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ISSAM FARES INSTITUTE FOR PUBLIC
POLICY & INTERNATIONAL AFFAIRS
معهد عصام فارس للسياسات العامة
والشؤون الدولية



CLIMATE CHANGE AND ENVIRONMENT PROGRAM

Climate Change Vulnerability Policy Tool for Coastal Cities

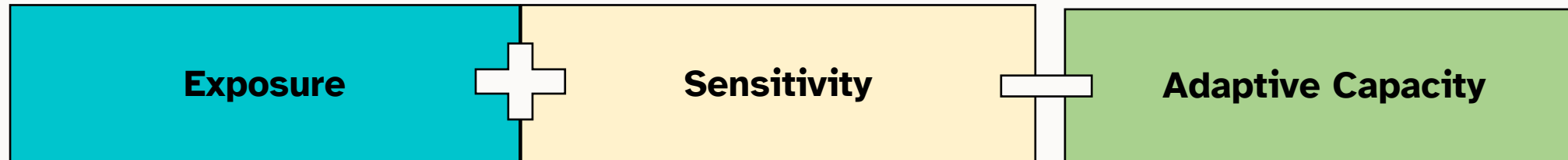
Cloud-based vulnerability assessment
and decision support tool for coastal
municipalities in Lebanon

Technology/AI Session
12th Sustainable Cities Conference
Amman, Jordan

Defining Vulnerability

Vulnerability is ‘the degree to which a system is **susceptible to and unable to cope with adverse effects of climate change**, including climate variability and extremes’.

It is a function of the **character, magnitude, and rate** of climate change and variation to which a system is **exposed**, the **sensitivity** and **adaptive capacity** of that system’.



The nature and degree to which a system is exposed to significant climatic variations.

The degree to which a system is affected, either adversely or beneficially, by climate-related stimuli.

The ability of a system to **adjust** to climate change, to **moderate** potential damages, to **take advantage** of opportunities, or to **cope** with the consequences

e.g.

Changes in temperature
Changes in precipitation
Number of hot days
Extreme weather events

Proximity to shore
Green cover
Income level
Age of infrastructure
Biodiversity

Disaster planning
Access to knowledge
Insurance plans
Livelihood diversity
Protected areas

Vulnerability of the Lebanese Coast

Exposure

Up to **1.7°C** rise in temperature
 Up to **11%** decrease in precipitation
 Increase in the frequency of **heat waves**
 Decrease in frost days
30-60cm rise in sea level by 2100

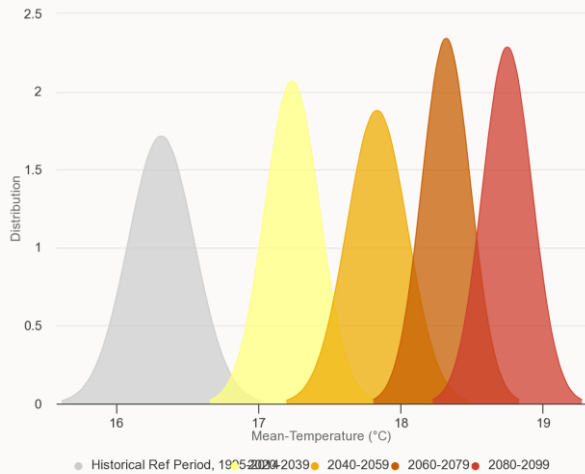
Sensitivity

90% of population resides in coastal urban centers
 Poor or **aging infrastructure**
 Majority of the country's **industrial, commercial** and **financial activity**
41% agricultural areas and **19%** natural areas

Adaptive Capacity

Poor governance or lack of enforcement of city planning or coastal zone management
 Resource **mismanagement**
Lack of national and regional disaster risk management

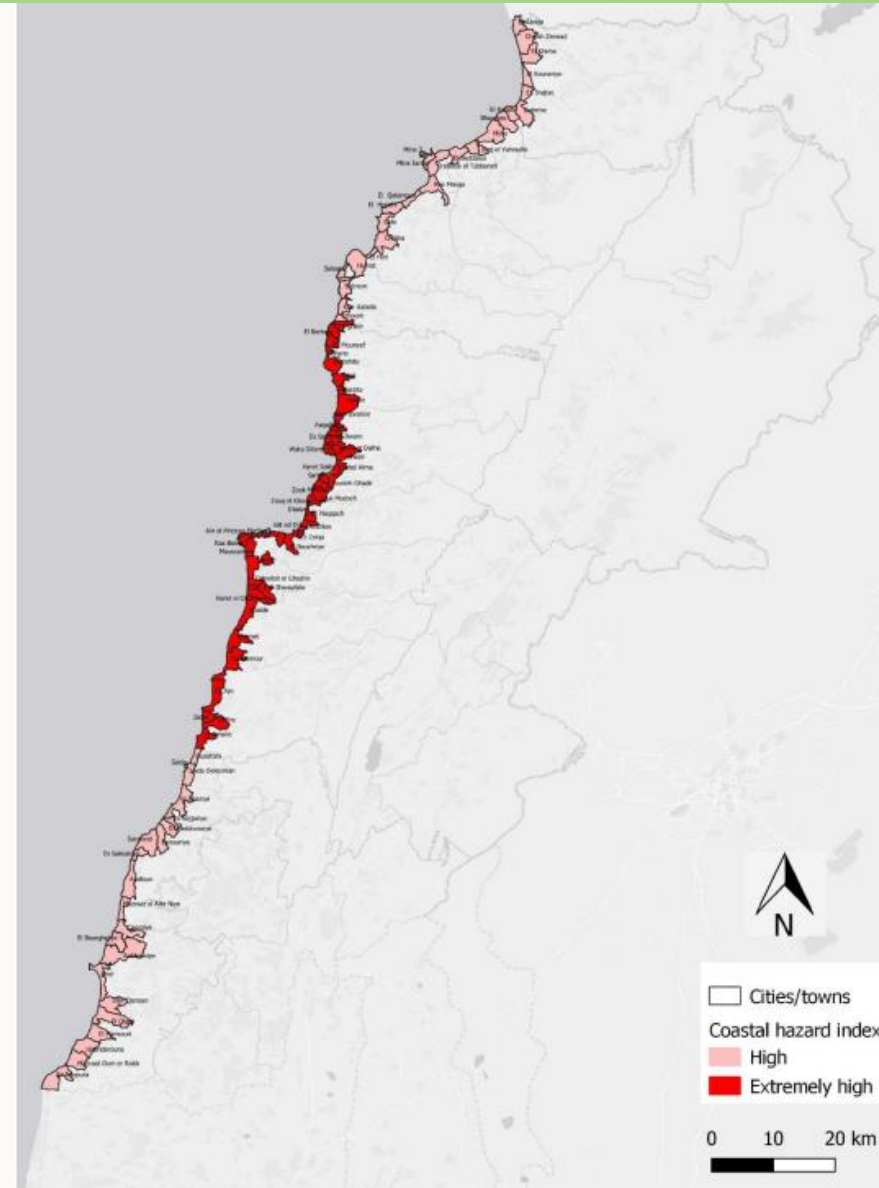
Projected Change in Distribution, Mean-Temperature, SSP2-4.5 Lebanon, Multi-model Ensemble



Source: World Bank

National Assessment of Disaster Risk Management of Coastal Climate Hazards (AUB-IFI and IUCN, 2021)

Components	Score / 5.0
Governance	2.3
Economy and Society	2.5
Coastal Resource Management	2.3
Structural Design and Land Use	1.4
Warning and Evacuation	2.5
Emergency Response	3.2
Disaster Recovery	1.8

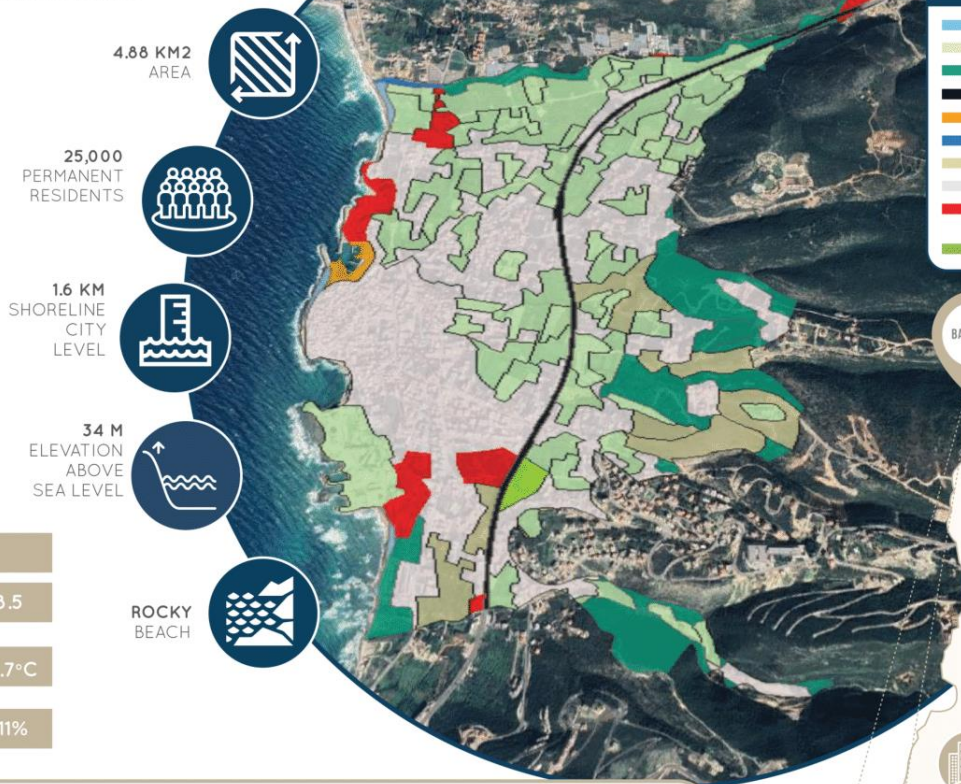


CLIMATE CHANGE RISKS & COASTAL CITIES IN LEBANON: PROFILING THE CITY OF BATROUN

CLIMATE CHANGE RISKS IN URBAN SETTINGS

- Rising Sea Levels & Storm Surges
- Extreme Precipitation
- Water Scarcity
- Inland & Coastal Flooding
- Heat Stress
- Landslides
- Drought & Increased Aridity

CLIMATE CHANGE PROJECTIONS FOR LEBANON	RCP	
	4.5	8.5
Temperatures	+1.2°C	+1.7°C
Precipitation	-4%	-11%



MAP LEGEND

- Beaches
- Agricultural Land
- Wooded Surface
- Highway
- Port
- River
- Scrubland
- Urban Fabric
- Industrial or Commercial Areas
- Green Urban Areas

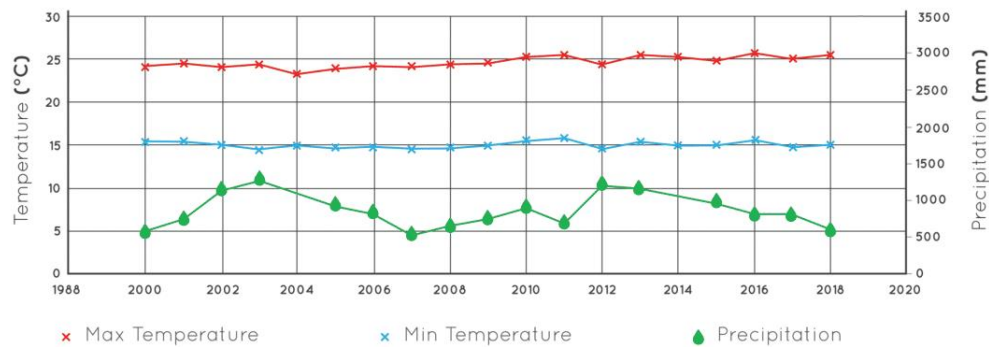
BATROUN

- WATER RESOURCES**
Nahr El Joz
- ENERGY SUPPLY**
Qadisha substation, generators during outages, 2% renewable energy on a district level
- SANITATION & DRAINAGE**
Basbina WWTP
95% of households connected to sewage system
- TRANSPORT**
Total length of international and secondary roads is 49km.
- TELECOMMUNICATION POLES**
Located above & underground.
3 Fixed fiber optic telephone links providing the city with telecom services
- HEALTH CARE & EMERGENCY SERVICES**
1 Hospital
1 Red Cross center
1 Civil defense station
1 Emergency center
1 Military infirmary
- BUILT ENVIRONMENT**
44% of the city's area is built-up area residential, commercial or industrial
30% Agricultural areas
3 Archeological/ Historical sites: Phoenician wall, Phoenician castle and the old souk
- ECOSYSTEM SERVICES**
No natural reserve areas. Vermittid reefs form an intertidal platform with a width of 170m. Macroalgae make up the highest % of these reefs.
- FISHERIES**
20 professional fishermen
1 port

Vulnerability Scores



TEMPERATURE AND PRECIPITATION TRENDS IN BATROUN (1999-2018)



Vulnerability Policy Tool

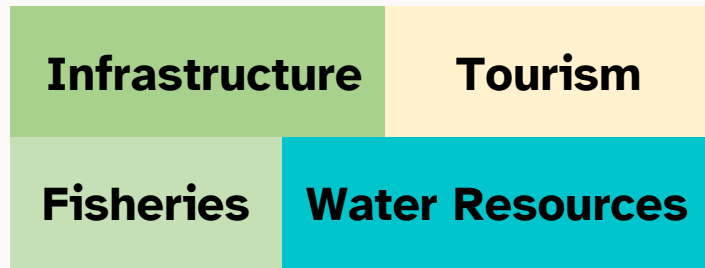
The tool aims to aid municipalities in **identifying vulnerabilities** related to climate and environmental changes and **opportunities for resilience building** or climate action

123

coastal municipalities

136

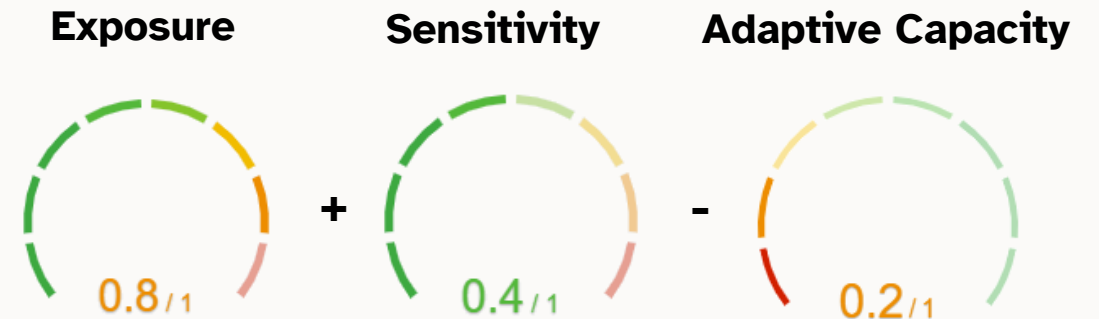
indicators for assessment



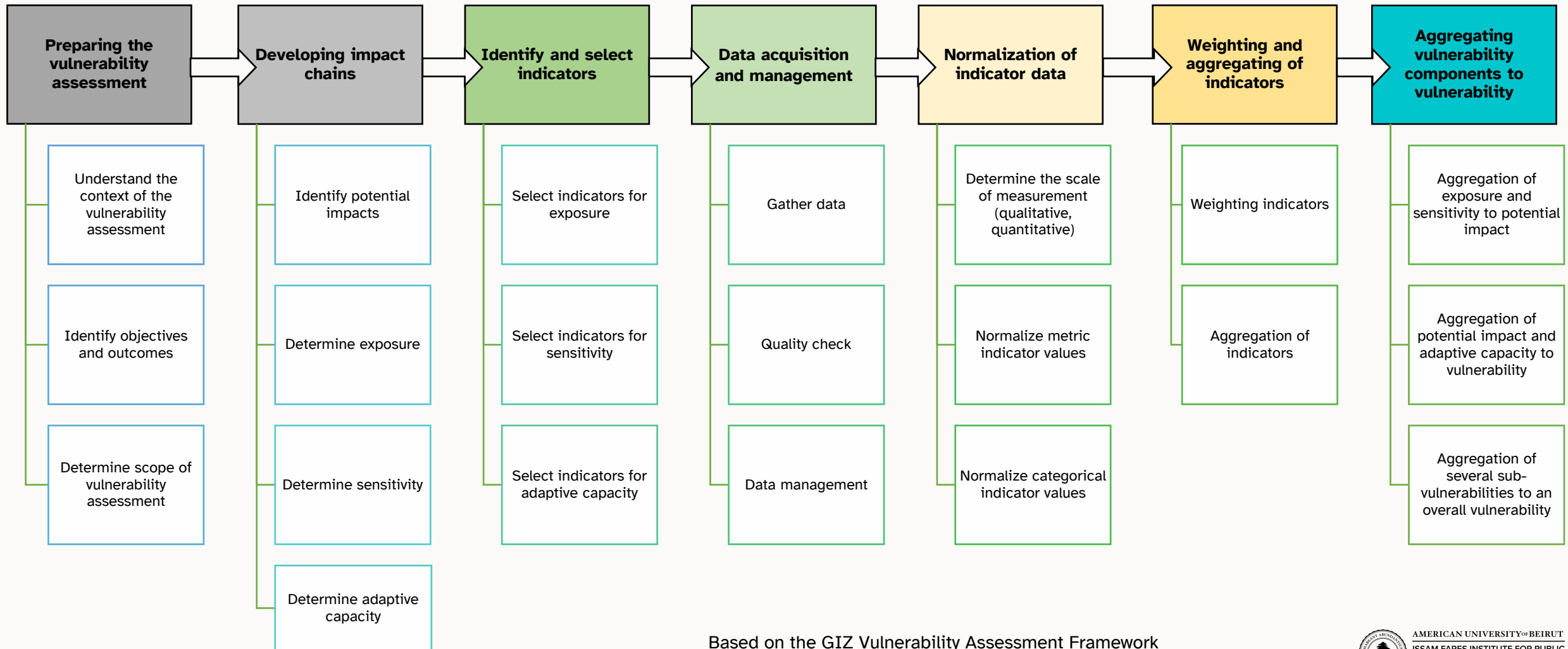
across four vital coastal sectors

Each indicator is compared against a **benchmark** derived from background research. Benchmarking results in a **normalized score** between **0 and 1** for each component which is then averaged and composited into a component score.

be



Vulnerability Assessment Process

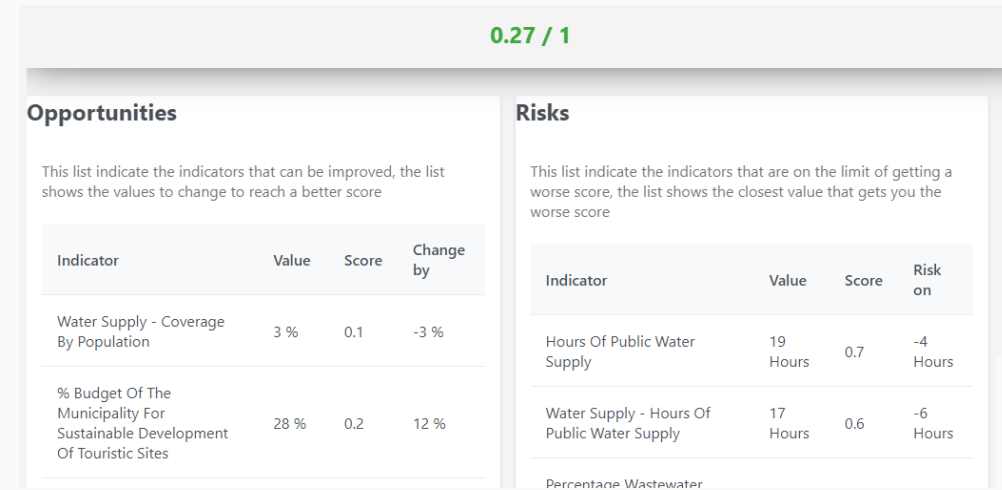
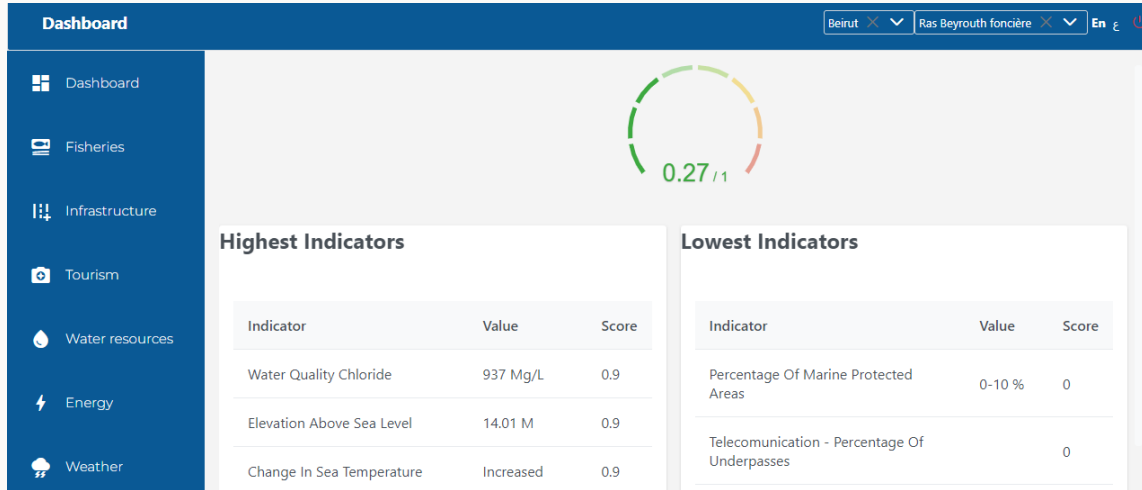


Based on the GIZ Vulnerability Assessment Framework

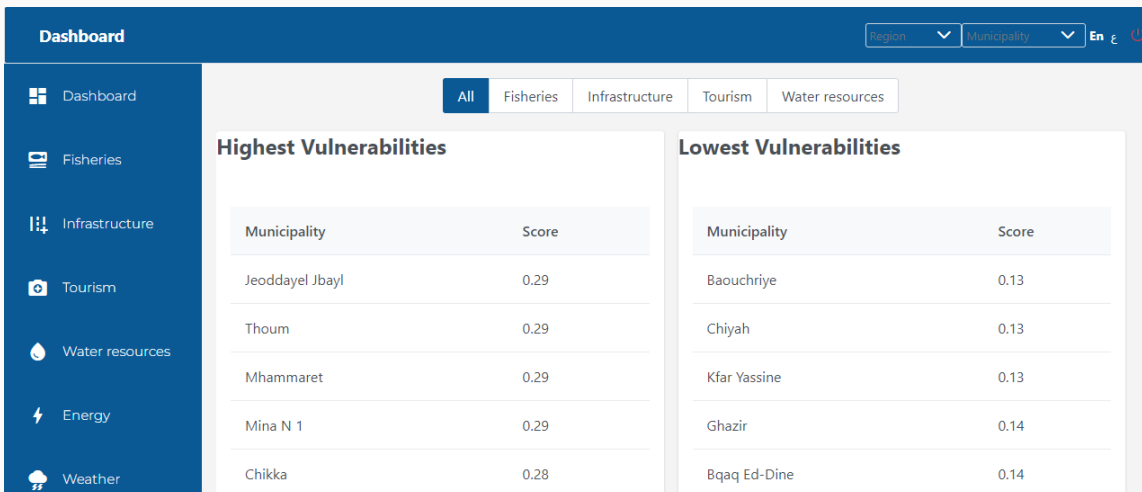
Vulnerability Policy Tool

Administrator Page

Municipality Dashboard



General Dashboard



Automated municipality-specific recommendations presented as risks and opportunities; quantifying action needed to achieve the closest favorable benchmark

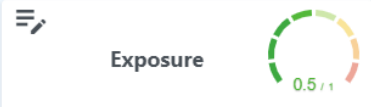
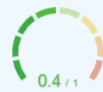
Vulnerability Policy Tool

Admin Sector Component Tabs

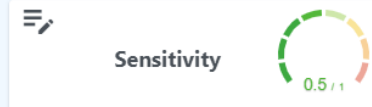
in English

بالعربية

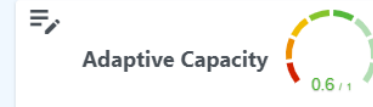
Fishing Infrastructure



Extreme Precipitation Events	9.30 Mm/Day
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Opening Of The Port To The Sea	North
Construction Material Of The Port	Concrete
Protection Of The Port	Absence
Fishing Distance From The Shore	Totally Complying
Depth Of Fishing	Partially Complying
Average Age Of Vessels	0-5 Years
Average Size/Length Of Vessel	0-6 Meters

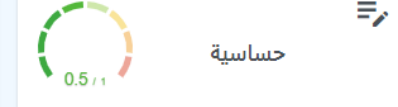


Wave Recorders Installed Along Coastal Areas	Absence
Climate Change Vulnerability Maps Of Coastal Zone Developed	Absence
Education Level Of The Fishermen	Partially Complying
Average Age Of The Fishermen	15-24 Year
Ease Of Access To And Knowledge About Insurance Plans	Absence
Insurance Coverage	Absence

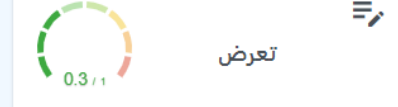


% 98.00	المشاريع المالية لأنشطة تغير المناخ (%)
Upon Request	وتيرة صيانة وإعادة تأهيل المواقع السياحية / الأثرية
غياب	خطة الإدارة المتكاملة للمناطق الساحلية (نعم / لا)
حضور	تعميم تأثيرات تغير المناخ في الخطط الحضرية / الرئيسية / المحلية
حضور	خطة إدارة الطوارئ (إدارة الحقوق الرقمية والتأمين وما إلى ذلك)
حضور	نقابات المناطق السياحية

التأثير التشغيلي



14.01 م	الارتفاع فوق مستوى سطح البحر
حضور	الحماية (مدى كسر المياه)
8.44 أمتار	القرب من الشاطئ



C° 0.01	تغير في درجات الحرارة السنوية
C° 21.82	متوسط درجة الحرارة الشهرية
7.00 أيام	عدد الأيام الحارة
0.00 مم / الشهر	عدد فيضانات المدن خلال الصيف (هطول الأمطار فوق 20 مم)
9.30 مم / الشهر	أحداث هطول الأمطار الشديدة

Vulnerability Policy Tool

User editing capabilities

Percentage of treated wastewater for reuse

As part of efficiency measures, reusing wastewater will increase the adaptive capacity of the city, since there will be more freshwater available to flow and to be consumed by the citizens.

18.0 %

0-20 (0.1)
21-40 (0.3)
41-60 (0.5)
61-80 (0.7)
81-100 (0.9)

save

ميزانية البلدية للتنمية المستدامة للمواقع السياحية %

من المهم تخصيص ميزانية لتطوير المواقع السياحية. سيؤدي ذلك إلى زيادة القدرة التكيفية للقطاع لأنه سينظم بطريقة مناسبة. هي النسبة المئوية المخصصة في ميزانية البلدية للتنمية المستدامة للمواقع السياحية من إجمالي ميزانية البلدية

21.0 %

(0.1) 0-20
(0.3) 21-40
(0.5) 41-60
(0.7) 61-80
(0.9) 81-100

save

Vulnerability Policy Tool

Components of Fish Catch Variability within the Fisheries Sector

Components	Indicators	Scale	Data Type	Historical data	Who enters the data	Who changes the data	Who can Overwrite data
Exposure	Change in annual temperature	Regional	Quantitative	Yes	FES	FES	FES
	Mean monthly temperature						
	Number of hot days						
	Mean monthly precipitation change in annual precipitation						
Sensitivity	Water quality (chemical and bacteriological)	Local	Qualitative	No	Municipality	Municipality	Municipality
	Acidification of marine water change in sea temperature	Regional	Qualitative	No	FES	FES	FES
	change in annual average fish catch (as a result of temperature change)						FES and Municipality
	Climate sensitive species from the catch						FES and Municipality
	shore erosion level	Local	Qualitative	No	FES	FES	FES
	% area constructed in coastal zone	Local	Quantitative Continuous	No			FES
Adaptive Capacity	Percentage of marine protected areas	Local	Quantitative Binned	No			FES
	Years of fishing experience	Regional	Quantitative Binned	No			FES
	Type of water treatment (1ry, 2ry, 3ry)	Local	Qualitative	No	Municipality	Municipality	Municipality
	Percentage wastewater treatment coverage	Local	Quantitative Binned	No			
	Sand conservation measures	Local					
	mainstreaming of Climate Change impacts in urban/master/local plans	Local	Qualitative	No	Municipality	Municipality	Municipality
	Fishing laws and regulations						
	integrated coastal zone management plan						

Data Management

The host (**FES**) acts as an **administrator** and **data custodian**

Indicator data, backend calculations and benchmarks were **collated, prepared** and **integrated** by AUB-IFI

Users (municipalities, donors, organizations..) request access to the tool by setting up a verifiable account

Users can only overwrite values of certain indicators specific to their jurisdictions

Energy Policy Tool

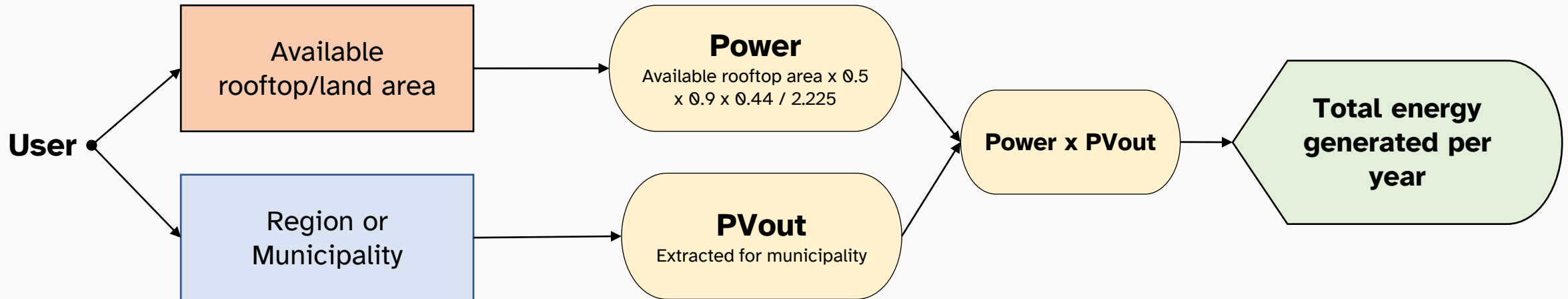
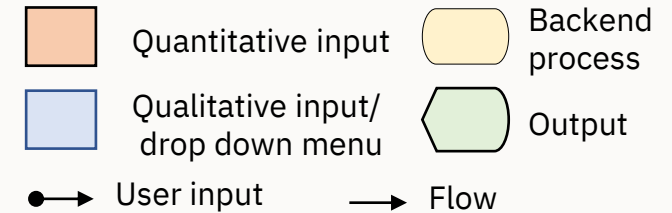
Energy Indicators: Solar Potential



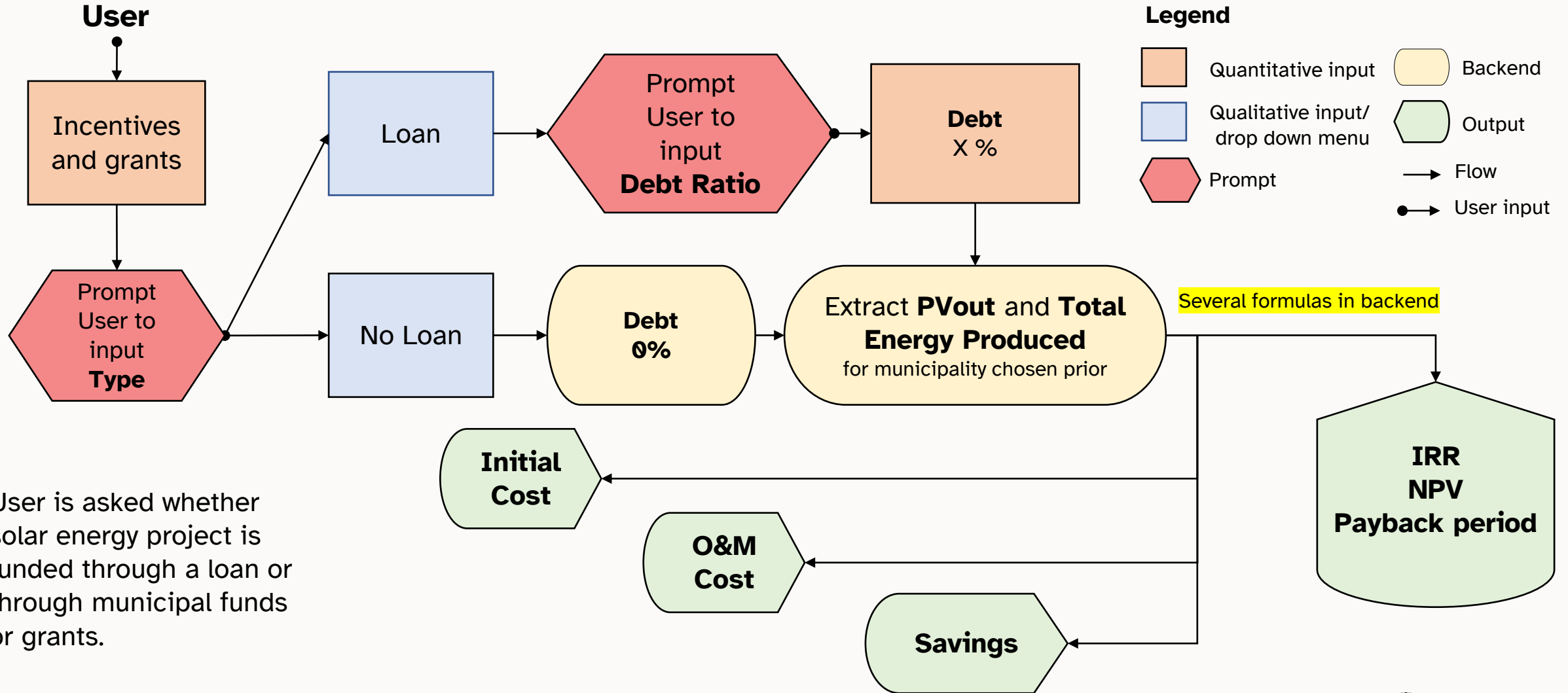
User alerted of the following requirements:

- Area cannot include agricultural land
- Area should include flat or slightly inclined land
- Area would preferably include public or municipal land

Legend



Energy Policy Tool



User is asked whether solar energy project is funded through a loan or through municipal funds or grants.

Economic Indicators: Feasibility

Outcomes

Tool still undergoing testing and piloting

Upon launch, the tool will allow local authorities to understand the vulnerabilities within their jurisdiction, and manage their data independently

The tools will aid municipalities and funding agencies in **targeting investments** in resilience building or solar energy production

Once populated, the tool can showcase periodic snapshots of vulnerability of cities along the coast that takes into account **socioeconomic variables** and **municipal investments**

Opportunities

This list indicate the indicators that can be improved, the list shows the values to change to reach a better score

Indicator	Value	Score	Change by
% Budget Of The Municipality For Sustainable Development Of Touristic Sites	31 %	0.2	9 %
Financial Projects For Climate Change Activities (%)	30 %	0.2	10 %

Example from Aadloun, Saida

Challenges

Data scarcity and scale of climatic and spatial data

Data verification and quality assurance

Mainstreaming assessments in municipal planning

Continuity of platform hosting and updates

Upscaling and diversifying sectors examined

Opportunities

Integration of machine learning/ AI in analysis of outputs (esp. Risks and Opportunities tabs)

Sensitivity analysis to determine most relevant indicators in-context

Expansion inland into mountainous and rural areas

Coordination and cooperation among municipalities and between municipalities and central government in disaster planning and resilience building

Thank you!

CLIMATE CHANGE AND ENVIRONMENT PROGRAM

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