

The New Wave in Coastal Engineering: From Structures to Systems

The Old Paradigm: Traditional Engineering



A small group of experts made fast, autocratic decisions prioritizing economic benefits.



Focus on the Physical Structure

The natural environment was treated as a boundary condition, not a design component.



$$\text{Risk} = \text{Probability of Failure} \times \text{Consequence}$$



Risk was defined narrowly by the physical failure of a structure.

The New Paradigm: Contemporary Systems Thinking



Stakeholder-Driven Decisions

An inclusive, transparent process involves the public, government, and industry for more sustainable outcomes.

$$\text{Risk} = \text{Hazard} \times \text{Exposure} \times \text{Vulnerability}$$



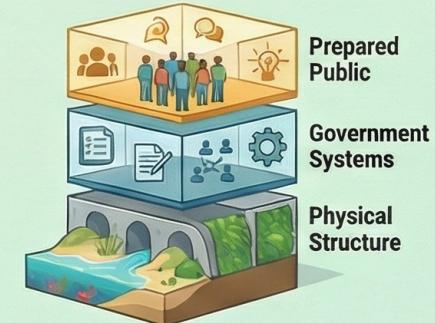
Risk now includes the hazard itself, the assets exposed, and society's ability to cope.

The Integrated System: PES on SES

Modern projects are a system where the Physical-Environmental part (PES) rests on a Socio-Economic foundation (SES).



Goal: Multi-Layered Resilience



True resilience requires strength across three levels: the physical structure, government systems, and a prepared public.