Interreg NEXT Black Sea Basin

Co-funded by the European Union

BLUE GATES

Viktor Yarovyi

The Digital Tide: Blockchain and Smart Ports Driving the Black Sea Blue Economy

Workshop
Presentation, 2023

The Digital Tide: Blockchain and Smart Ports Driving the Black Sea Blue Economy

When the cargo growth forecast becomes too real😂🎁🎁🎁

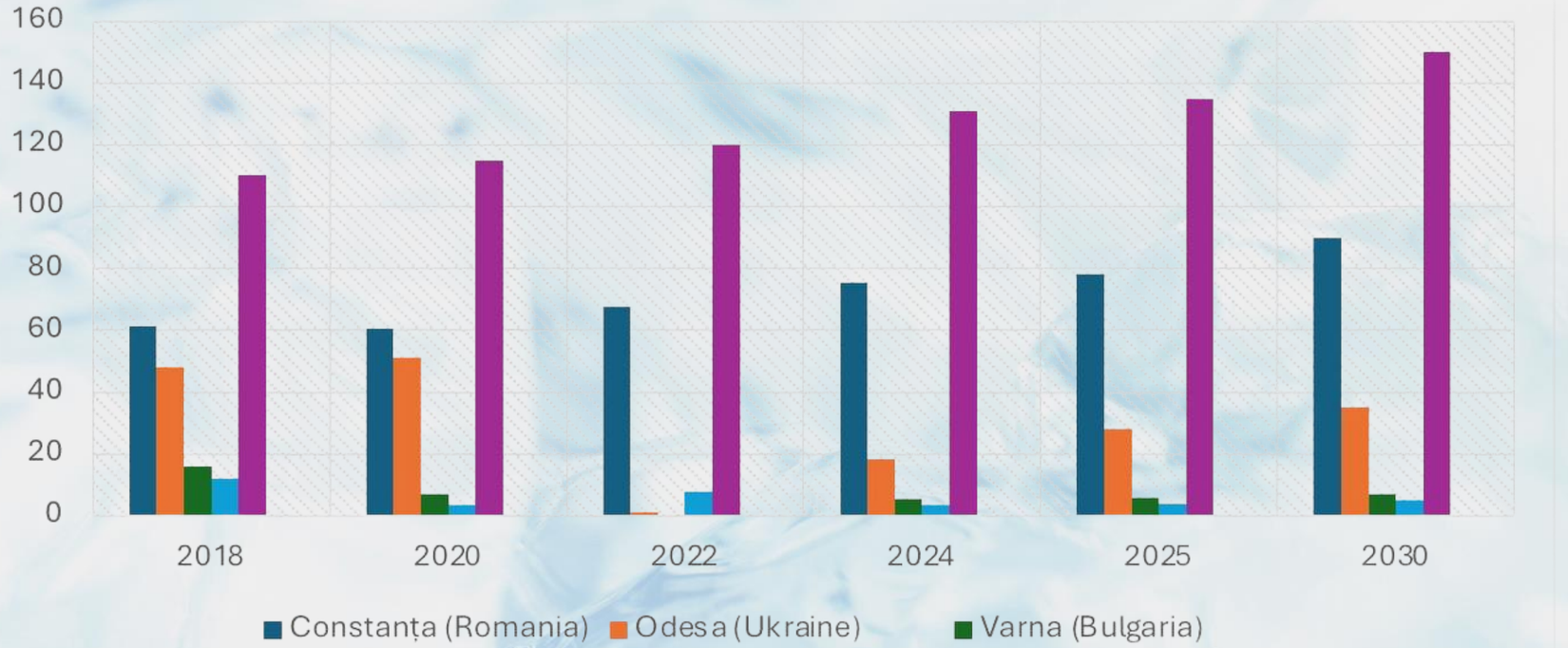
According to the European Maritime Safety Agency, Black Sea ports handled over 480 million tons of cargo in 2024, showing strong growth and digital transformation.
Smart technologies and blockchain are making ports faster, greener, and smarter. ⚓💻

Interreg NEXT Black Sea Basin

Co-funded by the European Union

BLUE GATES

CARGO THROUGHPUT DYNAMICS OF THE MAIN BLACK SEA PORTS (2018-2030)



Cargo throughput trends of the main Black sea ports (Constat, Odesa, Varna, Batumi, and Novorossiysk) from 2018 to 2025, with a forecast up to 2030. The upward trend reflects improved infrastructure, diversification of trade routes, and regional resilience after 2022

BLUE ECONOMY - MAKING WAVES IN TRADE!

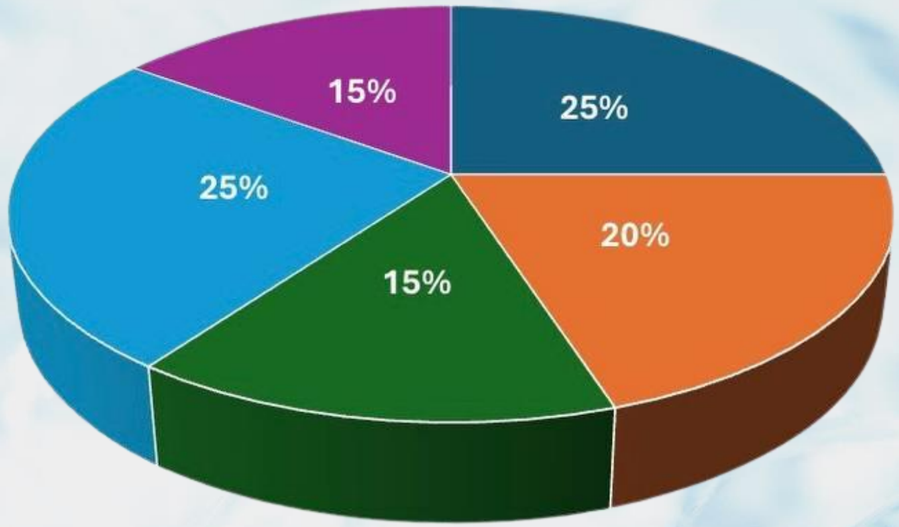
CARGO TURNOVER DYNAMICS FOR 2018–2030 FOR THE FIVE LARGEST PORTS

Port	2018	2025	2030	Change 2018–2025 (%)	CAGR* 2018–2025	Forecast* Growth 2025–2030 (%)	Share in Total 2025 (%)
Constanța (RO)	61.3	78.0	90.0	+27.3%	3.5%	+15.4%	28.5%
Odesa (UA)	48.0	28.0	35.0	–41.7%	–7.9%	+25.0%	10.2%
Varna (BG)	16.0	5.7	7.0	–64.4%	–13.7%	+22.8%	2.1%
Batumi (GE)	12.0	3.8	5.0	–68.3%	–14.9%	+31.6%	1.4%
Novorossiysk (RU)	110.0	135.0	150.0	+22.7%	2.9%	+11.1%	49.3%
Total (5 ports)	247.3	250.5	287.0	+1.3%	0.18%	+14.6%	100%

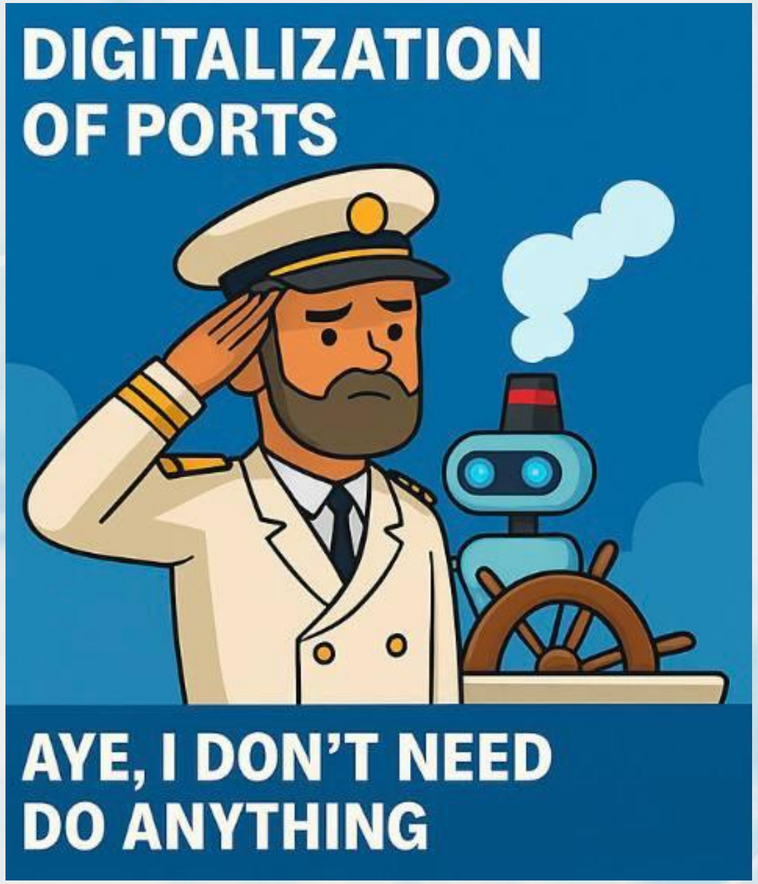
Note: a CAGR Compound Annual Growth Rate; b extrapolated based on 2025 data and the Forecast 2030 estimated growth rate

Source: Compiled by the author based on EMSA, Eurostat, and the Black Sea Commission (2018–2025).

DIGITALIZATION LEVEL IN PORT OPERATIONS (2025 FORECAST TO 2030)



- AI & Predictive Maintenance
- IoT Infrastructure
- Blockchain Document Flow
- Energy Efficiency & Smart Grids
- Digital Twin Systems

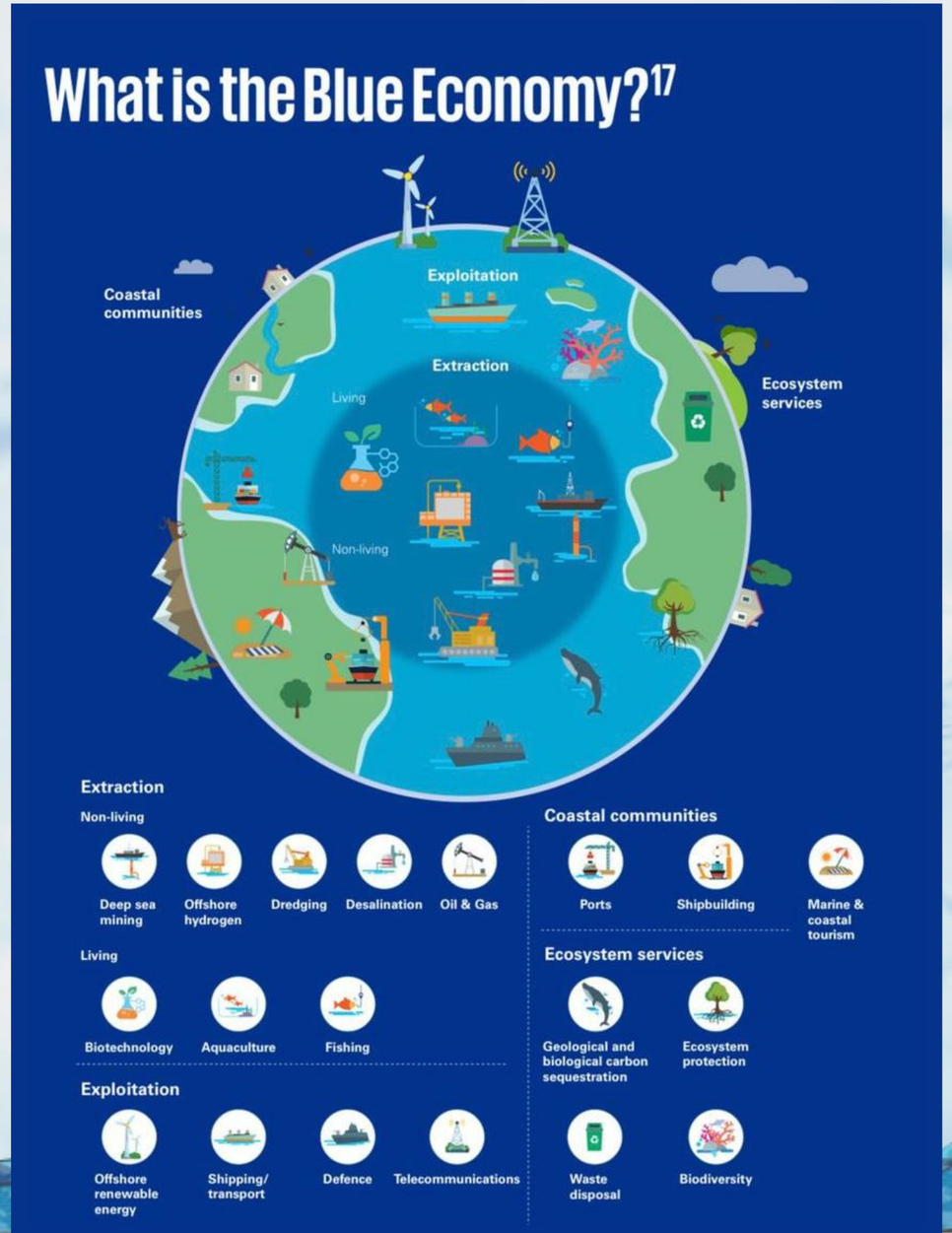


Interreg
Co-funded by the European Union
NEXT Black Sea Basin
BLUE GATES

PRACTICAL CALCULATIONS – DIGITIZATION IMPACT ON BLACK SEA PORTS

Parameter	Value	Unit	Notes
Digitalization Level Leve 2025	45%	%	Level from Fig. 2
Projected Level 2030	85%	%	Projected increase by 20⅘0
Avg. Processing Time Before	36	h	Estimated average cargo handling time
Reduction Factor (Time)	0.30		Estimated 30% time reduction at full
Berth Umulation Before	75	%	Current efficiency of berth usage
Improvement Factor	0.12		Expected increase in efficiency with AI/Io
Documents per Operation	50	pages	Estimated paperwork per cargo operation

Interreg
Co-funded by the European Union
NEXT Black Sea Basin
BLUE GATES



Blue Economy

Blue economy is a term in economics relating to the exploitation, preservation and regeneration of the marine environment. It is also used to describe the sustainable use of marine resources. It covers economic activities such as fishing, aquaculture, and tourism that depend on healthy oceans and seas but also includes new industries like biotechnology and maritime transport.

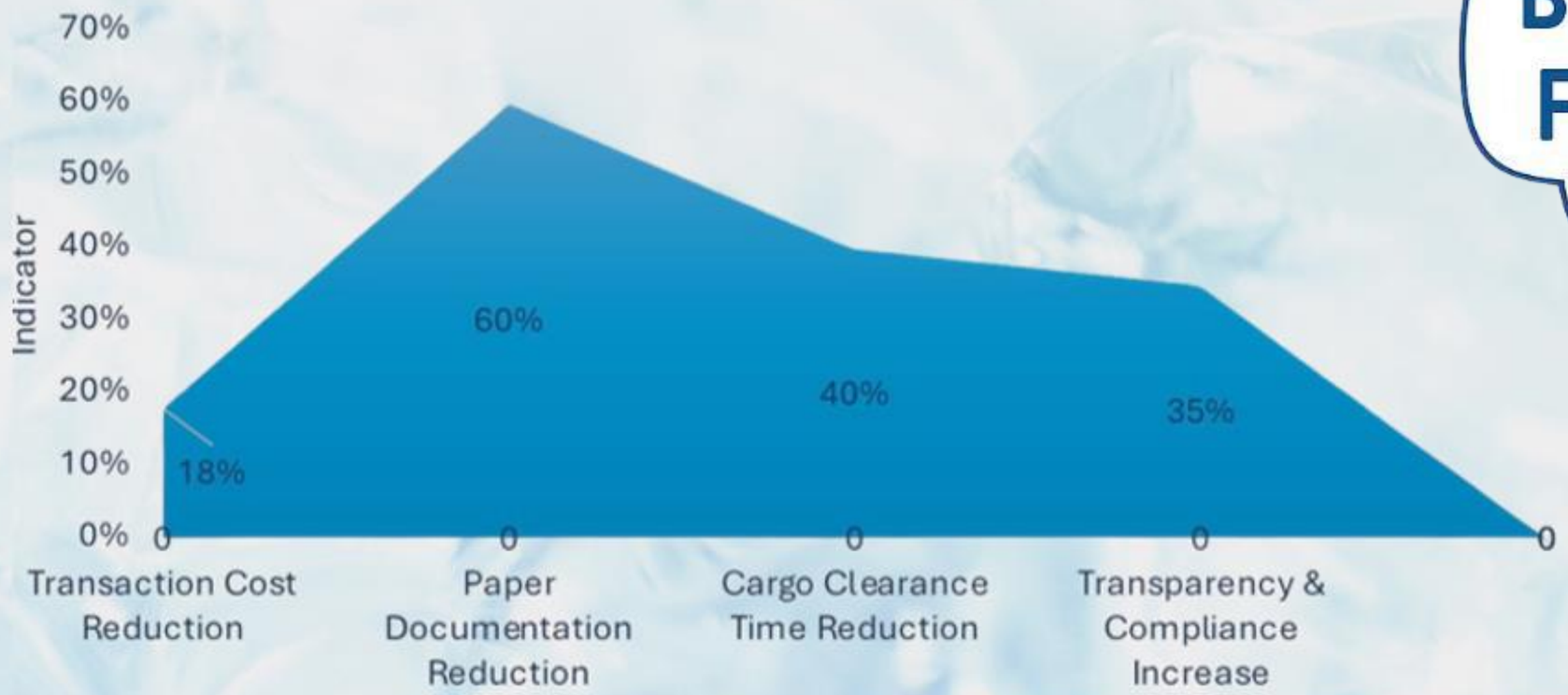
Interreg NEXT Black Sea Basin

Co-funded by the European Union

BLUE GATES

BLOCKCHAIN ADOPTION BENEFITS IN MARITIME LOGISTICS

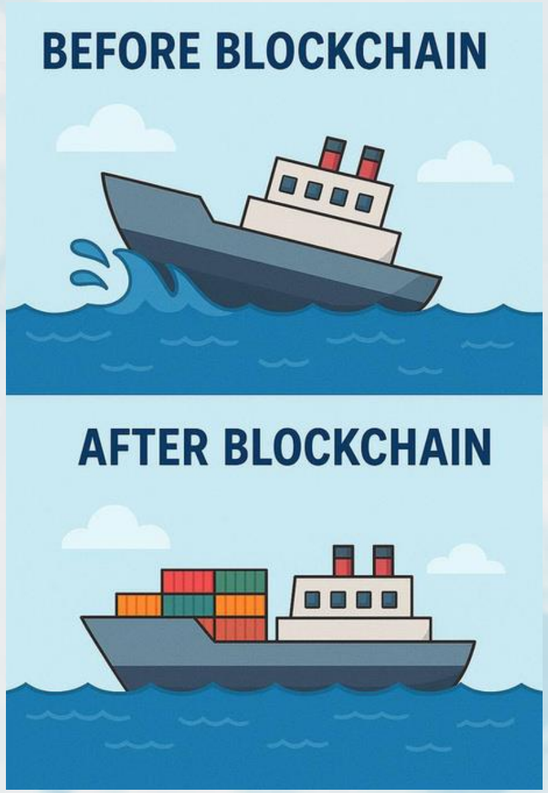
(Black Sea Region, 2025)



PRACTICAL CALCULATIONS - BLOCKCHAIN BENEFITS IN MARITIME LOGISTICS

The growing digitalization of port operations in the Black Sea region shows significant potential for increasing efficiency, reducing processing times and optimizing document flow. To illustrate the practical impact of digitalization, the following table provides example calculations demonstrating how artificial intelligence, Internet of Things and blockchain technologies can improve the productivity of seaports.

Parameter	Value	Unit	Notes
Transaction Cost Reduction	15–20%	%	Estimated reduction in logistics costs due to blockchain adoption
Paperwork Reduction	60%	%	Reduction in document handling and administrative work
Cargo Clearance Speed	+40%	%	Faster clearance through smart contracts and digital verification
Transparency & Compliance	+35%	%	Improvement in visibility and auditability of cargo flows
Avg. Cost per Transaction	$100	USD	Estimated cost per shipping transaction
Avg. Paperwork per Operation	50	pages	Number of pages per cargo operation
Avg. Time per Clearance	48	h	Time before blockchain implementation



Interreg NEXT Black Sea Basin
Co-funded by the European Union

PRACTICAL CALCULATIONS — BLOCKCHAIN BENEFITS IN MARITIME LOGISTICS

Parameter	Value	Unit	Notes
Transaction Cost Reduction	15–20%	%	Estimated reduction in logistics costs due to blockchain adoption
Paperwork Reduction	60%	%	Reduction in document handling and administrative work
Cargo Clearance Speed	+40%	%	Faster clearance through smart contracts and digital verification
Transparency & Compliance	+35%	%	Improvement in visibility and auditability of cargo flows
Avg. Cost per Transaction	$100	USD	Estimated cost per shipping transaction
Avg. Paperwork per Operation	50	pages	Number of pages per cargo operation
Avg. Time per Clearance	48	h	

1. Transaction Cost Savings

* Lower bound = 100 × 0.15 = $15 per transaction
* Upper bound = 100 × 0.20 = $20 per transaction

2. Paperwork Reduction

+ Pages saved per operation = 50 × 0.60 = 30 pages

3. Cargo Clearance Acceleration

+ New clearance time = 48 × (1 - 0.40) = 28.8 hours
+ Time saved per operation = 48 - 28.8 = 19.2 hours

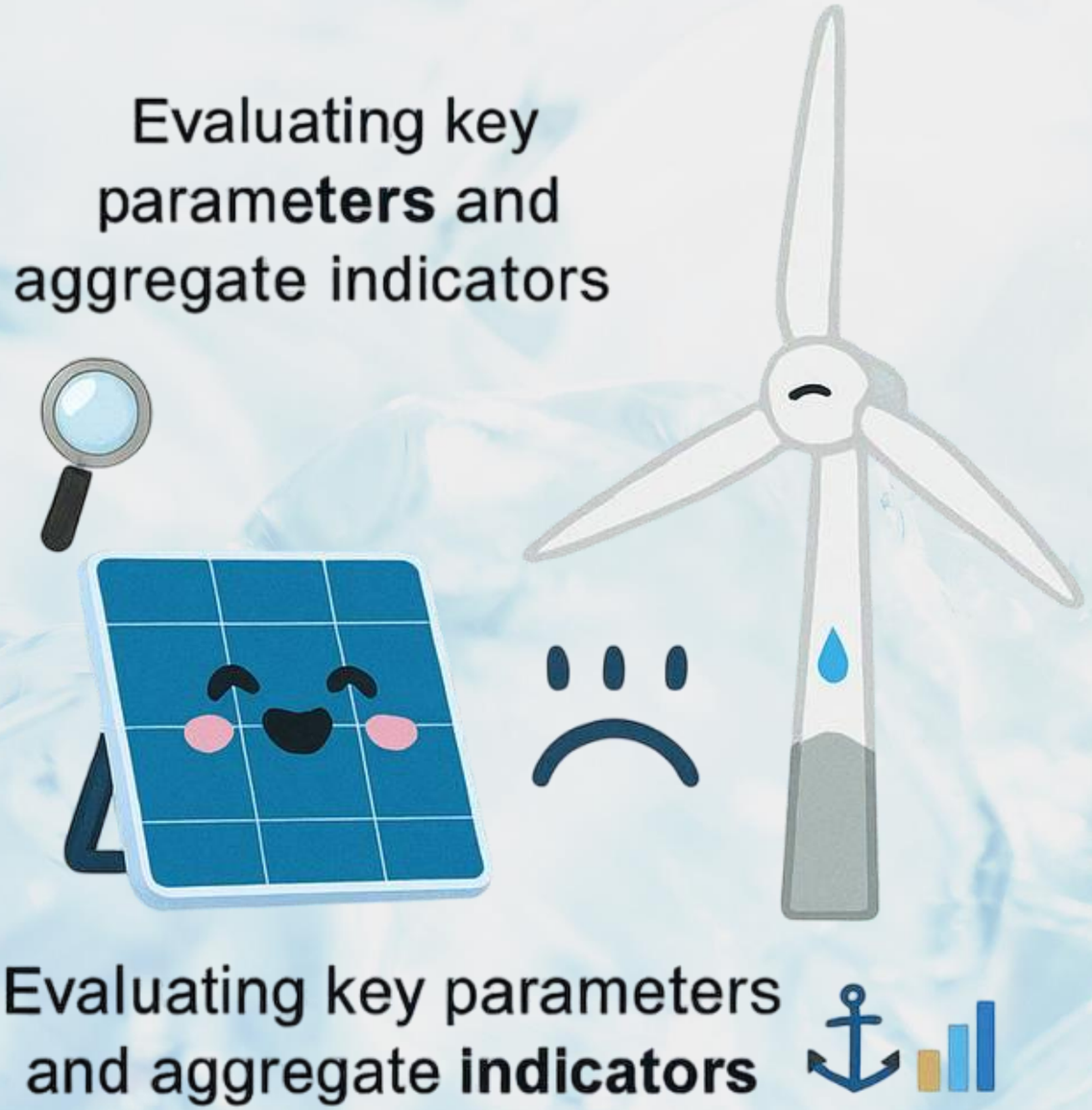
4. Transparency & Compliance Improvement

+ Qualitative improvement: +35% in visibility, reducing errors and disputes

CLASSIFICATION OF FACTORS

Interreg Co-funded by the European Union
NEXT Black Sea Basin
BLUE GATES

Tab le 1. Classification of Factors	
Climatic	Examples
Techno-economic	Wind speed (m/s); terrain openeness; solar insolation (W/m²); availability of water
Environ-onmental	Impact on wildlife; electromagnetic effects on marine life, emissions and greenhouse gas effects
Geographic	Distance from grid and fuel suppliers; minimum distance to



Interreg NEXT Black Sea Basin

Co-funded by the European Union

BLUE GATES

KEY FORMULAS

Solar panel efficiency forecast (by year of mass production T):

$$\eta_{SP}(T) = 10^{7} - 20e\,(0{,}0243\text{-}T)$$

Absolute economic effect:

(5) $$E_t = D - D_b - K$$

Replacement effect:

(6) $$E_t = D - D_b - K$$

Annual economic effect model for wind turbines (schematic):

$$E_{year_{wind}} = f(W_{WT}, C_{deliv}, C_{inst}, C_{maint})$$

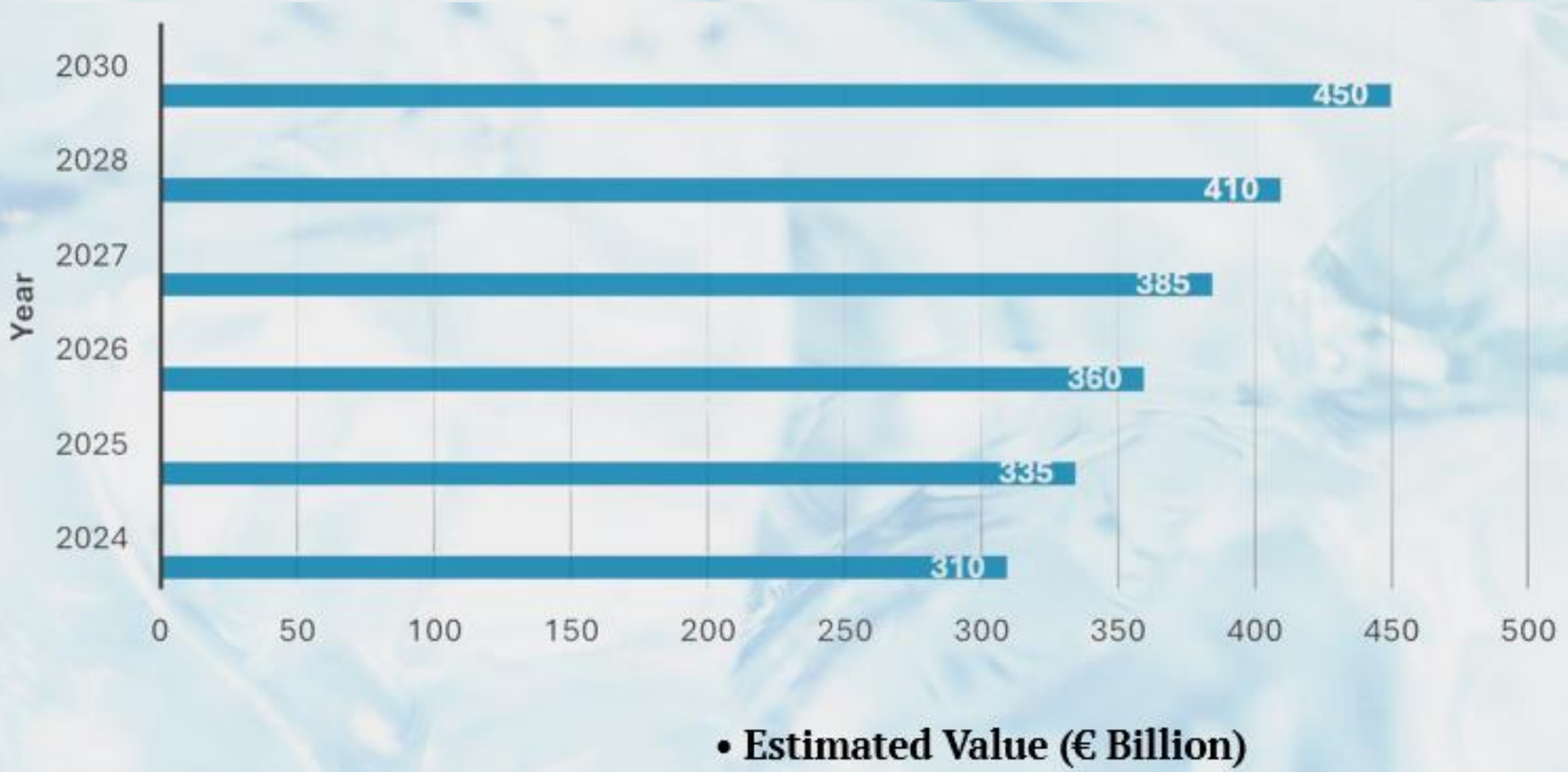
$$E_{year} = f(....)?!$$

When math meets sunlight

ECONOMIC EFFICIENCY OF RENEWABLE ENERGY SOURCES - ODESA PORT CASE

Parameter	Solar Collector .R VAZAR/250*	Wind Turbine *Eurowings10*
Price,$	525	13.400
Exchange, rate. UAH/$	40	40
Capacity,kWh/year	2,200	26,400
Traditional energy costs, UAH	6,147,357	6,147,357
Electricity tariff, UAH/kWh	6	6
Equipment size, m*	1,65*1*0.05	2
Delivery cost, UAH	153,780	1,088,000
Installation cost, UAH	1,957,200	4,180,800
Persannel. (technical+ workers), persons	4+16	10
Salary, UAH/month	15,000/10,000	15,000
Maintenance cost/yearUAH	2,640,000	1,800,000
Training cost per person,UAH	8,000	8,000
Total training cost UAH	160,000	80,000
Depreciation period,years	20	20
Profitability rate,%	20%	20%
Number of units required	466	39
Total area-occupted.	769	N/A
Annual economic effect,UAH	1,633,060	341,437

BLUE ECONOMY VALUE GROWTH FORECAST (2024–2030)



Interreg

Co-funded by the European Union

NEXT Black Sea Basin

BLUE GATES

Thank You!