Staying ahead of the game: A framework for effective aquaculture decision-making

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This thesis is submitted in fulfilment for the requirements for a conjoint degree of PhD at the University of Tasmania and the University of St Andrews, February 2016

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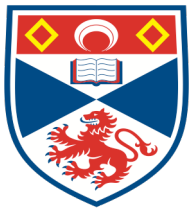

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Andrew Stephen King
Hobart, Australia & St Andrews, Great Britain
August 2015

ABSTRACT

Globally, Atlantic salmon aquaculture is faced with a critical challenge: How best to deliver long-term sustainable growth, whilst optimising the opportunity for the expansion of the industry presented by an increasing global seafood demand?

This thesis presents a novel framework of complementary decision support approaches to enable decision-makers to better understand the factors influencing aquaculture development, and examine alternative production (growout) technologies that more effectively address the challenges associated with intensification and expansion. The framework was developed through a combination of fieldwork (international data-gathering), key stakeholder discussions, and the application of targeted qualitative and quantitative analytical approaches; using the Tasmanian industry as a Case Study. The initial research focused on shorter-term (tactical) decision support. A situational analysis defined the business environment, and appraised viable expansion options (offshore, closed-containment and extractive bio-remediation). An economic analysis of selected options then provided a comparison of financial performance and risk. The outputs of this initial component next informed strategic decision-making approaches; employing scenario analysis to explore plausible strategies for the adoption of land-based recirculating aquaculture systems; and qualitative modelling to understand the causal dynamics driving and regulating the industry, and their impact on technology selection.

Whilst it was clear that business economic viability is paramount, the results suggested that societal acceptance (the Social License to operate) is playing an increasingly important role in influencing business decisions. There is no single 'right' technological solution; social acceptance, in particular considerations regarding human wellbeing, trust, and animal welfare concerns, will shape the business environment and therefore technology selection. The research emphasised the importance of employing a balance of tactical and strategic decision-making techniques, and of engaging with a broad range of industry stakeholders. It also highlighted the complexity and dynamic nature of the industry and that key variances (economic, regional, strategic, technological, and temporal) must be included in decision-making.

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LIST OF ABBREVIATIONS

AGD	Amoebic Gill Disease
ASC	Aquaculture Stewardship Council
CAGR	Compound Average Growth Rate
CAPEX	Capital Expenditure
CPM	Competitive Profile Matrix
CRC	Australian Seafood Cooperative Research Centre
COP	Cost Of Production
DCF	Discounted Cash Flow
DFO	Department of Fisheries & Oceans, Canada
DPIPWE	Department of Primary Industries, Parks, Water and Environment, Tasmania
EBIT	Earnings Before Interest and Tax
EIS	Environmental Impact Statement
ENGO	Environmental Non Governmental Organisation
FAO	Food and Agricultural Organisation
FCC	Floating Closed Containment
FCR_b	Biological Feed Conversion Ratio
FCR_e	Economic Feed Conversion Ratio
FRDC	Fisheries Research and Development Corporation, Australia
FRP	Fibre Reinforced Plastic
FTE	Full Time Equivalent
HOG	Head On Gutted
Hs	Significant Wave Height (mean wave height, trough to crest of the highest 1/3 of the waves)
ISFA	International Salmon Farmers Association
IMTA	Integrated Multi Trophic Aquaculture

IRR	Internal Rate of Return
NPV	Net Present Value
OPEX	Operational Expenditure
PESTEL	Political, Economic, Social, Technological, Environmental and Legal
RAS	Recirculating Aquaculture System(s)
ROE	Return On Equity
ROI	Return On Investment
ROW	Rest Of the World
SBP	Selective Breeding Programme
SEPA	Scottish Environmental Protection Agency
SME	Subject Matter Expert
SOPs	Standard Operating Procedures
SSPO	Scottish Salmon Producers Organisation
SWOT	Strengths, Weaknesses, Opportunities and Threats
TGC	Thermal Growth Coefficient
TSGA	Tasmanian Salmonid Growers Association