

8. With whom do you come to the beach?

Alone	
Family	
Friends	
With Significant Other	
Other	

9. How long do you usually stay at the beach?
    In Terms of Hours

10. How much do you usually spend on the beach?
    Include beach activities, rentals, food, shopping, etc. in your response (PKR / Person)

11. How often do you come to the beach?

Everyday	
Weekends	
Once a Year	
Never	

12. Which beach do you usually visit?

Clifton Beach	
Hawkesbay Beach	
Sandspit Beach	
French Beach	
Paradise Point	

13. What is the reason for choosing this particular beach?

Cleanliness of Beach and Sea Water	
Quiet and Relaxed Environment	
Close to Nature	
Good Views and Landscapes	
Beach Sports and Activities	
Economic Reasons	
Good Access and Facilities	

14. How will you rate the beach you usually visit on the following physical characteristics?

When answering please remember that 5 means maximum punctuation, what you value positively, and 1 means minimum punctuation, what you value negatively.

Characteristics	1	2	3	4	5
Beach Area Per Individual					
Beach Width					
Beach Material Colour and Texture					
Water Temperature					
Air Temperature					
Bathing Area Conditions					
Local and Far Vista Views					

15. How will you rate the beach you usually visit on the following environmental characteristics?

When answering please remember that 5 means maximum punctuation, what you value positively, and 1 means minimum punctuation, what you value negatively.

Characteristics	1	2	3	4	5
Beach Water Colour and Cleanliness					
Air Quality					
Vegetation Levels					
Animal Conservation					

16. How will you rate the beach you usually visit on the presence of the following environmental characteristics?

When answering please remember that 5 means maximum punctuation, what you value positively, and 1 means minimum punctuation, what you value negatively.

Characteristics	1	2	3	4	5
Floating Wastes					
Wildlife					

Pest Infestations					
Harmful Animals					
Noise Pollution					
Trash and Litter					
Oil and Tar Balls					

17. How will you rate the beach you usually visit on the availability and quality of the following services and facilities?

When answering please remember that 5 means maximum punctuation, what you value positively, and 1 means minimum punctuation, what you value negatively. In case any aspect is not present, please mark "not present".

Services and Facilities	1	2	3	4	5	Not Present
General Access						
Signposting						
Public Transport						
Parking Areas						
Pedestrian Accesses						
General Information (Rules, etc.)						
Public Rest Rooms						
Litter Bins						
Drinking Water						
Restaurants and Cafes						
Shops and Markets						
Rentals (Huts, etc.)						
Accommodations (Hotels, etc.)						
Vendors						
Promenades and Walkways						
Illumination at Night						
Artificial Shades (Umbrellas, etc.)						
Beach Sports						
Exclusive Facilities for Children, Elderly and Differently Abled People						
Lifeguards						
Safety and Security						
First Aid						

18. What is the likelihood of visiting the beach again?

	1	**2**	**3**	**4**	**5**	
Not Likely						Very Likely

19. Will you be willing to pay for visiting the beach so that the beach may be managed in a better manner?

Yes	
No	

If Yes, Skip to Question 20
If No, Skip to Question 22

20. What will be your preferred mode of payment?

Charged Parking	
Entrance Fee	
Private Sector Organization for Services	
Other	

_____

21. What do you consider a reasonable charge per person?

_____

22. What is the main reason behind your choice?

It is the Government's Job to manage resources	
I already pay my taxes	
I don't know if the money will be used for beach management	
Other	

_____

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