



Liveability Index of Hulhumalé, Maldives

KEY FINDINGS AND METHODOLOGY

Housing Development Corporation (HDC) was established pursuant to a presidential directive in the year 2001. Today, it stands as a visionary city developer dedicated to transforming landscapes that emerge from the seas of the Maldives. Our journey began with the reclamation of Hulhumalé, featuring the development of a smart and sustainable city, which is widely considered the most securely profitable investments in the Maldives. With its proven track record, HDC has currently emerged as the leading Urban Development Corporation in the Maldives, overseeing projects that span five significant islands of the country: Hulhumalé, Gulhifalhu, Thilafushi, Kudagiri, Urban Isle, and Rasmalé. Learn more at hdc.mv

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Citation: UNDP (2024). Liveability Index of Hulhumalé, Maldives - Key Findings and Methodology. Male, Maldives.

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1. Core Objectives

1.1 What is the Liveability Index of Hulhumalé?

This research paper is intended for the general public, researchers, and councils interested in crafting their own Liveability Index. It primarily concentrates on two key aspects: the introduction and the methodology that can be employed to formulate a Liveability Index. Additionally, this paper offers an introductory overview of Hulhumalé, a subject of relevance to the research.

Hulhumalé stands as a reclaimed island city adjacent to Velana International Airport, nestled within the North Malé Atoll. The development of this island was conceived as an integral component of the Government of Maldives' strategy to alleviate congestion in Malé City. It represents a project under shared jurisdiction between Malé City Council and Housing Development Corporation (HDC), a wholly state-owned corporation formed in 2001. Municipal services for Hulhumalé are carried out by Malé City Council under this jurisdiction, while the planning and development of Hulhumalé fall under the purview of HDC.

UNDP Maldives recently formed a partnership with Housing Development Corporation (HDC) to enhance data utilization for informed decision-making in pursuit of Sustainable Development Goal (SDG) 11 - Sustainable Cities and Communities. In pursuit of this objective, UNDP Maldives and HDC have collaboratively crafted a local Liveability Index, carefully aligned with the SDG framework. This index serves as an instrument for assessing the living standards and conditions of Hulhumalé residents. It encompasses five strategic priorities, or pillars, upheld by HDC: social inclusion, economic sustainability, environmental sustainability, good governance, and innovation and technology. **The index has undergone an initial prototyping phase at the citywide level to assess its quality, consistency, and reproducibility, with the ultimate aim of creating an index at the neighborhood level.**

¹Housing Development Corporation. 2022. Annual Report. Hulhumalé: HDC.



1.2 Why a Liveability Index?

The Liveability Index serves as a valuable tool enabling the HDC and UNDP teams to initiate a pilot assessment of the existing Liveability standards in Hulhumalé, intended for continuous use during monitoring of development progress. Leveraging this index, UNDP along with HDC has crafted an interactive data platform known as 'the Liveability Dashboard.' This innovative dashboard not only visualizes outcomes but also generates actionable insights, promoting evidence-based decision-making in the formulation and execution of development policies and services. The dashboard effectively underscores the significance of data in shaping development decisions to ensure economic prosperity, as well as social and environmental sustainability.

The city and the Greater Malé region experience pressing urban challenges, including climate-resilient development as well as the mounting strain on services and infrastructure due to population concentration. These issues necessitate both immediate remedial solutions for existing problems and forward-looking, aspirational approaches, aligning with normative sustainability and resilience principles. The Liveability Index empowers HDC to identify current gaps and strategize targeted interventions as required, both at the citywide and neighbourhood level.

1.3 Compared to What?

Countries have made significant strides in recent years towards realizing the objectives outlined in the 2030 agenda for Sustainable Development (the SDGs), the Paris Agreement of the UNFCCC, and the Sendai Framework for Disaster Risk Reduction. The progress made in setting national and local targets, enacting relevant legislation, crafting policies, and allocating budgets to support these initiatives reflects a growing commitment and awareness among government officials to coordinate efforts at both national and global levels. The Liveability Index offers a means to assess local development outcomes against normative benchmarks, particularly in comparison to other Upper Middle-Income countries, within the framework of the SDGs.

1.4 Prototype and Scalability

A core objective of the HDC-UNDP collaboration is to prototype and test the Liveability Index using an extensive array of available data resources for Hulhumalé. Given that HDC is also entrusted with the development of other islands in the Greater Malé region, including Thilafushi (an industrial island) and Gulhifalhu (a semi-residential port) following a model akin to Hulhumalé, there is an aspiration to apply this prototype to upcoming planned island developments. The prototype serves as a means for the team to identify current data gaps and methodological intricacies in the implementation of the index on a larger scale.



2. Index Framework Design Parameters

With these fundamental objectives in view, four principal design criteria have been established to guide the development of the Liveability Index of Hulhumalé and its associated dashboard, detailed below.



2.1 Framework Validation

The Liveability Index, in tandem with the dashboard, aims to provide a dependable and consistent means of monitoring significant elements that define on-ground development. To achieve this, the UNDP team solicited input from HDC (the client), local development experts, as well as residents and businesses of Hulhumalé, to validate the underlying concepts that contribute to Liveability in the Hulhumalé context and the assessed outcomes, as depicted in **Figure 1**.

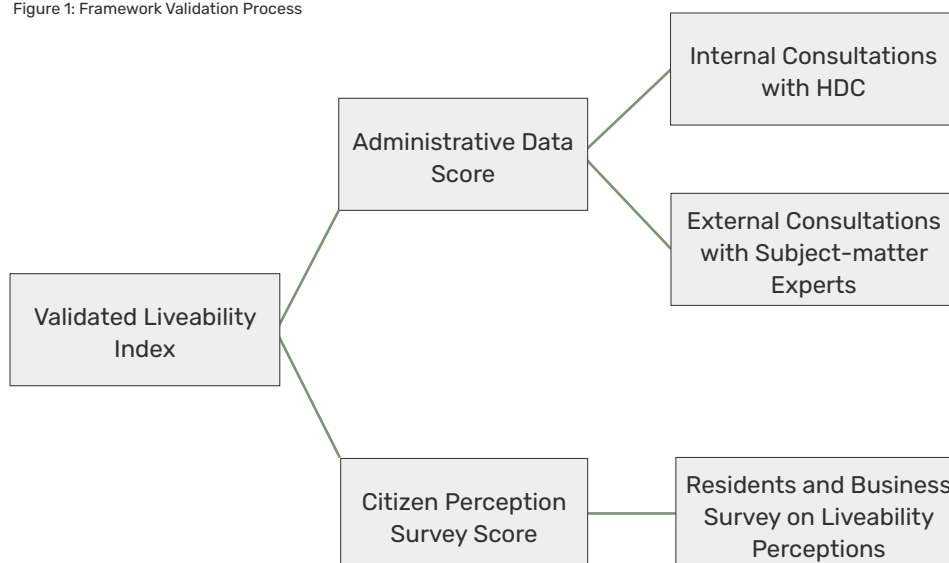
The comprehensive Liveability Index comprises two main components:

a. The Administrative Data (AD) Index Score, structured from official statistics specifically collected and compiled for Hulhumalé from various sources, and

b. The Citizen Perception Survey (CPS) Score, derived from a direct survey involving residents, workers, business owners, and property holders in Hulhumalé, where they rate various aspects of liveability in the City.

For the AD(AD) Index Score: Indicators representing the five strategic pillars – social inclusion, economic sustainability, environmental sustainability, good governance, and innovation and technology – were carefully selected for **internal validation** with HDC, as these best covered the concepts and inter-relationships contributing to liveability outcomes. HDC was in the best position to advise the UNDP team regarding the availability of proprietary information covering key development aspects in Hulhumalé. In conjunction with secondary AD sources, most notably the Maldives Bureau of Statistics (MBS), various ministries, and State-owned Enterprises (SOEs), indicators (variables) were chosen to encompass significant contributions to liveability standards.

Figure 1: Framework Validation Process



As part of this support, the UNDP team conducted numerous in-person workshops with HDC personnel in **May and June 2023**, as illustrated in **Figure 2**, to authenticate the concepts and Liveability Index indicators. The team also sought input from government experts for **external validation** of the core concepts employed and the selection of variables comprising the index in **June 2023**. The UNDP and HDC teams held a series of face-to-face meetings with a range of subject-matter experts, including key ministries and SOEs, to ascertain the relative significance of indicators, thereby validating the weighting scheme and the approach for index construction.

Moreover, in May 2023, the UNDP and HDC team engaged with community groups, including Persons with Disabilities (PwDs), to discern specific interests and concerns related to the enhancement of liveability in the City.

Lastly, direct input from residents, workers, and businesses in Hulhumalé was collected through a targeted **Citizen Perception Survey (CPS)** score, which was designed in June 2023 and executed in July 2023. The survey aimed to **validate the outcomes of the modelled AD Index Score** derived from secondary data. It focused on essential questions concerning the availability, accessibility, and quality of services and opportunities contributing to the quality of life. These survey questions were aligned with the **five strategic pillars** comprising the liveability framework, as also used in the AD Index Score for comparison and validation. Ideally, this survey will be conducted when there is an update of the Liveability index. Survey results can be employed for comparing the modelled data outcomes, as well as in conjunction to create a hybrid index that reflects a broader basis for performance.

Figure 2: Stakeholder Engagement



2.2 Data Consistency and Normative SDG Benchmarks

1. As previously mentioned, benchmarks were established and applied to the indicators for a comparative assessment of local development outcomes in Hulhumalé. The overarching approach was to link the comparative framework to the targets of the SDGs. The process employed for reviewing and selecting indicators and developing benchmarks is outlined below: Initial scrutiny of available local data for Hulhumalé to be aligned with the components of the Liveability Framework, including data from HDC, the MBS – Census and HIES datasets, and information from SOEs.

2. Internal and external consultations with subject-matter experts within HDC, various ministries, and SOEs on the conceptual soundness, availability/periodicity of source data, and possible strategies to develop indicators for Hulhumalé, where the data was not available.

3. Comparing the aforementioned list of variables with the National Strategy for the Development of Statistics (NSDS), 2021-2030, to ensure future data coverage and updates, guaranteeing regular revisions of the Liveability Index of Hulhumalé and potential application in other islands in the future.

4. Based on the evaluations conducted above, compile a final list of indicators to establish consistent comparative benchmarks.

5. Benchmarks were primarily derived from (or modeled based on) the Sustainable Development Report (SDR) 2022², which monitors progress towards achieving SDG targets on a global scale. This encompasses both initial points (baselines) and end objectives (targets) for gauging the rate of progress.

6. Several indicators selected for the Liveability Index of Hulhumalé extend beyond the scope of the SDR report. For these, benchmarks were established using average outcomes for upper-middle-income countries (UMIC), as defined by the World Bank³, which includes the Maldives.

2.3 Facilitate Targeted Interventions

Liveability Index of Hulhumalé is an aggregate representation based on Pillar Indexes crafted for HDC's five strategic areas. These Pillar Indexes, in turn, are derived from detailed categorical indexes that gauge specific development concepts pertaining to areas where policy interventions are required. Hence, one of the central objectives of this process is to identify clearly discernible areas or mechanisms for planning and policy adjustments that will logically enhance overall living standards, both at the citywide and neighbourhood levels. Depending on the impact area, policy decisions can be seamlessly integrated with the data platform to simulate potential outcomes, providing a robust decision-making tool based on the previously validated benchmarking process.

2.4 Data Dashboard and Periodic Updates

While the aforementioned sections delve into the processes underpinning the creation of the Liveability Index's backend, considerable attention has been devoted to designing an effective front-end 'Data Dashboard' for monitoring and evaluation, as elaborated in detail in Annex 1.

- The UNDP Accelerator Lab and HDC team leveraged its capabilities to implement a visualization system that integrates data using periodic updates.

- Furthermore, the Data Dashboard possesses the ability to simulate outcomes within a modelled environment in response to policy changes and interventions, as previously noted.

- In this regard, taking this concept a step further, it is strongly recommended that HDC invests in a 'Digital Twin' environment, creating a digital representation of Hulhumalé that integrates multiple spatial and information layers with real-time dynamic capabilities while adhering to ethical data privacy standards.

- As a logical extension, 'Digital Twins' form the foundational requirement for implementing a 'Smart City' command and control platform. This aligns with HDC's expressed interest in developing Hulhumalé as a Smart City.

- An integrated Digital Twin/Smart City command and control platform, coupled with the Liveability Index, would be a pioneering effort, even within the broader global context, transcending conventional smart city approaches that focus on basic services and infrastructure coordination to actively address sustainability and resilience targets, in accordance with the Maldives SAP and the UN SDGs.

²Sustainable Development Report 2022: From Crisis to Sustainable Development, the SDGs as Roadmap to 2030 and Beyond. June 02, 2022. <https://www.sustainabledevelopment.report/reports/sustainable-development-report-2022/>

³<https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>

3. Methodology of Liveability Index of Hulhumalé

The preceding discussion on the project's overall design approach highlights two key components in the creation and validation of the Liveability Index of Hulhumalé. The first component entails establishing the modeled AD Index Score, which is constructed using secondary data sources. The second component involves gathering input through a CPS Score from residents, workers, and businesses in Hulhumalé to assess the city's quality of life. As previously mentioned, the survey serves as a means to validate the modeled outcomes at the citywide level and also contributes to generating a hybrid index that incorporates resident perspectives.



3.1. Index Geographies

For this initial prototype in Hulhumalé, the Liveability Index has primarily been constructed at the citywide level. Future iterations of the index are expected to encompass neighbourhood-level assessments as data becomes available. Here is a discussion of these geographies:

- **City Level:** The current index is derived from aggregated citywide data drawn from various sources, including estimates from the Household Income Survey (HIES) 2019, information from SOEs, and proprietary data from HDC.
- **Neighborhood Level:** The UNDP and HDC team reviewed data available at this level. However, due to data constraints, the inclusion of this information has been deferred to future index updates. For upcoming iterations, neighbourhood geographies will be defined to ensure compatibility with administrative and other data, including infrastructure, services, and land use, already available with HDC. Initially, this may involve analysing data by Phase 1 and Phase 2 areas of Hulhumalé.
- **Hypothetical SDG City:** While not explicitly a spatial concept, by benchmarking outcomes, the City index is being compared to the ideal 'SDG City' based on targets within conceptual categories.

3.2. Dimensions of the AD Score

As illustrated in Figure 2, the modeled AD Index Score consists of four levels of data aggregation, ranging from the smallest unit of indicators to the citywide Liveability Indexes.

- **Modeled Liveability Index:** At the highest level of aggregation, the modeled Liveability Index is constructed at the city level by combining Pillar Indexes representing specific development concepts.
- **Pillar Indexes:** Five (5) indexes are crafted to represent specific development concepts identified as strategic priorities for this exercise. Three (3) pillars encompass the lived outcomes of residents, workers, and businesses: Social Inclusion, Economic Sustainability, and Environmental Sustainability. The Governance pillar is a crosscutting enabler impacting all the aforementioned outcome pillars, while Technology and Innovation serve as a supportive pillar within the current development context, facilitating activities and outcomes as described.
- **Category Indexes:** These indexes aggregate up to the Pillar Indexes based on the development concepts being measured. A comprehensive scope of 26 such categories was defined, encapsulating the essence of the pillars after incorporating internal and external inputs during May and June 2023. The initial implemented prototype of the AD Index Score currently includes 11 categories due to data availability limitations.
- **Indicators:** These indicators aggregate up to the Category Indexes and represent the fundamental units of observation within the Liveability framework. These indicators have been developed by applying statistical methods to transform raw variables (data) to enable their meaningful combination at comparable units and scales.

Figure 2: Theory of Change

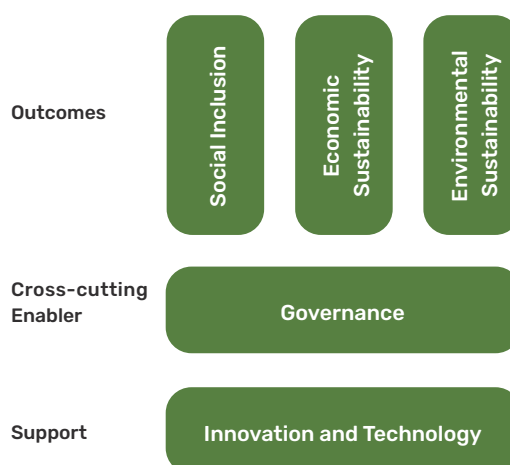
Liveability Framework

HDC's 5 Strategic Pillars

- Good Governance
- Social Inclusion
- Economic Sustainability
- Environmental Sustainability
- Innovation and Technology



Theory of Change



Modelled Liveability Index

5

Pillars

26

Categories

75+

Indicators

A. Governance

1. Core Infrastructure and Services

Roads, Drainage, Water, Electricity, Telecommunications

Data Level:
Neighborhood

Update Frequency:
Annual

2. Housing and Shelter

Housing mix, availability and cost.

Data Level:
Neighborhood

Update Frequency:
Annual

3. Transportation and Mobility

Public transport and walkability

Data Level:
Neighborhood / City

Update Frequency:
Annual

4. Public Finance, Accountability and Transparency

Operational Costs/ Revenue, Community Budgeting

Data Level:
City

Update Frequency:
Annual

5. Public Participation

Elections, Meetings, and City Outreach

Data Level:
Neighborhood / City

Update Frequency:
Annual

6. Citizen Services and Responsiveness

No. of Services, Digital, and Redressal Time for Complaints.

Data Level:
Neighborhood / City

Update Frequency:
Annual

7. Public Safety and Accessibility

Crime Rate, Emergency Services, Community and Disability Support

Data Level:
Neighborhood

Update Frequency:
Annual

B. Social Inclusion

8. Education	9. Health Coverage	10. Gender Inclusiveness
Attainment, Enrolment and Access (no. of centres)	Health Infrastructure and Trained Personnel	Representation in Govt., employment, education, health
Data Level: Neighborhood	Data Level: Neighborhood	Data Level: City
Update Frequency: Census + Annual	Update Frequency: Census + Annual	Update Frequency: Census
11. Social Protection and Poverty	12. Social and Cultural Programming	13. Cost of Living Burden
Poverty%, Pensions, Grants, Subsidies, Regulations	Women, Youth and Children programmes	Housing and Health Expenditures %
Data Level: City	Data Level: Neighborhood / City	Data Level: Neighborhood
Update Frequency: Census + Annual	Update Frequency: Annual	Update Frequency: Annual

C. Economic Sustainability

14. Economic Opportunity	15. Economic Diversification	16. Marketplace Conditions	17. Business and Investment Climate
Household Income, Gini, Job Openings, Unemployment Rate	Tourism dependence, Sector%, Occupancy Rates	Access to Goods, Services and Finance, Inflation	No. of business start ups, No. of Regulatory Steps, Foreign Invst.
Data Level: City	Data Level: City	Data Level: Neighborhood / City	Data Level: City
Update Frequency: Ministry	Update Frequency: Ministry	Update Frequency: Annual	Update Frequency: Annual

D. Environmental Sustainability

18. Pollution

Air and Water pollution
Outcomes by Source and
Type.

Data Level:
City

Update Frequency:
Annual

19. Hygiene and Circular Economy

Sanitation, Waste and
Resource Management

Data Level:
Neighborhood

Update Frequency:
Annual

20. Green Energy

%Renewables - direct and
electricity generation.

Data Level:
City

Update Frequency:
Annual

21. Disaster Risk

Flooding and Fire incidents,
Coastal Erosion

Data Level:
Neighborhood

Update Frequency:
Annual

22. Climate Risk

Temperature, Sea Level
measures

Data Level:
City

Update Frequency:
Annual

23. Natural and Open Space Assets

Parks and Natural Habitat
Coverage

Data Level:
Neighborhood

Update Frequency:
Annual

D. Environmental Sustainability

24. Business Innovation/ RD

No. of STEM firms, Patents,
Copyrights/IPs

Data Level:
City

Update Frequency:
Ministry

25. Technology Infrastructure and Services

Broadband, Startup Finance,
Training Programmes

Data Level:
City

Update Frequency:
Annual

26. Smart City Initiatives

No. of initiatives, Integration
with City Services/GovTech.

Data Level:
City

Update Frequency:
Annual

3.3 Determining Index Combination Weights

A core assumption in the construction of indexes concerns the selection of weights to combine the component variables (or other indexes). These selected weights indicate the relative importance given to each component variable (or sub-index) in its contribution to the underlying concept represented by the target index, an approach taken in similar studies .

The Liveability Index of Hulhumalé uses three sets of weights to aggregate from the base indicators to the final neighborhood/citywide index, as shown in greater detail in Section 3.6. In each of the cases shown below, the UNDP and HDC team consulted with subject-matter experts through structured workshop sessions to determine the relative contributions of different indicators (or sub-indexes) to their target index.

- **Pillar Weights:** This is a subindex to the main Liveability Index. As discussed earlier, these pillars are divided into Outcome Pillars (Social, Economic and Environmental outcomes), Cross-Cutting Pillar (Governance) and Support Pillar (Technology). The weights assigned to each of these pillar types would likely be different in contributing to the overall Liveability score.
- **Category Weights:** This is a subindex to the Pillar Index. There are 26 category indexes that map uniquely to one of the 5 pillars. Weights are assigned to each of the category subindexes to aggregate up to the pillars. The current first prototype of the AD Score includes 11 categories due to data availability limitations and assumes equal weights for all categories to avoid introducing calculation biases.
- **Indicator Weights:** These are used to assign indicators (the basic units of observation) to the category indexes. The full scope for the Liveability Framework identified 129 indicators. The current first prototype of the AD Score includes 33 indicators due to data availability limitations and assumes equal weights for all categories to avoid introducing calculation biases.

*Ministry of Urban Development. 2017. Liveability Standards in Cities. New Delhi: Ministry of Urban Development.

3.4. Guiding Concepts for the Pillar and Category Indexes

Table 1, below, shows the complete scope Liveability Index, including pillars and categories representing specific dimensions of development. The Governance Pillar Index – cross-cutting enabler- is composed of 7 category indexes that have impacts across development outcome areas. Social Inclusion is an outcome pillar and is composed of 6 category indexes. Economic Sustainability is an outcome pillar and is composed of 4 category indexes. Environmental Sustainability is an outcome pillar, composed of 6 category indexes. Technology and innovation are conceived as a cross-cutting support factor to facilitate good governance and city services and is composed of 3 category indexes.

Pillar Index	Category Index	Guiding Concept
<p>Liveability is enhanced, supported, or reflected by...</p> <p>A. Governance</p> <p>Good governance is critical for the provision of basic services and amenities that contribute to quality of life standards for citizens, and ensure safety and security.</p>	<p>Pillar enhanced, supported, or reflected by...</p> <p>1 Core Infrastructure and Services</p> <p>2 Housing and Shelter</p> <p>3 Transportation and Mobility</p> <p>4 Public Finance, Accountability and Transparency</p> <p>5 Public Participation</p> <p>6 Citizen Services and Responsiveness</p> <p>7 Public Safety and Accessibility</p>	<p>Pillar enhanced, supported, or reflected by...</p> <p>Provision of basic infrastructure and services, including affordable housing, is a direct measure</p> <p>Easy access to jobs, services and marketplaces measured in terms of public transportation options and walkability.</p> <p>Fiscal stability and own-resource generation is critical for sustainability.</p> <p>Citizen outreach and engagement in the decision making process critical for successful programme/plan outcomes.</p> <p>Simpler and quicker access to municipal services/records, and time taken to address complaints and service requests is a direct measure of effective governance.</p> <p>Creating a safe environment for all sections of society, especially children, women, elderly and individuals with disabilities.</p>

B. Social Inclusion Social inclusion enables citizens to fully realize their capabilities through access to education, health and housing, reduces social and economic risks, increases equitable access to opportunities, and shapes a well-informed and involved citizenry.	8	Education	Core measure of the Human Development Index
	9	Health Coverage	
	10	Gender Inclusiveness	The ability of women to participate effectively in society, including employment and educational opportunities, and access to financial and technological resources.
	11	Social Protection and Poverty	Reduce vulnerabilities, support citizens' ability to cope with economic and social risks, and enhance access to opportunities.
	12	Social and Cultural Programming	Programmes and initiatives that enhance sense of community, provide information, supplement education, and support citizen participation.
	13	Cost of Living Burden	The percent of household income on shelter, food and health is a direct measure of cost of living burden.

C. Economic Sustainability A sustainable economy is essential for job opportunities across a variety of industry sectors, and supported by enabling conditions for business and investment	14	Economic Opportunity	A direct measure of employment opportunities in the context of prevailing unemployment rates and background GDP growth.
	15	Economic Diversification	The extent to which the City moves away from over-dependance on a single or few economic sectors enhances economic resilience.
	16	Marketplace Conditions	Easy access to goods and services at affordable prices is a direct measure of Liveability.
	17	Business and Investment Climate	Supporting conditions to start, operate and scale businesses, important for jobs, output, revenues and taxes.

D. Environmental Sustainability Environmental conditions directly impact quality of life, and economic and social vulnerabilities. Mitigating measures to reduce natural, human-made and hybrid risks ensure environmental resilience and sustainability.	18	Pollution	Air and water pollution directly impacts health, impacting quality of life.
	19	Hygiene and Circular Economy	Maintenance of a clean environment key measure for quality of life and preventing public health crises.
	20	Green Energy	Transition from fossil fuels to green alternatives, directly or indirectly as used for electricity generation, will improve air quality.
	21	Disaster Risk	Disasters caused by natural, human-made and hybrid risks impact quality of life, and increase economic and social vulnerabilities.
	22	Climate Risk	Macro climate conditions intensify the impacts of natural, human-made and hybrid risks.
	23	Natural and Open Space Assets	Open space, including parks and natural habitats, critical for improving quality of life and mitigating disasters.

E. Technology and Innovation Economic activities tied to technology and innovation important for sectoral diversification, employment generation and building technical know-how. The city can leverage skilled workforce to implement and operate smart city solutions.	24	Business Innovation/RD	Direct measures of tech/R&D/innovation activities in the city reflects skilled workforce and capabilities.
	25	Technology Infrastructure and Services	Infrastructure and services supporting the innovation ecosystem, including high-speed broadband, and availability of training programmes and finance.
	26	Smart City Initiatives	Growing technical know-how can be leveraged to design, implement and operate Smart City Solutions to support all of the above pillars (Good Governance, Social Inclusion etc.) by improving the targeting and efficacy of city programmes, coordinate infrastructure and services, and improving system-wide efficiencies and real-time responsiveness.

3.5. Variable Selection

With a view of mapping basic indicators to their respective category indexes, a variety of data sources were reviewed by the UNDP team in various stages in consultation with HDC. The final list of variables and data sources is discussed in detail in Annex 1 on Methodology of Data Analysis. Important data sources included:

- **HDC Databases:** HDC provided a variety of data covering municipal services, utilities, real estate development, and community engagement and outreach.
- **Census 2022 and 2016:** Each dataset has more than 50 variables of interest that map to the five pillars of the Liveability framework. The Census covers key topics such as housing characteristics and amenities, energy consumption, employment situation and disabilities. Census 2022 is currently not available for analysis at the level of Hulhumalé.
- **Household Expenditure and Income Survey (HEIS) 2019:** This dataset includes more than 75 variables covering topics related income, employment, household expenditure and travel, to name a few. Estimations for Hulhumalé were made in consultation with HDC’s research team.

This was followed by in-person meetings in **May 2023** with the MBS and key ministries, including the former Ministry of National Planning, Housing and Infrastructure, that pointed to recent initiatives undertaken by the Government of Maldives to collect consistent high-quality data, linked to key frameworks, including the SDGs and National Strategic Action Plan (SAP). The UNDP and HDC team concluded that the Liveability Index of Hulhumalé, and eventually other future developments, be closely coordinated with these efforts:

- **National Strategy for the Development of Statistics (NSDS), 2021-2030⁵** : The 2021 Maldives Statistics Act established the Maldives Statistical System (MSS), with the Maldives Bureau of Statistics (MBS) as lead and was tasked to develop a framework for the collection and dissemination of key high quality and consistent statistics to monitor the country’s progress on inclusive, sustainable and gender-responsive development targets. The NSDS framework is not only a single-point aggregator of a variety of data sources, including the Census, various MBS surveys and information from various ministries, but also maps indicators to the SDGs. Currently available data points within the NSDS framework were reviewed by the team to determine the scope for ongoing updates of the Liveability Index of Hulhumalé.

3.6 AD Score Calculation

The modeled AD Score is constructed in the following sequence:



Each step is further explained below starting with the Liveability Index at the top, down to the indicators. The methodology is explained in detail in Annex 1.

- **Liveability Index:** At the very top, the Modeled Liveability Index results from a combination of the five pillars. Further, these pillars have been identified as Outcome Pillar (Liveability outcomes – Social, Economic, Environmental), Enabler Pillar (Governance), and Support Pillar (Technology). The weighting scheme assigns different weights to each of these groups. The aggregate Liveability Index is developed at the citywide level.

$$\text{Liveability Index} = \text{Governance Index } w1 + \text{Social Inclusion Index } w2 + \text{Economic Index } w3 + \text{Environment Index } w4 + \text{Technology Index } w5$$

where w1, w2, etc. are weights assigned to each pillar index

⁵Maldives Bureau of Statistics. 2021. National Strategy for the Development of Statistics, 2021 – 2030, Maldives. MBS: Malé.

	Pillar Index	Weight	Priority	Pillars	Weight
Example Weighting Schema:	Governance	0.15	Main Outcome Pillars Enabler Support	Economic, Environment, Social	0.25
	Social Inclusion	0.25		Governance	0.15
	Economic	0.25		Technology	0.10
	Environment	0.25			
	Technology	0.10			
	Total	1.00			

• **Pillar Index:** This sub-index is constructed from Category Indexes based on the **guiding concepts described previously in Section 3.4**. This index is calculated as the weighted sum of the categories divided by the number of categories. This averaging is done so that each of the five Pillars can then be combined (weighted) to form the aggregate Liveability Index. This is expressed in its most general form below with weights assigned to each category. It was decided that all categories be assigned the same weight, due to the current availability of data.

	Category Indexes
Governance Index	<ol style="list-style-type: none"> 1. Core Infrastructure and Services 2. Housing and Shelter 3. Transportation and Mobility 4. Public Finance, Accountability and Transparency 5. Public Participation 6. Citizen Services and Responsiveness 7. Public Safety and Accessibility

$$\text{Governance Index} = \frac{C1.WC1+C2.WC2+\dots+C4.WC4}{n}$$

where w1, w2, etc. are categories.
WC1, WC2 etc. are the respective weights
 $\sum WC1+\dots WC4=1.00$
n=7 ie. no of categories

• **Category Index:** This sub-index is constructed from indicators, that are transformed variables that are unit-less and scaled up to a number that can be visualized. The category score is a combination of the various indicators that could represent different concepts in their original state, including percentage share, ratios (per capita, per square meter, per meter etc.).

• **Indicator Index:** The indicators aggregated up to the Category Index level require standardization to similar scales and transformed to scores without units, as explained in further detail **Annex 1**. To this end, the UNDP team developed **target and baseline benchmarks** to normalize the indicator value between 0 and 1. This transformation is necessary especially when lower indicator values are better outcomes – for example, lower levels of pollution or income inequality. Referring to the methodology for normalization provided by the SDR, the research adopts the same methodology, as follows:

$$\text{Indicator index} = \frac{\text{Value} - \text{Baseline}}{\text{Target} - \text{Baseline}}$$

Both the target and baseline benchmarks relate to upper-middle-income group country data points, which are used to measure current Hulhumalé outcomes. These include SDR 2022 target and baseline benchmarks further evaluated in this study for upper middle-income countries, where directly available. For indicators used in this study beyond the SDR data framework, benchmarks were established from a variety of data sources, including World Bank Open Data, for the average performance of upper middle-income countries currently (target) and decade prior (baseline), as proxy measures.

*<https://dashboards.sdgindex.org/chapters/methodology#3-method-used-to-construct-the-sdg-index-and-dashboards>

After normalization, Indicator index measures the distance to achieve the target. For example, an indicator with an index of 0.7 means starting from the baseline, the city has progressed 70% towards achieving the target. Further, in cases where indicator values are higher than the target values, these are adjusted to 1, and conversely if lower than the baseline, these are adjusted to 0, as shown in **Annex 1**.

3.7 CPS of Residents, Workers, and Businesses

To validate outcomes of the modeled AD Score, a CPS was administered to city residents, workers, business operators and property owners, to assess their rating of the various aspects of liveability in the City. Additionally, given the current data limitations, the CPS offers a way to address information gaps. Accordingly, the survey was designed to obtain responses mapped to the 26 Category Indexes of the Liveability Index, as explained previously. The CPS was administered in July 2023 over four days and received 500+ responses. The survey instrument is included in **Annex 2**.

The CPS included 44 unique questions, and resulted in 60 rating variables, which were mapped to their respective categories and pillars. Following the method described in the preceding section, a survey-based score of the five Pillars was calculated, which was then aggregated up to a “Citizen Perception Survey Score” in contrast and comparison to the “AD Score”.

3.8 Index Validation and Adjustments

The CPS Score was then used in two ways.

- First, as a direct comparison to evaluate and validate the modeled AD Score, which is constructed from secondary data sources. The survey index provides the means for validating the data-based modeled outcomes.
- Second, given the possibility for biases in both the AD (due to current limited availability and data coverage of the category concepts) and reported perceptions (due to subjective opinions), the two different indexes could be combined to provide an integrated and holistic picture of the state of liveability in Hulhumalé.
- To this effect, the Liveability Index of Hulhumalé was calculated by assigning weights to the AD Score and the CPS Score for a combined score. Based on similar studies⁷, for example the India ‘Ease of Living Index: 2020’ and in consultation with the HDC research team, the data index was assigned a weight of 70 percent, whereas the survey score was assigned 30 percent, for a combined weight of 100 percent.

⁷Ease of Living Index. India. 2020. Institute for Competitiveness, New Delhi. <https://competitiveness.in/ease-of-living-2020-report/o>

4. Results, Key Findings and Conclusions

Presented and discussed further here are the results from the Administrative Data (AD) Score and the Citizen Perception Survey (CPS) Score, a comparison of the two indexes, and a hybrid index including both scores.

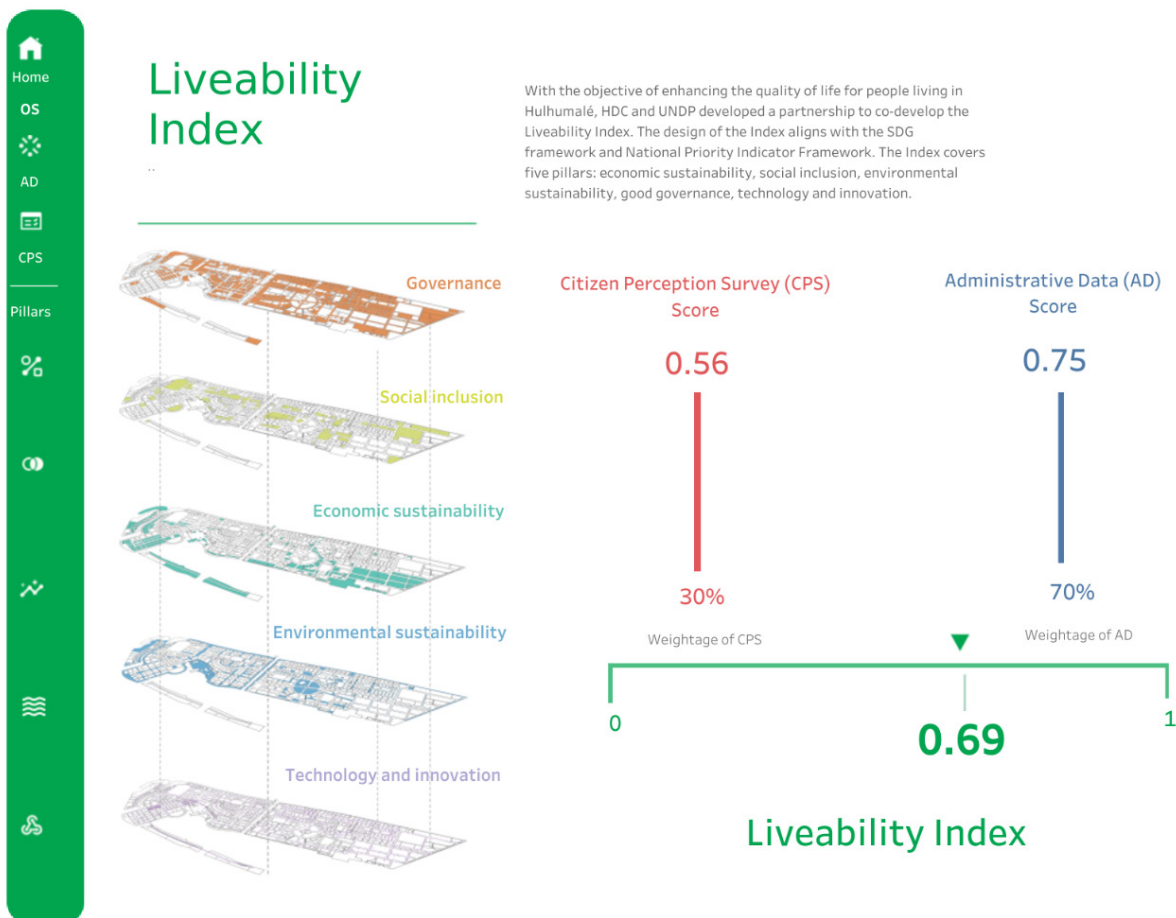


4.1 Administrative Data (AD) Score

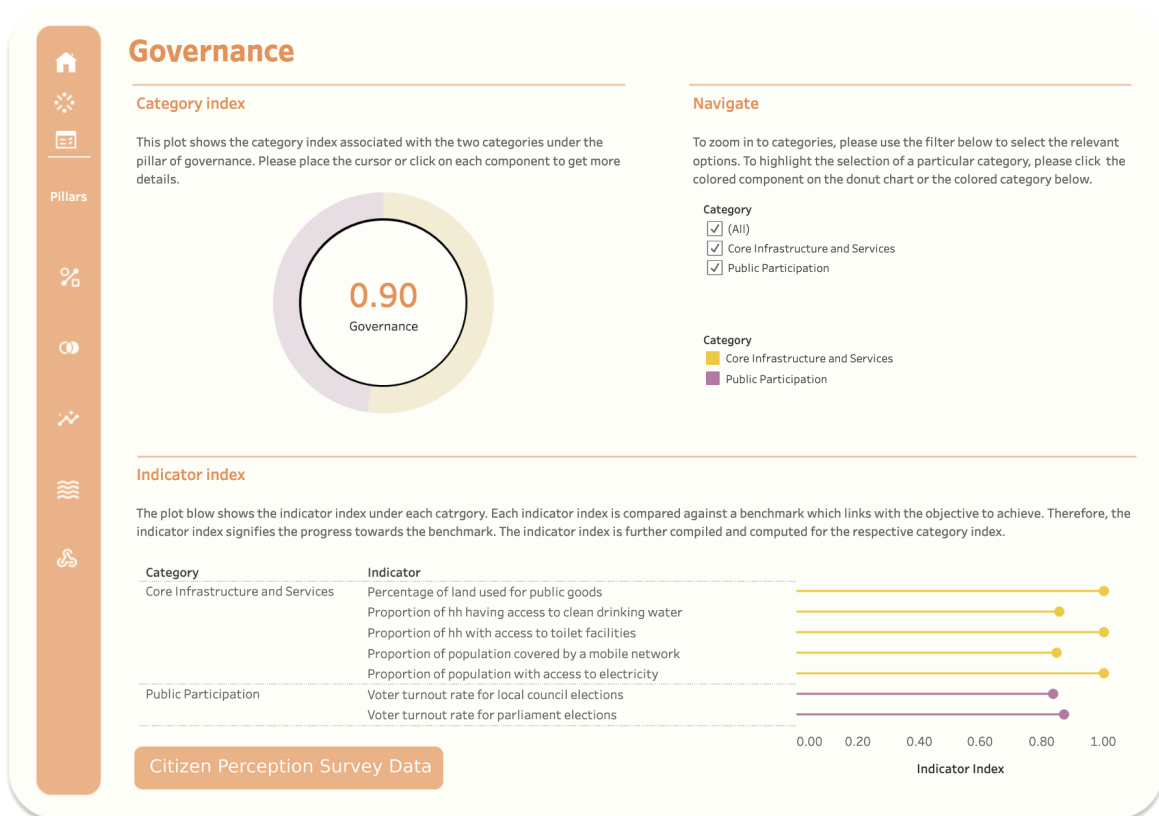
As shown in Figure 5, results from the index analysis are summarized as presented on the homepage of the Data Dashboard designed by UNDP for this first Liveability Index study in Hulhumalé. The features of the Data Dashboard are described further in Annex 1.

The overall AD Score for Hulhumalé is aggregated up from the five Pillar Indexes, as discussed previously. Based on this approach, the overall AD Score for Hulhumalé is calculated at 0.74, based on target and baseline benchmarks, where the optimum outcome is 1.00 in the aggregate. The Pillar Indexes were calculated as follows- Governance (0.90), Social Inclusion (0.77), Economic Sustainability (0.78), Environmental Sustainability (0.50) and Technology and Innovation (0.98). These are discussed further in the following section.

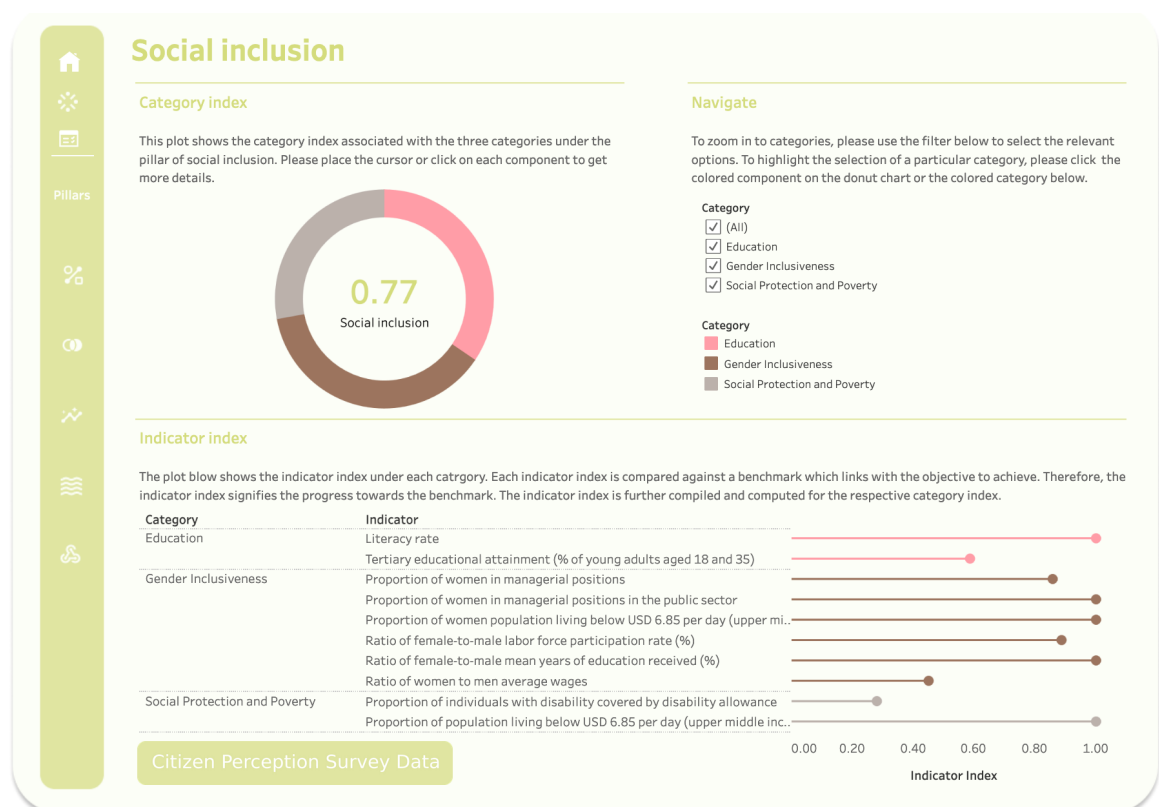
Figure 5: Administrative Data Score Dashboard Outcomes



- **Governance Pillar:** The overall score of 0.90 for this Pillar Index is calculated from 2 Category Indexes and total 7 indicators:
 - o 'Core Infrastructure and Services' is calculated from 5 indicators.
 - o 'Public Participation' is calculated from 2 indicators.



- **Social Inclusion Pillar:** The overall score of 0.77 for this Pillar Index is calculated from 3 Category Indexes and total 10 indicators:
 - o'Education' at 0.94 is calculated from 2 indicators.
 - o'Gender Inclusiveness' at 0.85 is calculated from 6 indicators.
 - o'Social Protection and Poverty' at 0.64 is calculated from 2 indicators.



• **Economic Sustainability Pillar:** The overall score of 0.78 for this Pillar Index is calculated from 3 Category Indexes and total 7 indicators:

o 'Business and Investment Climate' at 0.67 is calculated from 1 indicator.

o 'Economic Opportunity' at 1.00 is calculated from 3 indicators.

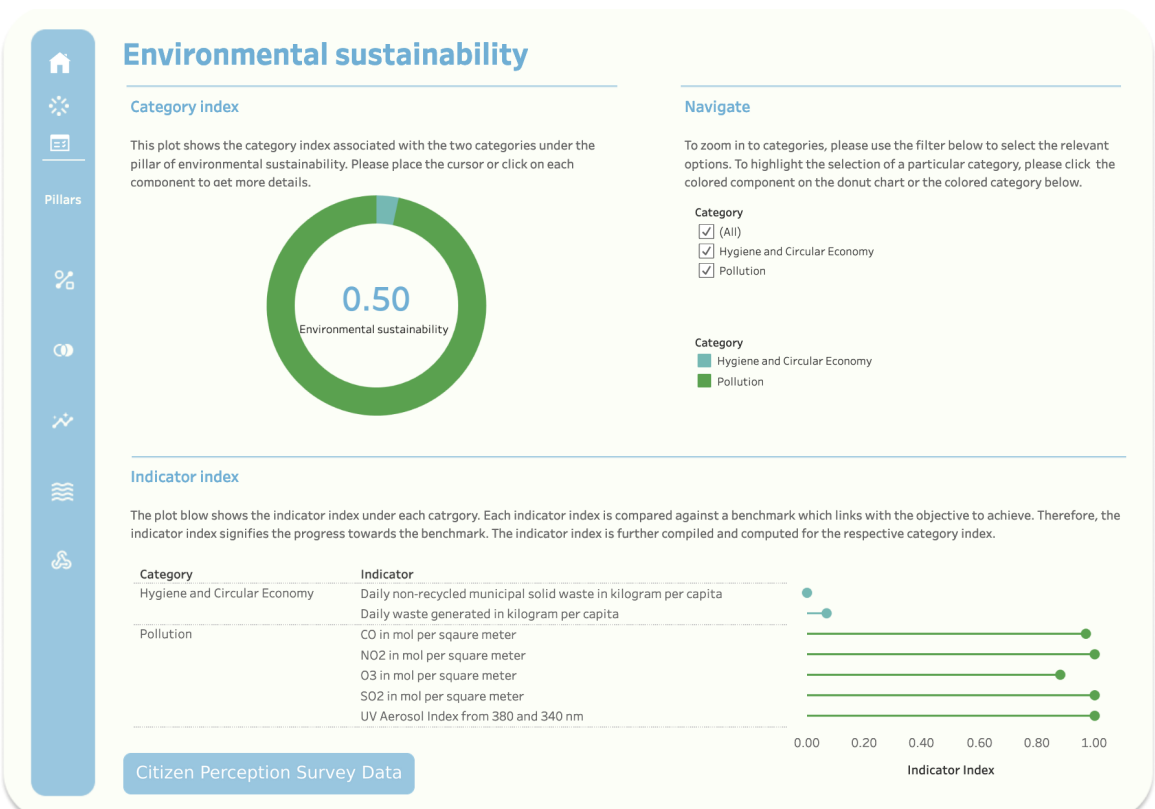
o 'Social Protection and Poverty' at 0.68 is calculated from 3 indicators.



• **Environmental Sustainability Pillar:** The overall score of 0.50 for this Pillar Index is calculated from 2 Category Indexes and total 7 indicators:

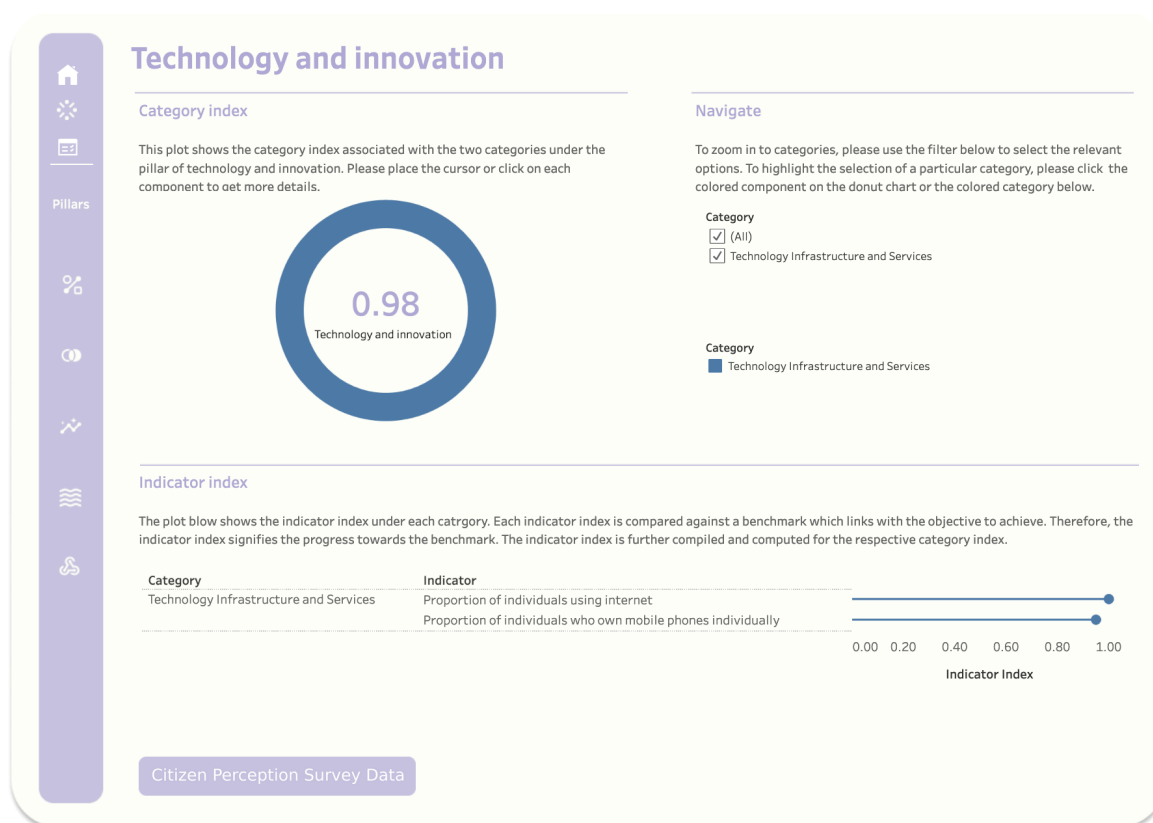
o 'Pollution' at 0.96 is calculated from 5 indicators.

o 'Hygiene and Circular Economy' at 0.03 is calculated from 2 indicators.



•**Technology Pillar:** The overall score of 0.98 for this Pillar Index is based on 1 Category Index and total 2 indicators:

- o ‘Technology Infrastructure and Services’ at 0.98 is calculated from 2 indicators



4.2. CPS Score

The CPS plays a significant role in addressing information gaps given current data limitations, and thus, provides a better understanding of the liveability conditions in the City.

As noted previously, the survey was designed to obtain responses mapped to the 26 Category Indexes of the Liveability Index of Hulhumalé covered over 44 unique questions and 60 rating variables. These were mapped to their respective pillars to develop the Pillar Scores, as shown in Table 2.

Table 2: Comparison of the CPS Score and AD Score

	CPS		AD		
	Score	Weight	Index	Weight	Difference
Governance	0.5600	15%	0.9000	15%	0.3400
Social Inclusion	0.5258	25%	0.7700	25%	0.2442
Economic	0.5433	25%	0.7800	25%	0.2367
Environmental	0.5912	25%	0.5000	25%	-0.0912
Technology	0.5717	10%	0.9800	10%	0.4083
Aggregate Score	0.5563		0.7455		0.1892

An Aggregate CPS of 0.55 (or 55 percent favorable response), where 1.00 (or 100%) is the most favorable response rating (for e.g., 5 out of 5, “Best”, “Always” etc.), was obtained from the ratings of specific questions mapped to the 5 Pillars of the Liveability Index. Pillar Scores range from 52 percent for Social Inclusion to nearly 60 percent for Environmental Sustainability.

As shown in Table 2, the CPS is compared against the AD Score, which shows differences between the two sets of calculations across Pillars. This outcome is not easily interpretable in the absence of a sample cohort of cities to compare the respective averages (outcome levels) and correlations between the survey and data index.

Other studies, for example, the Ease of Living 2020 study⁸ conducted in India for 111 cities, which included both data index and survey scores, found no direct linear relationship (positive or negative) between these two sets of observations. The study, however, found that leading performers for the equivalent AD Index were surprisingly among the lowest in terms of citizen perception score outcomes. The report hypothesizes that this could be due to higher expectations for quality services and amenities by residents in higher income (typically higher data index) cities, which translates to poorer rating outcomes. It is hard to generalize from this observation for the context of Hulhumalé but is worth noting.

In the Hulhumalé CPS, the leading (Top 15) and lagging (Bottom 15) response areas, across the 60 rating areas, are further shown below in Table 3 and Table 4, respectively. These highlight potential areas of attention for HDC in the future. Since this is the first survey of its kind on liveability issues in Hulhumalé (and Maldives), follow-up periodic surveys are recommended to draw more stable conclusions for policy design and interventions.

Table 3: Leading Performance Areas in the Citizen Perception Survey

Indicator	Pillar	Rating/Outcome
24-hr Electricity	Governance	81.2%
Variety of restaurants and cafés in Hulhumalé	Economic	73.0%
Availability of bus stops near your place of residence / work / business	Governance	71.5%
Do you use online access to government/utility services?	Technology	70.1%
Access to food and produce stores in Hulhumalé	Economic	68.5%
Have you heard of the term ‘Smart Cities’?	Technology	68.3%
Availability of Taxi or Rideshare Service	Governance	67.1%
Ease of access to pharmacies	Social Inclusion	67.0%
Have you used the HDC mobile app or website?	Technology	66.9%
Beach & harbour water pollution	Environment	66.2%
Unfiltered Tap Water	Governance	65.5%
Ease of Use of Public Bus Transportation	Governance	65.3%
Frequency of waste pickup at your residence or place of work	Environment	64.7%
Roads	Governance	64.5%
Variety of retail stores in Hulhumalé	Economic	64.4%

⁸Ease of Living Index. India. 2020. Institute for Competitiveness, New Delhi. <https://competitiveness.in/ease-of-living-2020-report/o>

Table 4: Lagging Performance Areas in the Citizen Perception Survey

Indicator	Pillar	Rating/Outcome
Physical service centers in Hulhumalé to access government services	Governance	47.0%
Start-up funding	Technology	46.2%
Air pollution, including dust from construction sites	Environment	45.7%
Clear explanation of processes by HDC to start a business	Economic	45.0%
Safe roads and traffic lights	Social Inclusion	43.7%
Support provided by HDC to facilitate processes	Economic	42.6%
Availability of shaded sidewalks	Governance	41.9%
Ease of connecting with investors	Economic	41.8%
Ease of starting a business	Economic	41.7%
Timeliness of the approvals to start business or own property	Economic	40.9%
Do you agree that Hulhumalé is a safe city with low rates of crime?	Governance	40.7%
Adequate lighting and CCTV in public spaces	Social Inclusion	40.1%
Car parking facilities	Governance	36.9%
Access to technology events/expos	Technology	36.1%
Public toilets	Governance	34.8%

4.3 Liveability Index of Hulhumalé

Additionally, the CPS Score was combined with the AD Score resulting in the Liveability Index of Hulhumalé. This score provides a wider coverage of local information and a more stable interpretation of liveability outcomes, given current limitations on the AD side. Over time, with further expansion in the coverage of official statistics and periodic survey updates, the two scores will likely stabilize within a range of values.

Following other examples, the Liveability Index of Hulhumalé is calculated by assigning weights to the AD Score and the CPS Score for a combined score. Here a 70 percent weight is assigned to the AD and 30 percent score to the CPS. As shown in Table 5 below, this results in combined Liveability Index of 0.689 or 68.9 percent.

Table 5: Calculation of the Liveability Index of Hulhumalé

	Index Value	Weight
AD Score	0.746	70%
CPS Score	0.556	30%
Liveability Index of Hulhumalé	0.689	

4.4 Conclusions and Recommendations

- The quality of the AD Score is necessarily defined by the quality and availability of information. For this prototype index in Hulhumalé, the UNDP and HDC team attempted a thorough assessment of public data resources and developed the necessary framework to incorporate data as and when made available by the ministries, agencies and SOEs.
- The index itself will be updated on a periodic basis, as more of the requested information is made available. At the time of writing this report, nearly 80 additional indicators were requested but to be received.
- Pillars and categories with fewer data points should be interpreted with caution, including the Technology Index, which only included two indicators that were available.
- This prototype study has raised working awareness among HDC staff on the type of information required on an ongoing basis to update the Liveability Index that would ultimately assist in effective urban management.
- This will also help HDC build capabilities and experience towards implementing a similar approach and methodology to other islands in the future.
- The extensive outreach conducted by the team for this project has also raised awareness among various government agencies on the liveability concept and the need for ongoing coordination with HDC on improving data dissemination, especially as the index could potentially be rolled out in other islands.
- Access to the Data Dashboard, that tracks progress along various dimensions, could also be beneficial to several government agencies for streamlining their strategic priorities.
- The CPS is an important tool to address current and future gaps in the data environment that impacts the calculation of a reliable AD Score. It is recommended that this survey be conducted on a regular basis to track public perception reliably.
- If possible, more than one survey outreach should be conducted every year (e.g., semi-annual) to prevent possible skew in responses due to recency biases and any number of factors external to the local context. A frequent sample allows for stable and more robust insights over the long-term.

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ANNEX 1

DATA ANALYSIS
METHODOLOGY
AND OVERVIEW



Overview of the research of Liveability Index

Under the backdrop of the collaboration between HDC and UNDP Maldives on enhancing data use for building an inclusive and sustainable island city in Hulhumalé that offers high quality of life for the local communities, research on developing the Liveability Index is conducted to understand the living condition and experience in Hulhumalé and inform evidence-based decision making in urban design and development. Given this is the first time for Hulhumalé to develop a localized Liveability Index, this research also creates a baseline of assessment on the quality of life and intends to provide a framework for monitoring the changes in the level of liveability in the future.

Through applying an evidence-based approach, the research aims to use the Liveability Index as an effective tool to diagnose crucial challenges in the urban development of Hulhumalé and identify the strategic areas to intervene for improvement. Building on the joint efforts by government agencies, city services providers, and other key stakeholders in the ecosystem, by conducting the Liveability Index research as a starting point, HDC and UNDP Maldives support the development of a Smart Island City that demonstrates a new development paradigm to promote local economic prosperity, embrace social inclusion, and create a resilient, sustainable environment.

The research designs a Liveability Index framework that links to the SDG framework to assess the liveability of Hulhumalé from five pillars – governance, social inclusion, economic sustainability, environmental sustainability, and technology and innovation. Under each pillar, there are associated categories to further define the key concept behind the pillars. At a more granular level, there are constituent indicators under each category. Building on the conceptual framework of the Liveability Index, the research collects data from various sources covering the five pillars and develops an interactive data dashboard to analyse and visualise the Liveability Index.

The relevant data that were collected includes socio-economic data from Household Income and Expenditure in 2019 (HIES), data related to city development in Hulhumalé provided by HDC, open data from Google Places API and Sentinel Hub. The upcoming publication of the Census 2022 could potentially provide more updated data or fill in the data gaps. In addition, we also organized bilateral meetings and stakeholder workshops with relevant government agencies and city service providers to map out the existing data and channel data from these data providers for formulating the liveability indicator index. Meanwhile, complementing to the available data from the sources mentioned above, we design and conduct the community perception survey to deepen the understand of residents' satisfaction to city services.

A mapping of the available data against the Liveability Index framework was conducted to identify the indicators that could be calculated for the time being. The indicators that are important to comprise the Liveability Index but currently lack available data are highlighted separately with the indication of potential data sources for future development.

To effectively communicate the results and insights obtained from the data analysis, a data dashboard is developed to visualize the analysis across the levels of pillars, categories and indicators. It will serve as a tool for decision-making in the urban development of Hulhumalé and create an open channel for the community to track the progress of liveability and share feedback for improving quality of services or designing new services for unmet demands.

About this document

The research involves design of a Liveability Index framework, the development of this Liveability Index in the Hulhumalé city, and key insights generated from the data analysis. Building on the conceptual framework of the Liveability Index, this document covers the methodology of Liveability Index calculation, results from data analysis, and key insights derived from the analysis.



Methodology of Liveability Index calculation

The design of Liveability Index is evolved from the concept of the five key pillars – governance, social inclusion, economic sustainability, environmental sustainability, and technology and innovation. To further define the meaning behind the pillars, a breakdown of each pillar at the category level is developed. And with consultation with key stakeholders, specific indicators are formulated under each category.

Therefore, at the most granular level, Indicator indexes that are normalized within a range of 0 and 1 are averaged to develop the respective category indexes. And the final Liveability Index is aggregated by the calculation of the pillar indexes which are computed by the category indexes with weightages.

Several important factors are taken into consideration to determine the selection of indicators from the Liveability Index framework, including 1) the availability of data to calculate the value for the indicators; 2) the availability of benchmark and baseline data to further calculate the indicator index. A list of indicators is identified for the development of Liveability Index in the current version (Annex I). Based on these indicators, formulas for calculating the value for those indicators are further developed and documented in the Annex II. The input data for calculating the indicator value are from various sources. If the indicators have the ready-to-use value provided by the data owners or a verified secondary data source, a new calculation is not required.

In order to aggregate the index from the indicator level to the pillar level and eventually to formulate the Liveability Index, the indicator value needs to be normalized within a range of 0 to 1. Also, the normalization is necessary to convert the indicators with “negative direction” into meaningful measurement of indicator index. For example, the indicator of crime rate has a “negative direction” because the outcome of public security is better when the crime rate is lower. In case the indicator value exceeds the target, the Indicator index will be adjusted to be the maximum of 1. Likewise, if the indicator value is below the baseline, the Indicator Index will be adjusted to be the minimum of 0.

Referring to the methodology for normalization provided by the Sustainable Development Report, the research adopts the same methodology but adapts it in the following way:

$$\text{Indicator index} = \frac{(\text{Value} - \text{Baseline})}{(\text{Target} - \text{Baseline})}$$

Where Value is the measurement of the indicator in Hulhumalé; Target is the benchmark of the indicator for Hulhumalé to compare with; Baseline is the bottom line for the indicator; and Indicator index is the normalized value of the indicator. The selection of the benchmark and baseline is determined at the stage of design of Liveability Index framework.

After the normalization, Indicator index measures the distance to achieve the target. For example, an indicator with an index of 0.7 means starting from the baseline, the city has progressed 70% towards achieving the target.

Once the Indicator indexes are developed, they will be used as input data for the calculation of category index. Given each indicator has the same weightage, a category index is the mean of all the Indicator indexes within the respective category. The formula is shown below:

$$\text{Category index} = \frac{\sum_{i=1}^n \text{Indicator index}}{n}$$

Where Indicator index is the normalized value of the indicator that is calculated in the previous step; n is the number of indicator indexes; and category index is the aggregated index at the category level.

Building on the result from the category indexes, pillar indexes can be calculated. Since each category has the same weightage under the respective pillar, a pillar index is the mean of all the category indexes. The formula is shown below:

$$\text{Pillar index} = \frac{\sum_{i=1}^n \text{Indicator index}}{n}$$

Where Category index the aggregated index at the category level which is calculated in the previous step; n is the number of category indexes; and pillar index is the aggregated index at the pillar level.

The final Liveability Index is calculated based on the pillar indexes. There are different weightages assigned to each pillar. For the pillars of social inclusion, economic sustainability, and environmental sustainability, the weightage is 0.25. The pillar of governance has a weightage of 0.15. And the pillar of technology and innovation has a weightage of 0.10. The sum of weightages equals to 1. The formula is shown below:

Liveability index

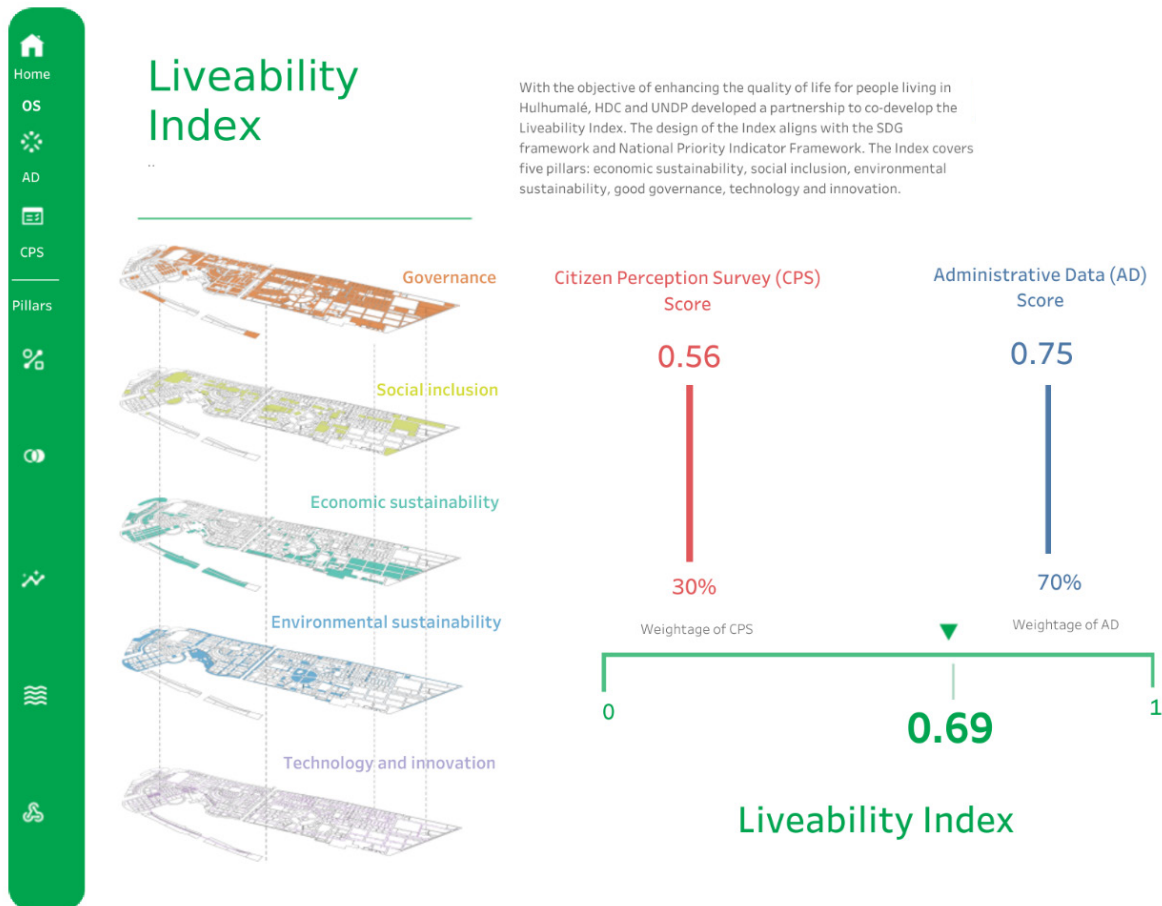
$$\begin{aligned} &= 0.25 \times \text{social inclusion pillar index} \\ &+ 0.25 \times \text{economic sustainability pillar index} \\ &+ 0.25 \times \text{environmental sustainability pillar index} \\ &+ 0.15 \times \text{governance pillar index} \\ &+ 0.10 \times \text{technology and innovation pillar index} \end{aligned}$$

Limitations

Though the research conducted a comprehensive data mapping, attempted to collect data from various sources and coordinated with multiple data owners to gather the most relevant and timely data for the analysis, some data gaps still exist. Also, to standardize the Liveability Index and ensure a fair comparison between the development Hulhumalé and a desirable outcome, the indicator benchmark and baseline need to be collected and matched to the level of measurement. However, the data on benchmark and baseline is not available sometimes. Given this situation, the analysis explores other possible data sources or applies a proxy to bridge the data gaps. Also, the research conducted the community's perception survey. Data collected from the survey could potentially be used for the development of Liveability Index.

Overview of data dashboard

The design of data dashboard follows the structure of the five pillars which are underpinned in the development of Hulhumalé. To represent this idea, the five pillars are visualized on the map of Hulhumalé with the highlights of key components that are relevant to these pillars. The numbers shown under the column of pillar index are the respective index to each pillar.



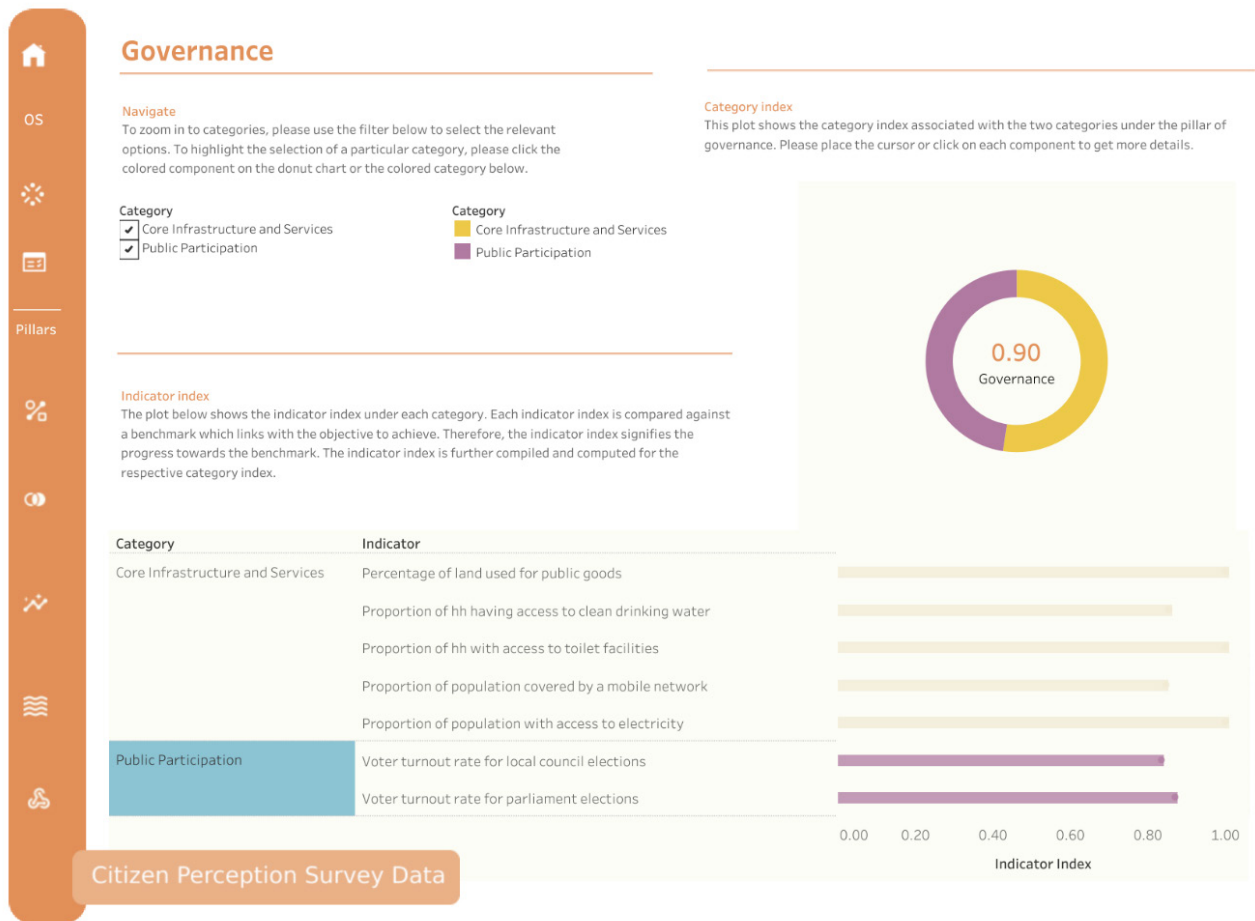
In the navigation bar on the left-hand side, there are buttons to enable navigation to the detailed analysis at the category and indicator level in each pillar.

- The icon 🏠 is linked with the page of governance pillar.
- The icon 🌐 is linked with the page of social inclusion.
- The icon 📈 is linked with the page of economic sustainability.
- The icon 🌿 is linked with the page of environmental sustainability.
- The icon 🚀 is linked with the page of technology and innovation.

Also, the pages to each pillar can be navigated by clicking the images of the maps representing the pillars. The navigation bars in the pillar pages have the same function to ensure consistent navigation between the home page and pillar pages.

Results and insights observed from data analysis

The overall Liveability Index of Hulhumalé is 0.69. It is a compound index based on the calculation of the five pillar indexes. Among the five pillars, technology and innovation pillar has the highest score of 0.98, followed by the governance pillar with an index of 0.90. The economic sustainability pillar and social inclusion pillar get almost equivalent index of 0.78 and 0.77 respectively. The environment sustainability pillar has the lowest score of 0.50 mainly due to the issue related to waste generation in the city.



Citizen Perception Survey Data

Diving into the governance pillar, based on the available data, Indicator indexes for the seven indicators under the category of core infrastructure and services and the category of public participation are calculated. The category index on core infrastructure and services is 0.94 while the category index on public participation is 0.85. Collectively, it contributes to the governance pillar index of 0.90.

It is shown that the Indicator indexes of proportion of population with access to electricity and proportion of household with access to toilet facilities have the value of 1, meaning the city reaches the target of providing residents living in Hulhumalé full access to electricity and toilet facilities. The Indicator index of percentage of land use for public goods also reaches the value of 1, indicating the city has allocated substantive space for public goods.

The Indicator index related to proportion of household having access to clean drinking water is 0.86. It indicates that there are still a small proportion of households without access to clean drinking water. Data related to clean drinking water is obtained from HIES 2019. It is considered as having access to clean drinking water when a household reported using bottled water or taking measures to make the water safe for drinking.

With the target of having 100% coverage of mobile network, the indicator of proportion of population covered by a mobile network has an index value of 0.85, indicating there is a gap of around 15% of households to cover. Since the data on individual mobile subscription is currently not available, the analysis uses household data obtained from HIES 2019.

Both Indicator indexes for voter turnout rate for local council elections and voter turnout rate for parliament elections exceed 0.80. The voter turnout rate for local council elections in Hulhumalé was 54.27% in 2020. To achieve the target of having the turnout rate of 65%, the city has made a progress of 83.50%. The voter turnout rate for parliament elevation was higher, with a number of 65.28% recorded in 2019. Comparing to the target of reaching a turnout rate of 75%, the city has achieved 87.04%.



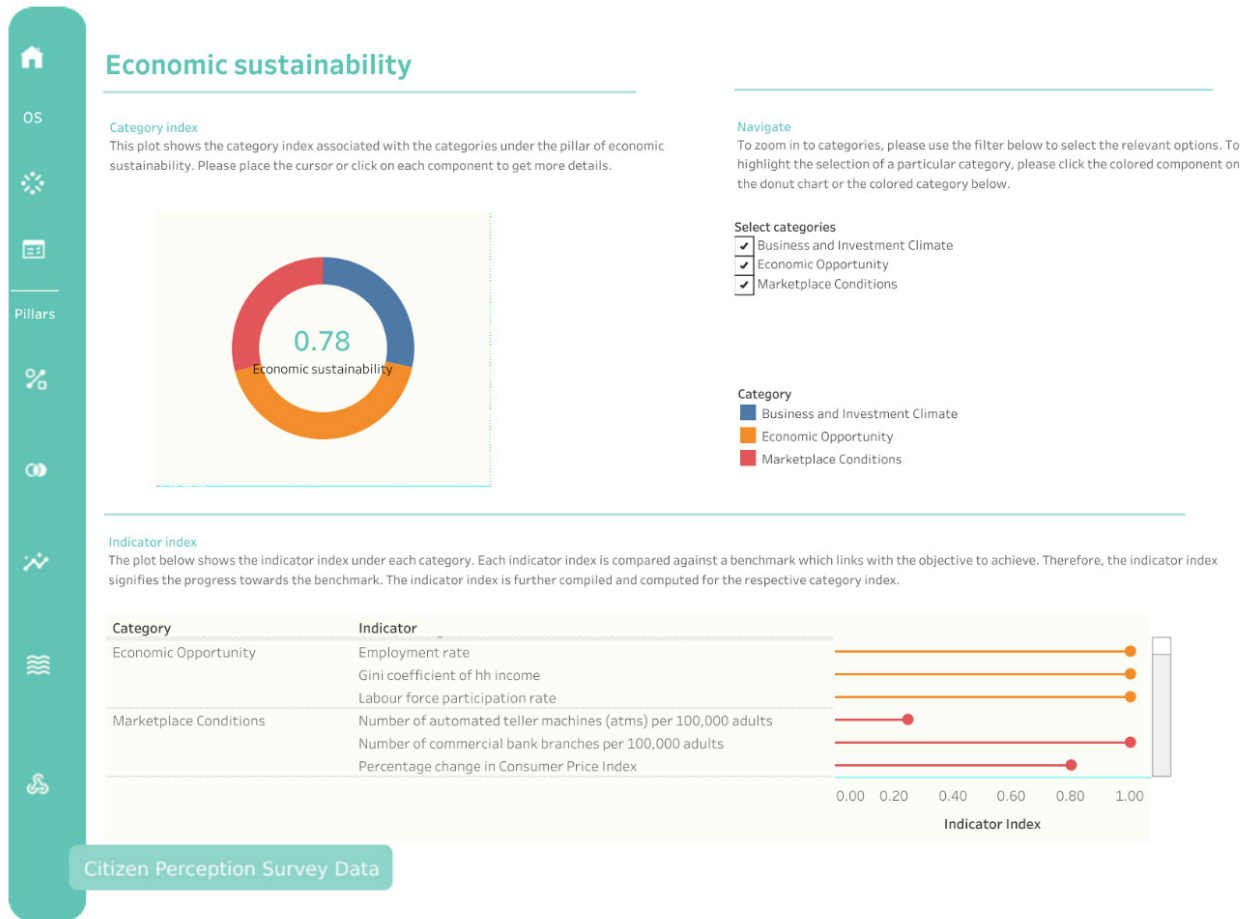
Navigating to the social inclusion pillar, it covers three categories in education, gender inclusiveness, and social protection and poverty. Among them, gender inclusiveness has the highest category index (0.87) while the education category and social protection and poverty category have indexes of 0.79 and 0.64 respectively. These lead to the pillar index of 0.77 in social inclusion.

Delving into the indicators, the high category index of gender inclusiveness is largely contributed by the good performance in ratio of female-to-male mean years of education received, proportion of women in managerial positions in the public sector, and proportion of women population living below USD 6.85 per day. All indexes for the three indicators reach the value of 1.

Though the outcomes achieved in these aspects are promising, more efforts are required to enhance female labour force participation, promote more women to the managerial positions, and balance wage level between men and women. It is worth noting that the ratio of women and men average wage was 0.45. And when all the working women regardless of types of institutions are taken into consideration, the overall proportion of women in managerial positions is much lower than those working in the public sector, implying potential support to promote gender inclusion might be needed in the private sector.

The literary rate is high in Hulhumalé. But the tertiary educational attainment among the youth (aged between 18 and 35) has a lower index of 0.59, indicating a gap of around 41% in achieving the target.

With the Maldives progressing to an Upper Middle-Income country, the poverty level has reduced significantly. Therefore, there is less population living below USD 6.85 per day. However, support to people with disabilities will need to be strengthened because the disability allowance is limited and not all the people with disabilities receive it. The indicator on proportion of individuals with disability covered by disability allowance shows only 28% of households reporting having people with disabilities in the family receive the disability allowance.



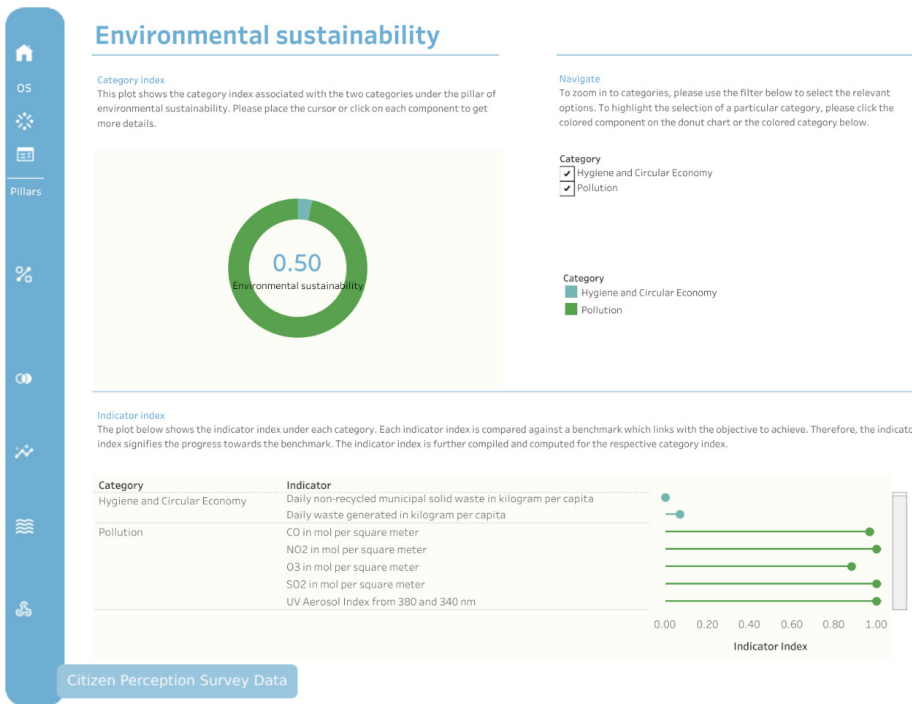
The economic sustainability pillar covers three categories in economic opportunity, marketplace conditions, and business and investment climate. The category of economic opportunity has the highest pillar index of 1. However, the category of marketplace conditions as well as business and investment climate have lower indexes of 0.68 and 0.67 respectively.

The performance in the category of economic opportunity is outstanding because its subordinate indicators of labour force participation rate, employment rate and Gini coefficient of household income reach the targets. It is worth mentioning that since data on Gini coefficient in Hulhumalé is not available, the analysis applies the Gini coefficient in Malé as a proxy.

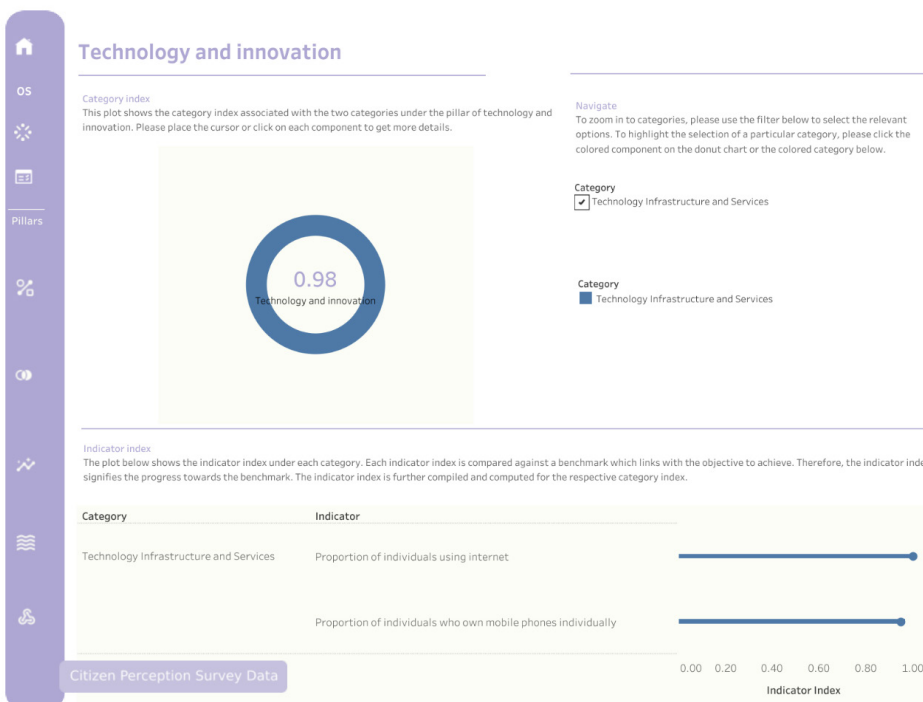
The marketplace conditions are measured by the number of commercial bank branches per 100,000 adults, number of automated teller machines (ATMs) per 100,000 adults, and percentage change in Consumer Price Index (CPI). Though there are enough coverage of commercial bank branches in Hulhumalé, more coverage of ATMs is needed as the Indicator index is only 0.25. The change in percentage of CPI is higher than the benchmark level, with average month-to-month percentage change of 27.41% in 2022. The high number of percentage change in CPI implies a price fluctuation. Please note that since data on this indicator is not available in Hulhumalé, following the same principle of using a proxy, the analysis refers to the data in Malé given the proximity between the two cities.

The category related to business and investment climate is currently reflected by the ease of doing business. The data is obtained from the World Bank's global research¹⁰ on ease of doing business. Given the data at a more granular level in Hulhumalé is not available at the moment, the analysis uses the score for the Maldives as a proxy. The Maldives ranked the 47th place in the group of Upper Middle-Income Countries.

¹⁰<https://www.doingbusiness.org/content/dam/doingBusiness/country/m/maldivesMDV.pdf>



The environmental sustainability pillar has an index of 0.50 with two extreme performances in the category of pollution and the category of hygiene and circular economy. The pollution pillar mainly covers the emission of greenhouse gases and harmful chemicals in the air. The data is obtained from the satellite data in the Sentinel Hub¹² which estimates the level of the air pollutants at the surface level. Apart from the relatively high level in ozone, little air pollutant is detected under this mechanism. Therefore, the category index of pollution is as high as 0.97, indicating a good performance in maintaining the air quality. However, the category of hygiene and circular economy has a low index of 0.03 because the amount of waste generated per capita is much higher than the benchmark.



Given the limited data related to technology and innovation, only one category which covers technology infrastructure and services is included. Since the Maldives has a high internet and mobile phone penetration in general, the Indicator index measuring the proportion of individuals using internet and proportion of individuals owning mobile phones are high.

¹¹ <https://archive.doingbusiness.org/en/rankings?incomeGroup=upper-middle-income>

¹² <https://apps.sentinel-hub.com/eo-browse>

Pillar	Category	Indicator
Governance	Core Infrastructure and Services	Proportion of population with access to electricity Proportion of household with access to clean drinking water Proportion of household with access to toilet facilities Proportion of population covered by a mobile network Percentage of land used for public goods
	Public Participation	Voter turnout rate for local council elections Voter turnout rate for parliament elections
Social inclusion	Education	Literacy rate Tertiary educational attainment (% of young adults aged 18 and 35)
	Gender Inclusiveness	Proportion of women in managerial positions Proportion of women in managerial positions in the public sector Ratio of female-to-male mean years of education received (%) Ratio of female-to-male labour force participation rate (%) Ratio of women to men average wages Proportion of women population living below USD 6.85 per day (upper middle income country level) (2017 PPP\$)
	Social Protection and Poverty	Proportion of individuals with disability covered by disability allowance Proportion of population living below USD 6.85 per day (upper middle income country level) (2017 PPP\$)
Economic sustainability	Economic Opportunity	Employment rate Gini coefficient of household income Labour force participation rate
	Economic Diversification	Percentage change in Consumer Price Index
	Marketplace Conditions	Number of commercial bank branches per 100,000 adults Number of automated teller machines (ATMs) per 100,000 adults
	Business and Investment Climate	Ease of doing business
Environmental sustainability	Pollution	UV Aerosol Index from 380 and 340 nm NO2 in mol per square meter CO in mol per square meter O3 in mol per square meter SO2 in mol per square meter
	Hygiene and Circular Economy	Daily waste generated in kilogram per capita Daily non-recycled municipal solid waste in kilogram per capita
Technology and innovation	Technology Infrastructure and Services	Proportion of individuals using internet Proportion of individuals who own mobile phones individually

Pillar	Category	Indicator	Calculation needed	Formula for calculation	Data source	Reference document
Governance	Core Infrastructure and Services	Proportion of population with access to electricity	no	It is assumed to be 100%. It can be further validated with the HIES data	HDC	Liveabilityindicator_data processing.Rmd
		Proportion of hh having access to clean drinking water	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
		Proportion of hh with access to toilet facilities	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
		Proportion of population covered by a mobile network	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
		Percentage of land used for public goods	no	Direct data and calculation from HDC	HDC	Planning data.xlsx - Land Area Utilisation
	Public Participation	Voter turnout rate for local council elections	yes	Total number of people voted / Total number of eligible people to vote (local councils)	Elections Commission	https://stat.elections.gov.mv/
		Voter turnout rate for parliament elections	no	Direct data and calculation from Elections Commission	Elections Commission	https://stat.elections.gov.mv/
	Social inclusion	Education	Literacy rate	yes	Refer to calculation using HIES data	HIES
Tertiary educational attainment (% of young adults aged 18 and 35)			yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
Gender Inclusiveness		Proportion of women in managerial positions	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
		Proportion of women in managerial positions in the public sector	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
		Ratio of female-to-male mean years of education received (%)	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
		Ratio of female-to-male labour force participation rate (%)	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
		Ratio of women to men average wages	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
Proportion of women population living below USD 6.85 per day (upper middle income country level) (2017 PPP\$)		yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd	
Social Protection and Poverty		Proportion of individuals with disability covered by disability allowance	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
		Proportion of population living below USD 6.85 per day (upper middle income country level) (2017 PPP\$)	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd

Economic sustainability	Economic Opportunity	Employment rate	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
		Gini coefficient of hh income	no	Use Gini coefficient in Malé as a proxy for Hulhumalé	MBS	https://statisticsmaldives.gov.mv/nbs/wp-content/uploads/2023/06/Maldives-Poverty-Assessment-2022-1.pdf
		Labour force participation rate	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
	Economic Diversification	Percentage change in Consumer Price Index	yes	Average month-to-month percentage change of CPI in Hulhumalé	MBS	https://statisticsmaldives.gov.mv/nbs/wp-content/uploads/2023/03/Review-of-the-Consumer-Price-Index-2022-1.pdf
	Marketplace Conditions	Number of commercial bank branches per 10,000 adults	yes	(Number of commercial bank branches / Total population in Hulhumalé) * 10000	HDC + Google Map	Real estate property data. xlsx + Google_Places_API.Rmd
		Number of automated teller machines (ATMs) per 10,000 adults	yes	(Number of ATMs / Total population in Hulhumalé) * 10000	HDC + Google Map	Real estate property data. xlsx + Google_Places_API.Rmd
Business and Investment Climate	Ease of doing business	no	Direct data and calculation from World Bank	World Bank	https://www.doingbusiness.org/content/dam/doingBusiness/country/m/maldives/MDV.pdf	
Environmental sustainability	Pollution	UV Aerosol Index from 380 and 340 nm	no	Direct data and calculation from Sentinel Hub	Sentinel Hub	https://apps.sentinel-hub.com/eo-browser/
		CO (carbon monoxide) in mol per square meter	no	Direct data and calculation from Sentinel Hub	Sentinel Hub	https://apps.sentinel-hub.com/eo-browser/
		NO2 in mol per square meter	no	Direct data and calculation from Sentinel Hub	Sentinel Hub	https://apps.sentinel-hub.com/eo-browser/
		O3 in mol per square meter	no	Direct data and calculation from Sentinel Hub	Sentinel Hub	https://apps.sentinel-hub.com/eo-browser/
		SO2 in mol per square meter	no	Direct data and calculation from Sentinel Hub	Sentinel Hub	https://apps.sentinel-hub.com/eo-browser/
	Hygiene and Circular Economy	Daily plastic waste generated in kilogram per capita	yes	Average daily plastic waste generated / Total population in Hulhumalé	WAMCO	HMTS-112022-042023.xlsx
		Daily non-recycled municipal solid waste in kilogram per capita	yes	Average daily non-recycled municipal solid waste / Total population in Hulhumalé	WAMCO	HMTS-112022-042023.xlsx
Technology and innovation	Technology Infrastructure and Services	Proportion of individuals using internet	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd
		Proportion of individuals who own mobile phones individually	yes	Refer to calculation using HIES data	HIES	Liveabilityindicator_data processing.Rmd

ANNEX 2

CITIZEN PERCEPTION SURVEY



Perception Survey - Hulhumalé

We would like to invite residents, employees, business owners and / or property owners in Hulhumalé to complete this survey, which will take no more than 10 minutes of your time. Your dedicated time and valuable responses are greatly appreciated.

You are receiving this survey on behalf of HDC and UNDP Maldives to better understand the liveability conditions in Hulhumalé city. This survey is carried out under HDC and UNDP's ongoing initiative on developing a localized Liveability Index for Hulhumalé. The responses that you provide in this survey will help prioritize HDC's planning efforts and investments. All responses will be considered confidential. The survey is targeted for the 18+ age category. When completing the survey, please keep in mind that all questions are regarding the conditions within Hulhumalé and not of any other location(s).

Which of the following categories best describe you? [Please check all boxes that apply]

Live in Hulhumalé

Currently employed in Hulhumalé

Business Owner or Operator in Hulhumalé

Residential Property Owner in Hulhumalé

Commercial Property Owner in Hulhumalé

None of the above

How long have you been living in Hulhumalé? (in years)

[Put 1 for under 1 year]

How long have you been employed in Hulhumalé? (in years)

[Put 1 for under 1 year]

How long have you been a business owner or operator in Hulhumalé? (in years)

[Put 1 for under 1 year]

How long have you been a residential property owner in Hulhumalé? (in years)

[Put 1 for under 1 year]

How long have you been a commercial property owner in Hulhumalé? (in years)

[Put 1 for under 1 year]

Age

Gender

 Male Female

Physical disabilities

 Mobility Vision Vision Speech Hearing None of the above

Your living situation

 Live with family Living alone Live with roommates

Employment status

 Employed Unemployed

Annual household income

 under MVR 220,000 MVR 220,001 - MVR 500,000 MVR 500,001 - MVR 1,000,000 Over MVR 1,000,000

Highest level of education

 Primary education and below Secondary & higher secondary education Tertiary education No formal education

Type of accommodation

 Live in social housing Live in private housing

How many people live in your residence?

How would you rate the condition/quality of the following services/facilities in and around your place of residence/work or owned property in Hulhumalé?

Roads



Street Lighting



24 hr Electricity



Unfiltered Tap Water



Public Toilets



Mobile Service Quality



Motorcycle Parking Facilities



Car Parking Facilities



How would you rank the following in terms of your total household expenses?

Highest expenditure

- Rent
- Utility
- Food
- Medical

Second Highest expenditure

- Rent
- Utility
- Food
- Medical

Third Highest expenditure

- Rent
- Utility
- Food
- Medical

Of the following, what are your top modes of travel within and around Hulhumalé?

1st Choice

- Walking
- Motorcycle
- Bicycle
- Personal Car
- Taxi or rideshare car
- Public bus
- Ferry

2nd Choice

- Walking
- Motorcycle
- Bicycle
- Personal Car
- Taxi or rideshare car
- Public bus
- Ferry

3rd Choice

- Walking
- Motorcycle
- Bicycle
- Personal Car
- Taxi or rideshare car
- Public bus
- Ferry

How would you rate the condition/quality of the following services/facilities regarding transportation in Hulhumalé?

Availability of bus stops near your place of residence / work / business



Timeliness of Public Bus Transportation



Ease of Use of Public Bus Transportation



Availability of Taxi or Rideshare Service



Condition of Sidewalks



Availability of Shaded Sidewalks



Do you agree that you receive frequent information concerning ongoing public projects in Hulhumalé, and their associated budgets and progress?

1 2 3 4 5

Strongly Disagree Somewhat Disagree Not Sure Somewhat Agree Strongly Agree

Of the following, what types of public events in Hulhumalé are you most interested in?

1st choice

- Festivals and holidays
- Educational and Healthcare
- Disability awareness and inclusion Expos and city development projects
- Disaster Awareness
- Arts and Sports
- Events for children

2nd choice

Festivals and holidays

Educational and Healthcare

Disability awareness and inclusion Expos and city development projects

Disaster Awareness

Arts and Sports

Events for children

3rd choice

Festivals and holidays

Educational and Healthcare

Disability awareness and inclusion Expos and city development projects

Disaster Awareness

Arts and Sports

Events for children

Do you use online access to government/utility services?

E.g. Paying utility bills, taxes, fees, applying for ID card and passport, requesting services, and lodging complaints

Always

Most of the times

Sometimes

Rarely

Never

How would you rate the condition/quality of the following services/facilities in Hulhumalé?

Coverage of Government services available online



Ease of use of online government services



Physical Service Centers in Hulhumalé to Access Government Services



Have you used the HDC mobile app or website?

 Yes No

Do you agree that Hulhumalé is a safe city with low rates of crime?

 1 2 3 4 5

Strongly Disagree Somewhat Disagree Not Sure Somewhat Agree Strongly Agree

How would you rate the following aspects of public safety and accessibility in Hulhumalé?

Safety for Women, Children and Elders



Safe roads and traffic lights



Disability friendly pedestrian crossings and sidewalks



Adequate lighting and CCTVs in public spaces



Disability friendly buildings and public spaces



How would you rate the following aspects of the education system in Hulhumalé?

Proximity of schools,
educational institutions to
residential areas



Variety of schools /
institutions catering to
different education levels



Overall quality of
education system in
Hulhumalé



For healthcare needs in Hulhumalé, do you primarily go to...

Government hospitals and clinics

Private hospitals and clinics

How would you rate the following aspects of the healthcare system in Hulhumalé?

Availability of treatment



Ease of access to pharmacies



Availability of medication



Besides any qualifying government assistance, which of the following support do you receive from community groups?

Financial assistance

Educational assistance

Jobs and skills training support

Elderly support

Childcare support

None of the above

Are you currently seeking job opportunities?

Yes

No

How would you rate the following aspects within and around Hulhumalé?

Current availability of jobs in Hulhumalé matching your skills



Salary and benefits offered in Hulhumalé



Ease of accessing job locations in Hulhumalé



Workplace safety in Hulhumalé



Access to banks in Hulhumalé



Access to ATMs in Hulhumalé



Access to food and produce stores in Hulhumalé



Variety of retail stores in Hulhumalé



Variety of restaurants and cafés in Hulhumalé



How would you rate the following regarding the business climate in Hulhumalé?

Clear explanation of processes by HDC to start business



Timeliness of HDC and other government approvals to start business or own property



Ease of starting a business



Support provided by HDC to facilitate processes



How would you rate the following regarding the investment climate in Hulhumalé?

Recent growth in investment activity



Your eagerness to buy more property



Your eagerness to start a new/ another business



Ease of connecting with investors



Interest from people you may know to invest or start business in Hulhumalé



How would you rate the following environmental aspects of Hulhumalé?

Beach & harbour water pollution

- Not noticeable
- Noticeable
- Very noticeable
- Concerningly noticeable

Noise pollution from traffic and construction

- Not noticeable
- Noticeable
- Very noticeable
- Concerningly noticeable

Unclean parks and sidewalks

- Not noticeable
- Noticeable
- Very noticeable
- Concerningly noticeable

Air pollution, including dust from construction sites

- Not noticeable
- Noticeable
- Very noticeable
- Concerningly noticeable

How would you rate the following aspects regarding waste management in Hulhumalé?

Identifiable garbage collection areas at your residence or place of work



Frequency of waste pickup at your residence or place of work



Are there solar panels on your building?

- Yes
- No
- Don't Know

Do you agree that there is an urgent need to adopt alternative energy sources like solar energy?

1 2 3 4 5

Strongly Disagree Somewhat Disagree Not Sure Somewhat Agree Strongly Agree

Alternative energy sources will reduce environmental pollution?

1 2 3 4 5

Strongly Disagree Somewhat Disagree Not Sure Somewhat Agree Strongly Agree

Alternative energy sources will reduce energy costs?

1 2 3 4 5

Strongly Disagree Somewhat Disagree Not Sure Somewhat Agree Strongly Agree

With regards to disaster (natural/ human-made) preparedness and climate change, please answer the following

You are knowledgeable on these issues

1 2 3 4 5

Strongly Disagree Somewhat Disagree Not Sure Somewhat Agree Strongly Agree

Public outreach and information shared by the Government to raise disaster awareness, including location, availability, and accessibility of crisis facilities, has been high

1 2 3 4 5

Strongly Disagree Somewhat Disagree Not Sure Somewhat Agree Strongly Agree

Types of disasters facing Hulhumalé have been clearly identified and communicated to you by the government

1 2 3 4 5

Strongly Disagree Somewhat Disagree Not Sure Somewhat Agree Strongly Agree

Do you work in a technology-related field?

Yes

No

Graduate or student in a science, engineering, or technology specialization?

Yes

No

How would you rate the current conditions for innovation and technology in Hulhumalé?

Availability of local pool of technology workers

★ ★ ★ ★ ★

Start-up funding

★ ★ ★ ★ ★

Business development support

★ ★ ★ ★ ★

Access to technology events/expos

★ ★ ★ ★ ★

What are the main reasons for you to use the internet?

1st choice

Work

Education and News

Online commercial services (food delivery, retail, ride share...etc.)

Online government services Entertainment or communication

Don't use internet

2nd choice

Work

Education and News

Online commercial services (food delivery, retail, ride share...etc.)

Online government services Entertainment or communication

Don't use internet

3rd choice

Work

Education and News

Online commercial services (food delivery, retail, ride share...etc.)

Online government services Entertainment or communication

Don't use internet

Have you heard of the term 'Smart Cities'?

Yes

No

"A smart city leverages a suite of technologies for connectivity and data analysis to improve the efficiency and delivery of city services and infrastructure performance for its residents."

**What should a Smart City Programme for Hulhumalé prioritize?
Identify your 3 top priorities**

1st choice

- Simplify Citizen Services
- Transportation Solutions
- Waste Management Solutions
- Street lighting
- Emergency Services
- Parking Services

2nd choice

- Simplify Citizen Services
- Transportation Solutions
- Waste Management Solutions
- Street lighting
- Emergency Services
- Parking Services

3rd choice

- Simplify Citizen Services
- Transportation Solutions
- Waste Management Solutions
- Street lighting
- Emergency Services
- Parking Services

Are there any comments or suggestion you would like to share with us?

Thank you for taking part in this survey!

United Nations Development Programme

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Boduthakurufaanu Magu
Malé 20094, Maldives.

www.undp.org/maldives

Housing Development Corporation

HDC Building, Ground Floor
Hulhumalé 23000, Maldives.

www.hdc.mv