



# **ECONOMIC POTENTIAL OF INTEGRATED MULTITROPHIC AQUACULTURE (IMTA):**

## **REVIEW OF PRELIMINARY RESULTS FROM THE IDREEM PROJECT**

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## IMTA's DOUBLE-DIVIDEND

HIGHER PROFIT POTENTIAL

### PRIVATE DECISION-MAKERS

- Entrepreneurs
- Investors
- Professional associations

IMPROVED ENVIRONMENTAL  
SUSTAINABILITY

### PUBLIC DECISION-MAKERS AND STAKEHOLDERS

- Planners & regulators
- NGO
- Consumers

Chopin et al., 2013; Soto et al., 2009



**Lack of understanding?**

**WHY DON'T WE SEE MORE IMTA?**

**Beliefs &  
perceptions?**

**Inertia?**

**Institutional barriers?**



# EX-ANTE ISSUES FOR ENTREPRENEURS AND INVESTORS

## UNPROVEN TECHNIQUES

Is it technically feasible? How costly is refitting/establishing, producing?

## GOVERNANCE

Can licences be obtained? Will regulatory compliance be more difficult? Will regulation change?

## STAKEHOLDER CONFLICTS

Will they be different than for monoculture?

## MARKETS

Consumer receptiveness? Price competitiveness?





# RISK, UNCERTAINTY AND DECISION MAKING

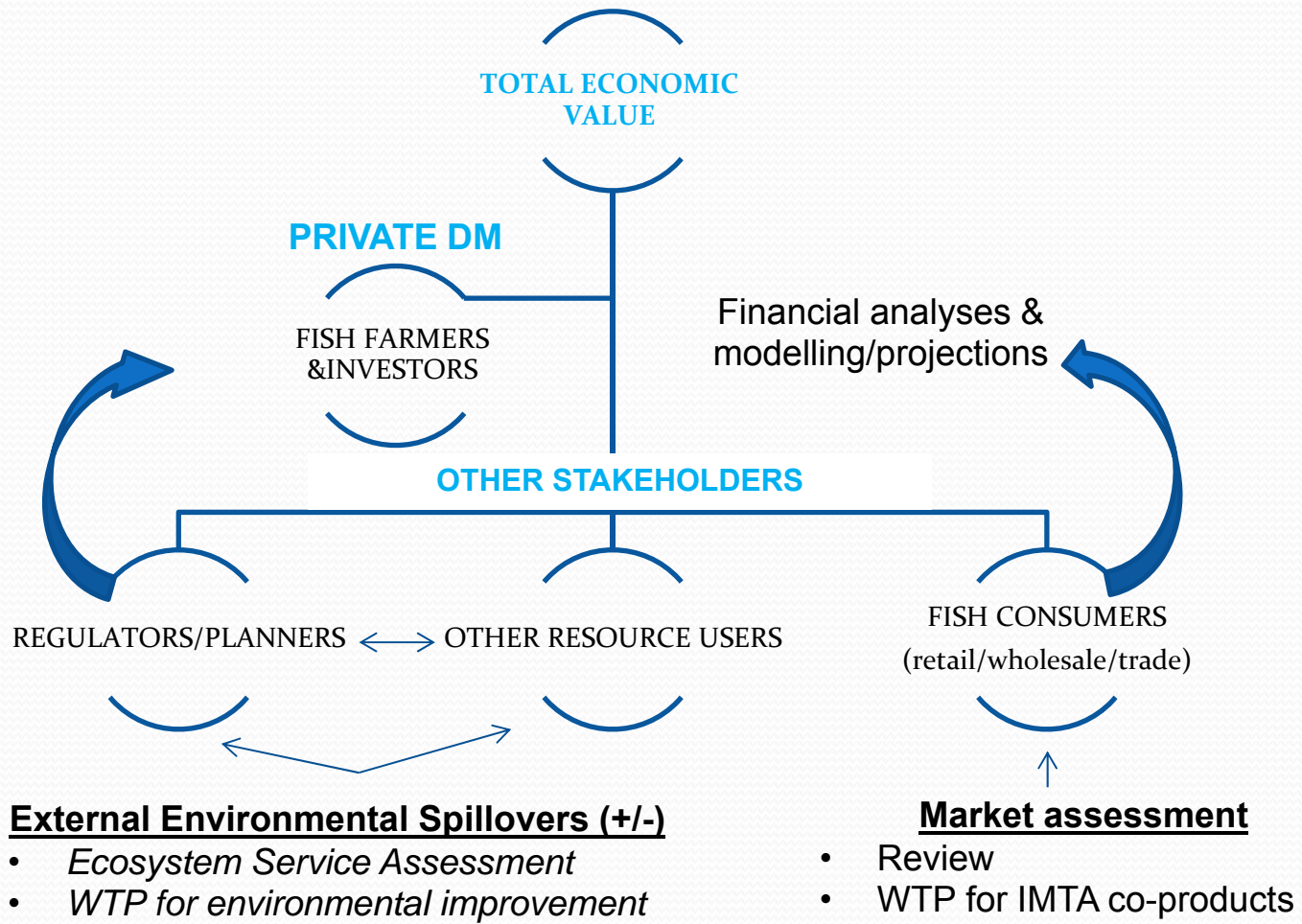
## REAL OPTIONS APPROACH (ROA)

Models using NPV consistently overpredict levels of investment leading to economists to apply tools of financial options analysis to investment in fixed plant and equipment.

ROA postulates that in general, investors usually have flexibility as to the timing and magnitude of their and will delay and/or make small, possibly exploratory investments when faced with uncertain returns.

IMTA decision-makers face: high up-front investments, uncertain returns and flexibility (crop size, species mix, timing)

Bernanke, 1983, Dixit and Pindyck, 1994, McDonald and Siegel, 1985, McDonald and Siegel, 1986, Pindyck, 1988, Pindyck, 1991, Pindyck, 1993, Trigeorgis, 2002







## Work completed to date

- Scoping of risks and workshop on risk perceptions
- Translation into stochastic processes modeling framework
- Preliminary review of markets for IMTA products related to IDREEM SMEs and countries
- Six-country choice modelling survey
- Scoping of six-country and European-wide ecosystem service mapping and advanced draft of Israeli case study
- Partial data collection: financial baselines (monoculture);
- Workshop on risk perceptions



# PRELIMINARY RESULTS







### Major risk categories:

- ✓ R&D – engineering and species selection
- ✓ Financial – cost and revenues
- ✓ Regulatory
- ✓ Contamination: chemical, toxins, pathogens

### Stochastic processes for risk modelling

- ✓ Drift control for continuous processes (eg: price fluctuations, effluent flux)
- ✓ Jump processes for occasional events (eg: extreme weather events, crop loss)
- ✓ Representations of environmental impacts from establishing/refitting farms and ongoing operations



## Markets (6-country comparison)

- ✓ Increasing demand for finfish in all countries
- ✓ Variable demographic trends from country to country but generally, largest increases in consumption among 40+ age group
- ✓ Niche market potential favours IMTA's sustainability attributes (e.g.: local production/consumption, sustainable certification)
- ✓ Variable attitudes toward farmed fish vs wild-caught
- ✓ Variable levels of knowledge about IMTA





## Ecosystem Service (Israeli Case Study)

- ✓ Stakeholders potentially affected by services include property owners, tourists and recreational users of beaches and the sea, educators, conservationists, regulators/planners/policy-makers, commercial fishers and a natural gas producer
- ✓ IMTA's sustainability attributes may improve attitudes towards aquaculture within the regulatory community



## MOVING FORWARD TOWARDS DECISION-SUPPORT TOOLS

Ongoing data collection

Modeling to upscale pilot project results for financial performance and ecosystem service assessment

Analysis of choice modelling data

Consideration of the role of regulation in encouraging/inhibiting innovation (Porter Hypothesis, 1991)

Marketing strategies as a risk mitigation strategy for commodity price fluctuations (Robinson, 2014)

Quantification relevant risky and uncertain processes (price trends, extreme weather,

Online survey on risk perceptions on website





# THE TEAM

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environmental economic valuation)

## **IDREEM RTD/SME Partners:**

SAMS/Loch Fyne Oysters

DOMMRS

Bioforsk/Gifas

University of Genoa/Aqua

MER/Seawave

University of Haifa/SuFish