

Development of Next Generation Farming Systems using a Multi-Criteria Decision-Making framework

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Next Generation Systems



Our wide open spaces are brimming with lush, green grasses that animals roam through and graze on, freely and happily.

As farmers we work with these natural gifts to produce the one thing you can only get from New Zealand beef and lamb.

That's the taste of pure nature.



New Zealand Population (millions)

People



4.7

Sheep



27.0

Dairy Cattle



6.5

Beef Cattle



3.6

agresearch

āta mātai, mātai whetū



Urbanisation

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āta mātai, mātai whetū





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āta mātai, mātai whetū



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āta mātai, mātai whetū

Bad news comes in threes...





Water Quality

Safe for
Swimming
Drinking

Contaminants
Nitrates
Phosphorous
Pathogens
Sediment

Drivers for changing farming's footprint

Expectations of
New Zealanders

Expectations of our
global discerning
consumers

The farmers dilemma

Risk if do not
adapt to
change

Huge risk to
change

Next Generation Systems



Pick a Winner?

Manuka Honey

Dairy Goats

Dairy Sheep

Cherries

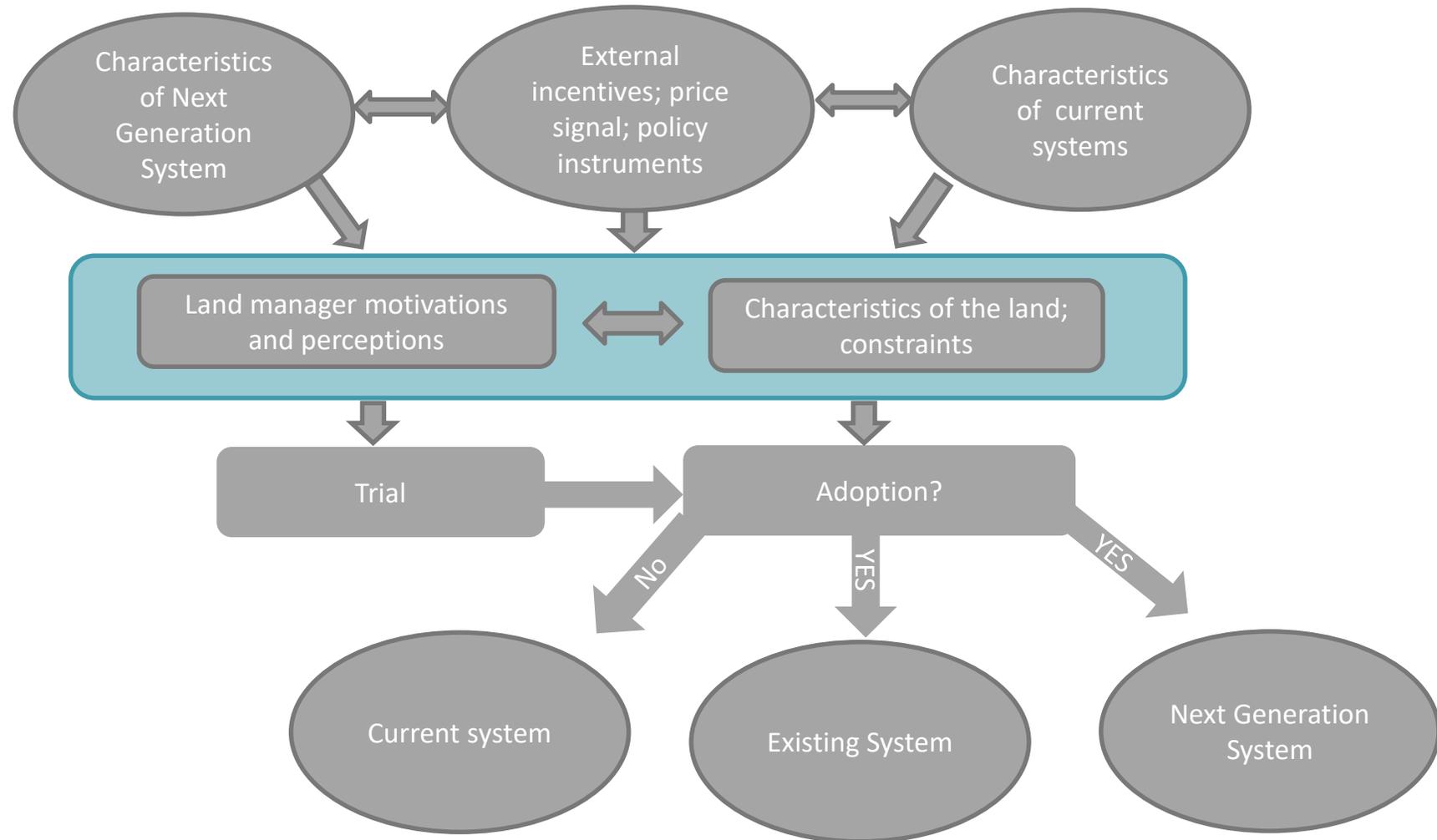
Kiwifruit

Truffles

Hemp ...



Framework



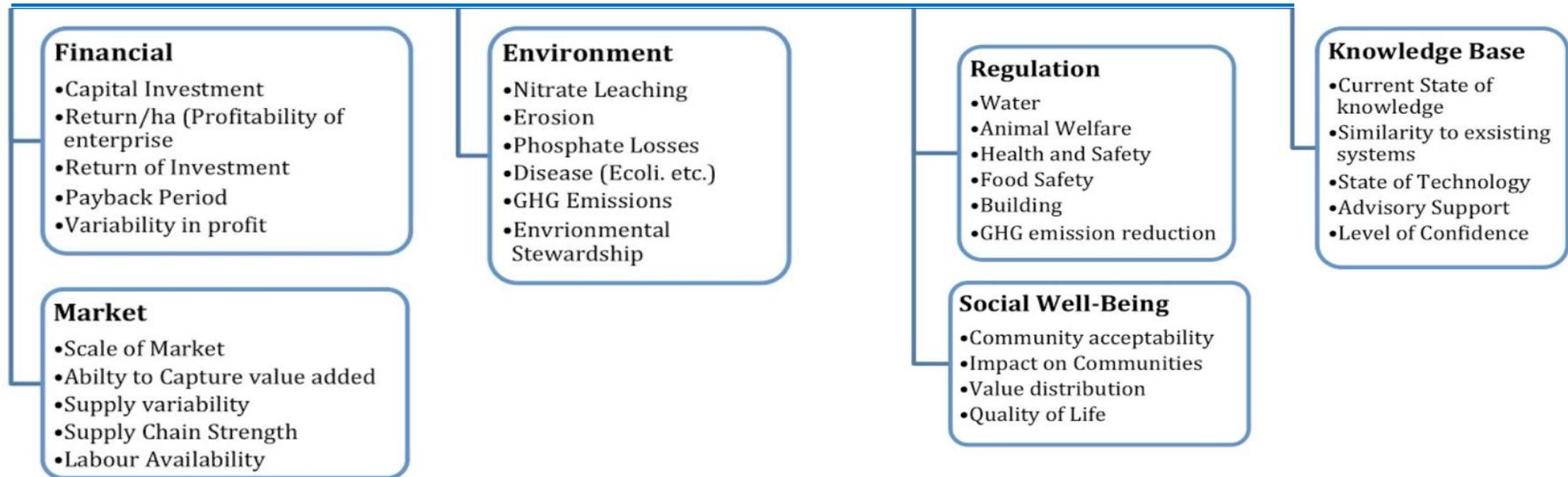
Leads to some questions

- To what extent are these various external incentives/disincentives influencing land-use decision making?
- What are the key perceptions and motivations of the land-manager in determining their land use?
- How much weight are land managers placing on these external and internal factors?
- Basic premise is that if we can understand these then have better chance of understanding what characteristics NGS need to have in order to facilitate their adoption & prioritise science investment



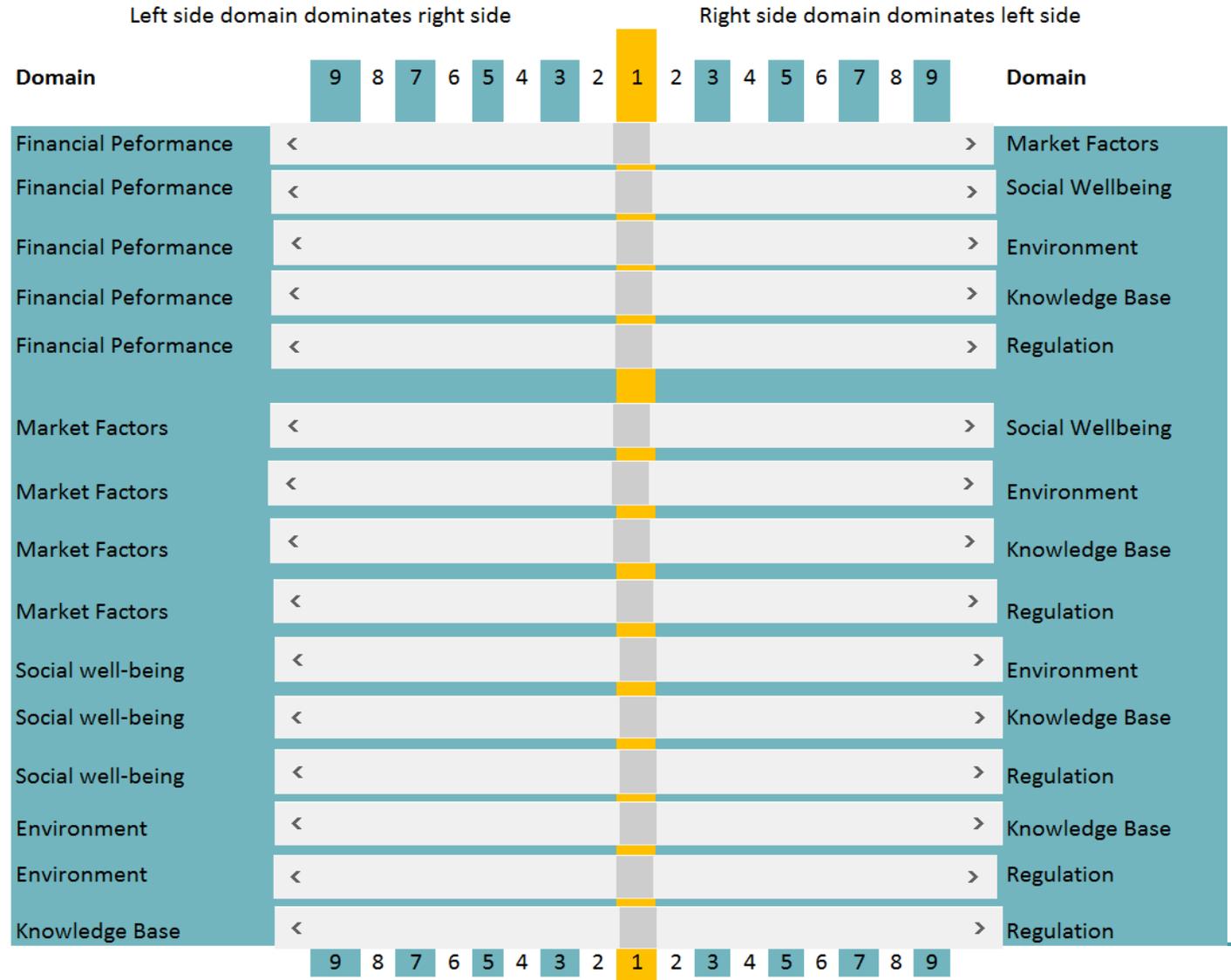
Multi-Criteria Decision-Making framework

DOMAINS

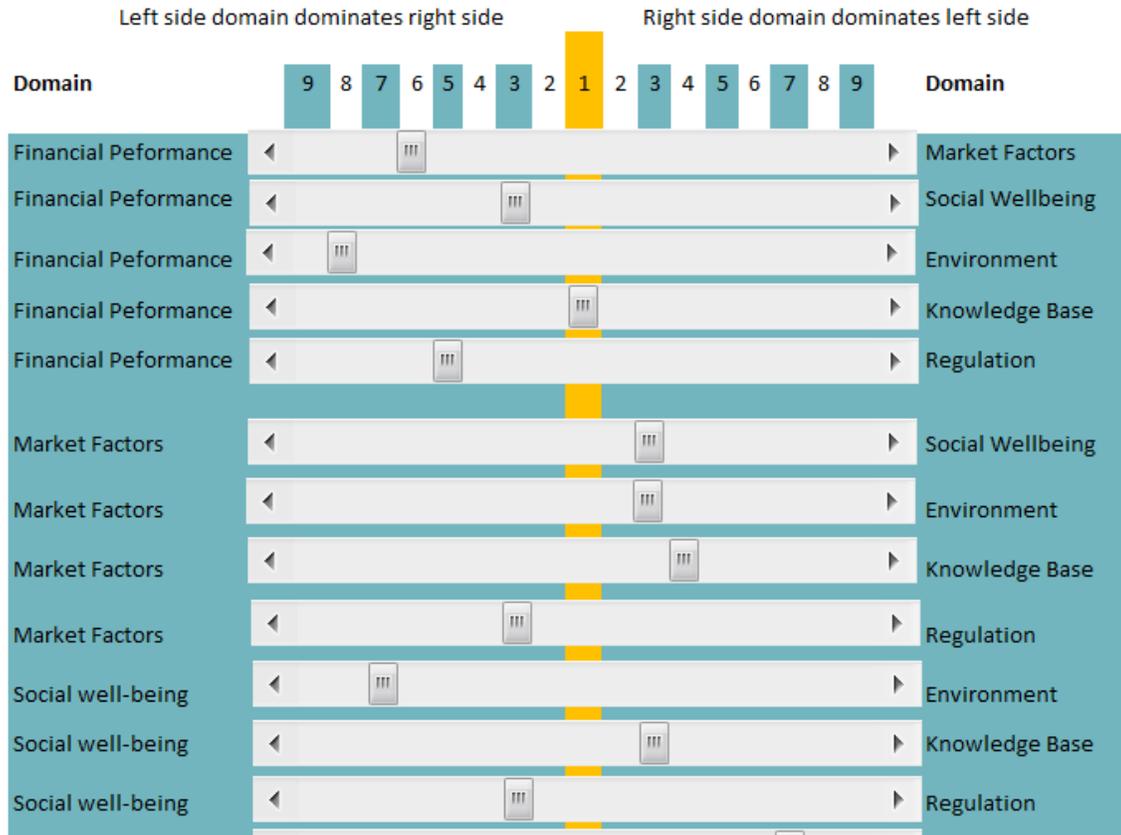


How it works

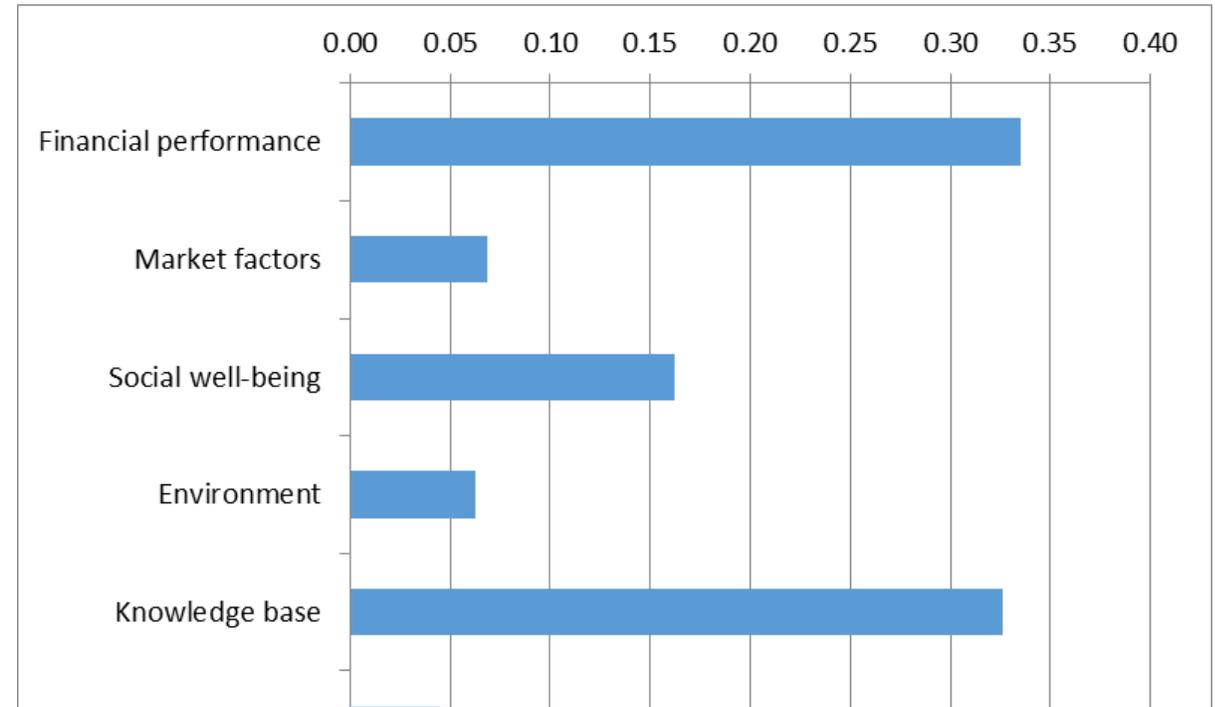
Score	Definition	Explanation
1	Equal importance	The two domains contribute equally to the decision process
3	Moderate importance	One domain is slightly more important than the other
5	Strong Importance	One domain strongly dominates the other
7	Very strong importance	One domain very strongly dominates the other
9	Extreme importance	One domain completely dominates the other in the decision process
2,4,6,8	can be used to express intermediate values	



An Example



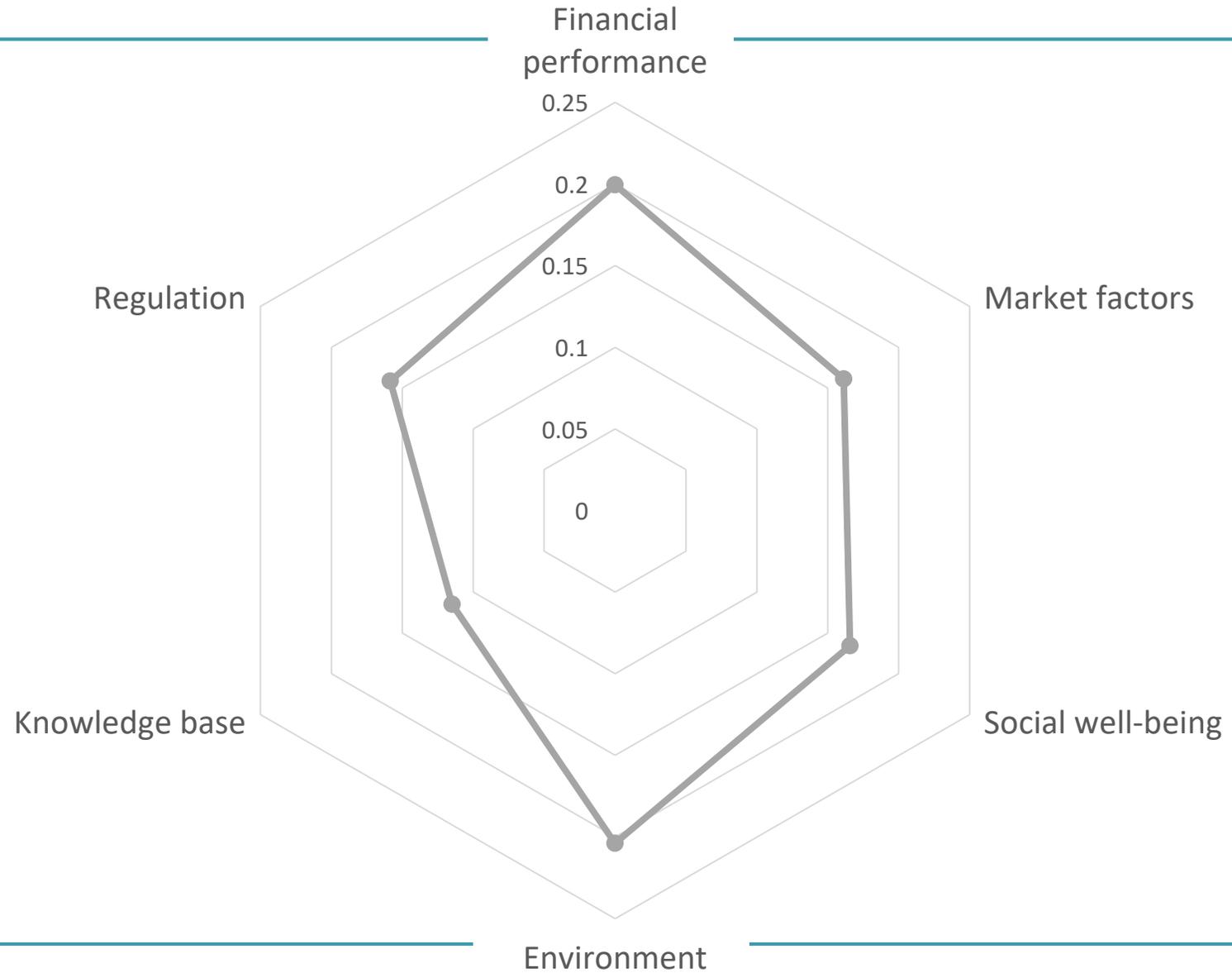
Weights Generated



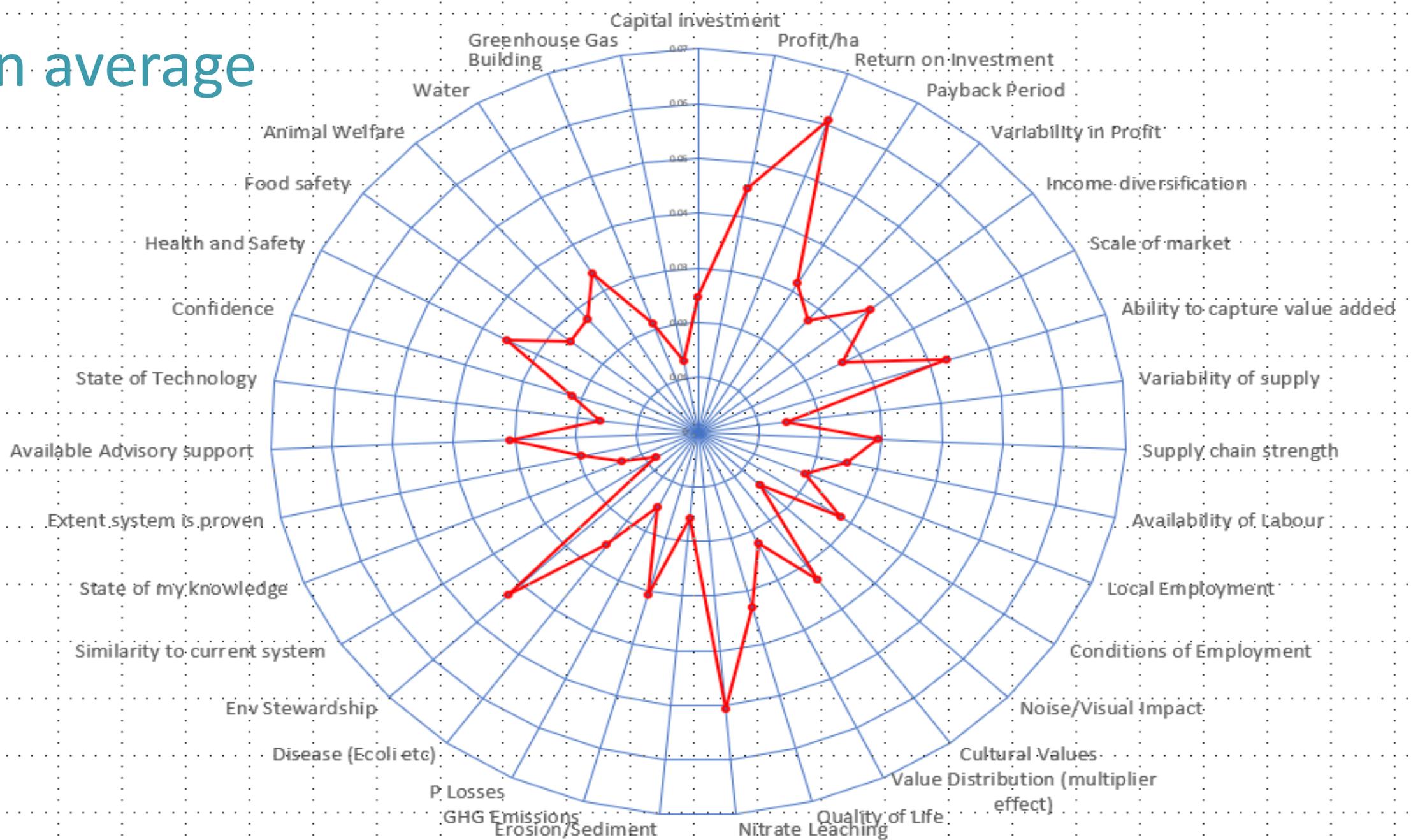
Case Studies

<u>Land Manager type</u>	<u>Location</u>	<u>Driver for Change</u>	<u>Considering</u>
Small Family Farmer	SI	Generate income from relatively small area	Sheep dairy
Small Family Farmer	NI	Needs value added from area constrained by strong regulatory control in terms of nitrate limits	Value added beef
Family Farmers (10)	SI	Irrigation Scheme moved from dryland to irrigated land with increased opportunities	Range of crop systems / collective action
Large Family Farmer	NI	Succession planning key. Return from arable seen as too low .	Switch to horticulture (apples, kiwifruit)
Smallholding*	NI	Needs high value added, concerned about regulatory impact	Multiple cropping linked with forestry (nuts etc.)
Maori Trustees MT (4)*	NI	Harvested forestry land and now looking for alternatives	Hazelnuts, mixed tree crops, tourism, horticulture
Regenerative Farmer*	NI	Looking for sustainable land uses at scale	Hazelnuts
Maori Corporate MC (4)	SI	Looking for returns from land coming out of forestry and diversification from dairy investment	Sheep dairy, horticulture
Hill Country	SI	Looking to generate profit from traditional sheep and beef land	Range of diversified land uses
Family Farmer	SI	Regulation from water placing pressure on dairy production	Sustainable land uses

On Average



On average

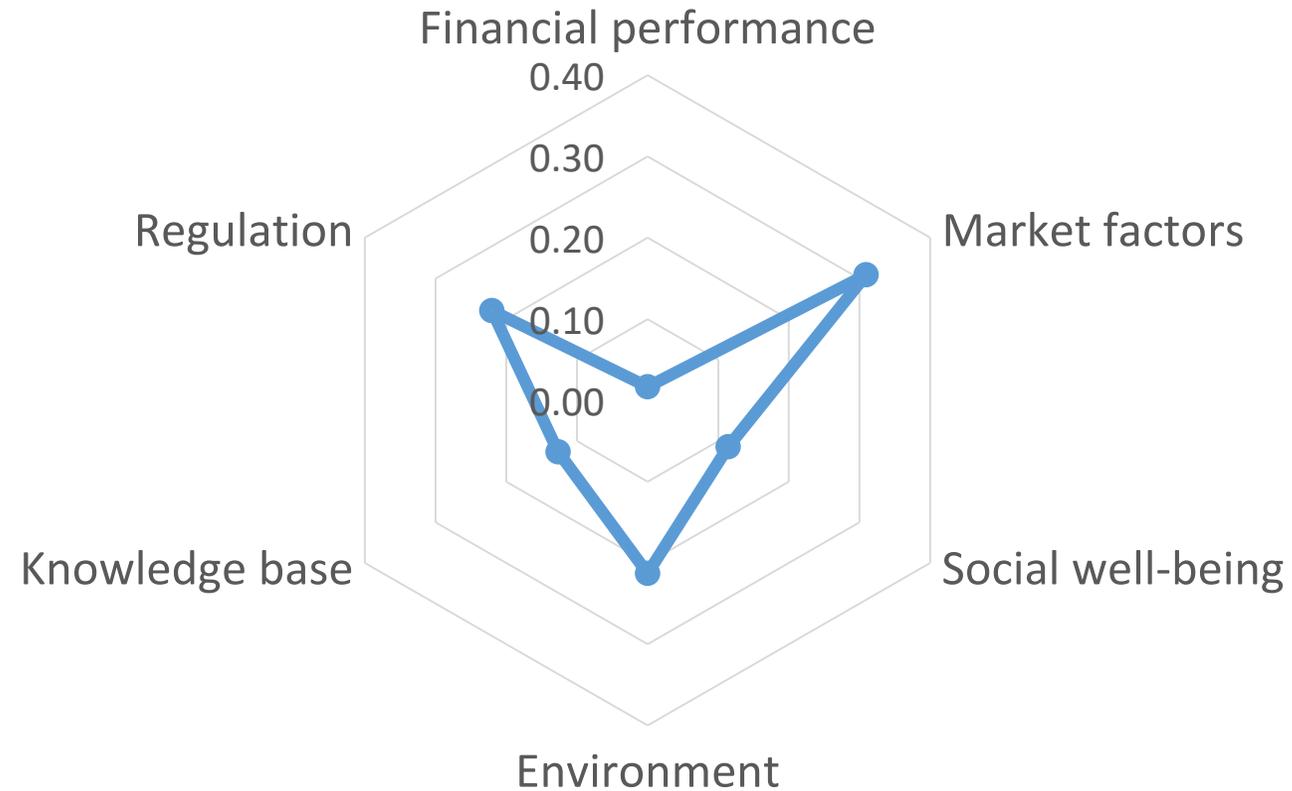


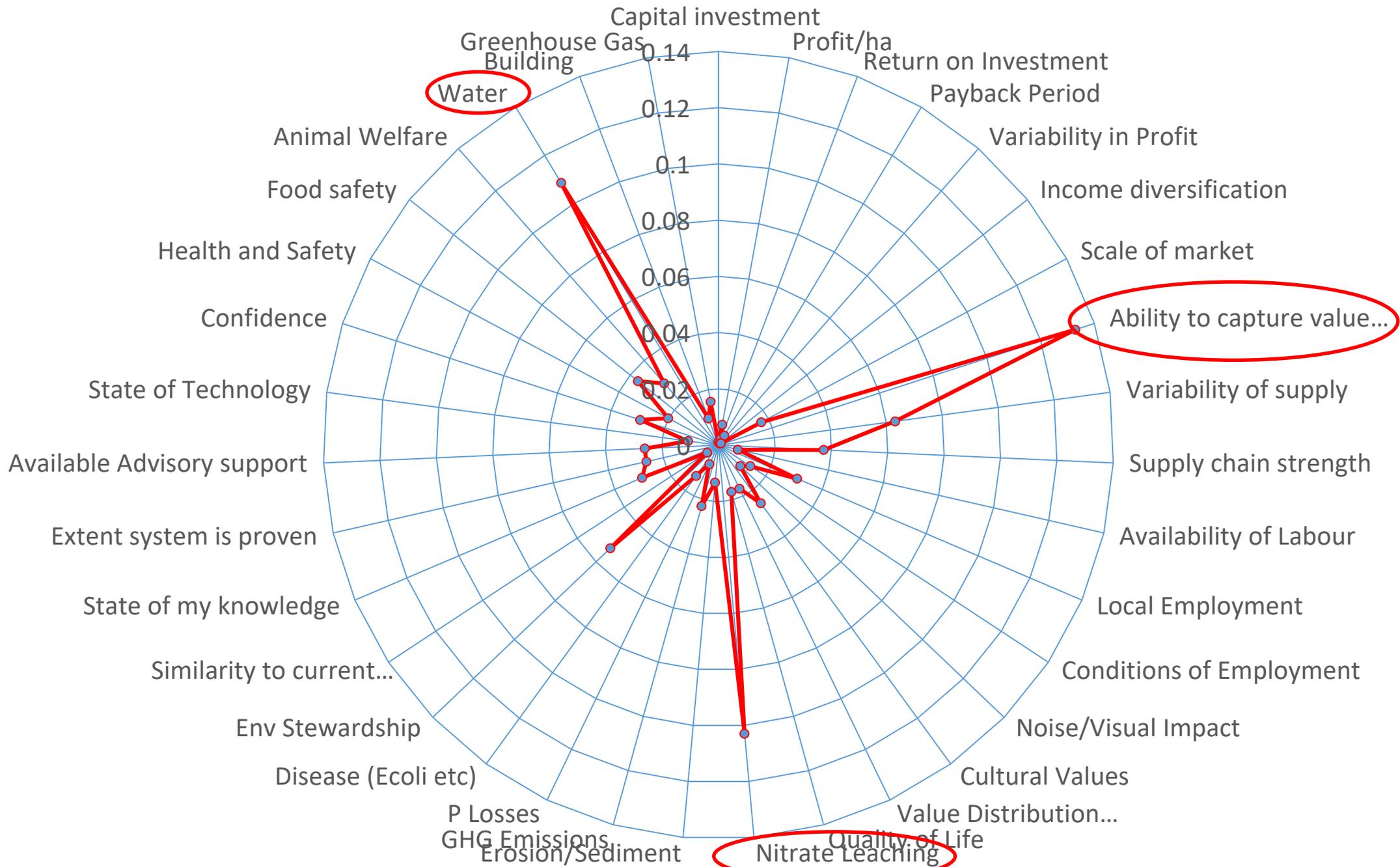


Taupo Beef & Lamb

Protecting water quality by rethinking premium meat

Taupo Beef





Rotoma No. 1 Incorporation



Drumpeel Farm

THE FARM

- Drumpeel Farms, Otane, Hawke's Bay.
- 1960 effective hectares (including leased land) taking in breeding stock, finishing lambs and cattle, with 700 hectares cropped each year. About 310 hectares are irrigated.
- Main crops include wheat, barley, herbage seed, maize, peas, sweetcorn and squash, and some vegetable seed crops are also grown.
- Soils range from clays to sands, loams and peat.
- 20 000 stock units wintered, 1000 R2 bulls and 20 000 trading lambs.
- Annual rainfall of 800–850mm.

THE FAMILY

- Drumpeel Station is owned by the Drumpeel partnership and farmed by Hugh and Sharon Ritchie.
- Hugh is Chairman of the Primary Sector Water Partnership, and a founding member and Chairman of LandWISE, a sustainable cropping group in Hawke's Bay. Hugh was previously a Federated Farmers board member with responsibility for water issues at a national level.



ADAPTING TO A CHANGING

HAWKE'S BAY CROPPING FARM Optimising irrigation efficiency in a

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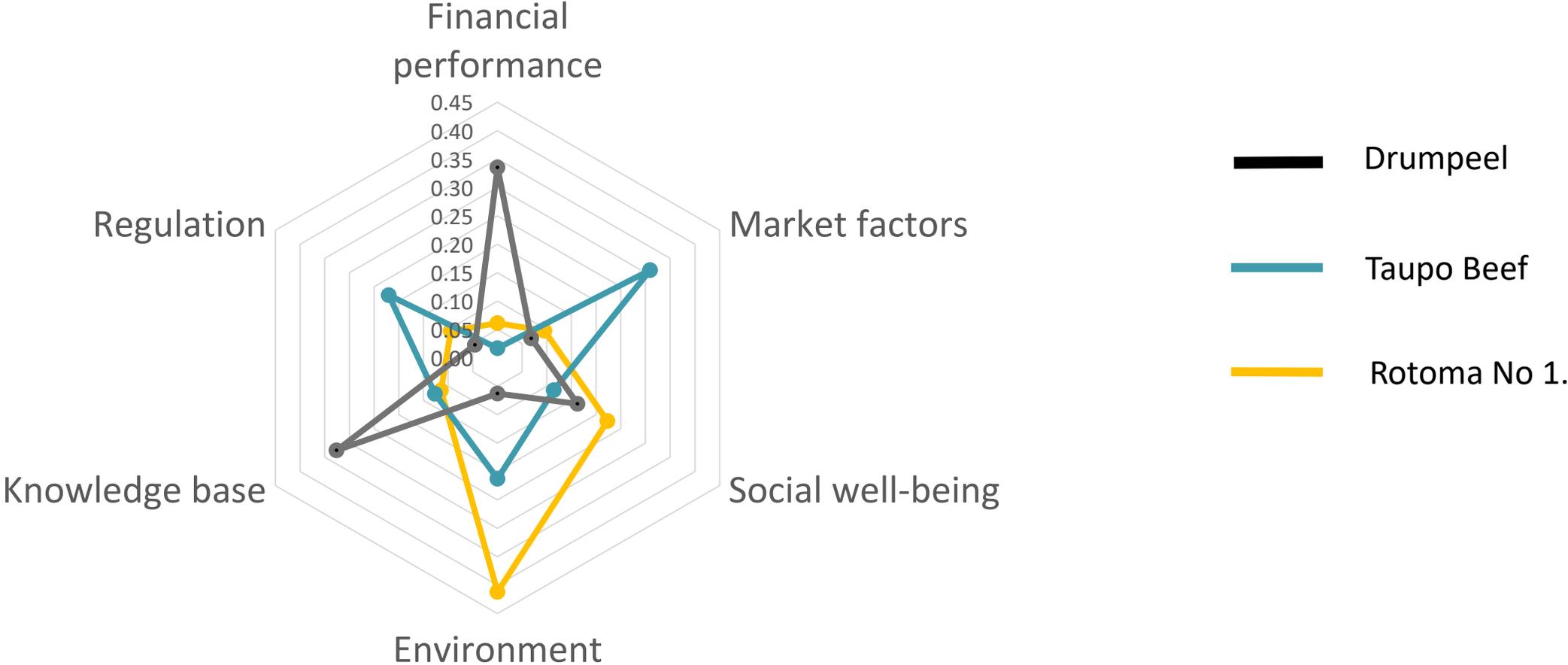
A multi-strand approach adopted at Drumpeel Station for crop rotation, crop priorities

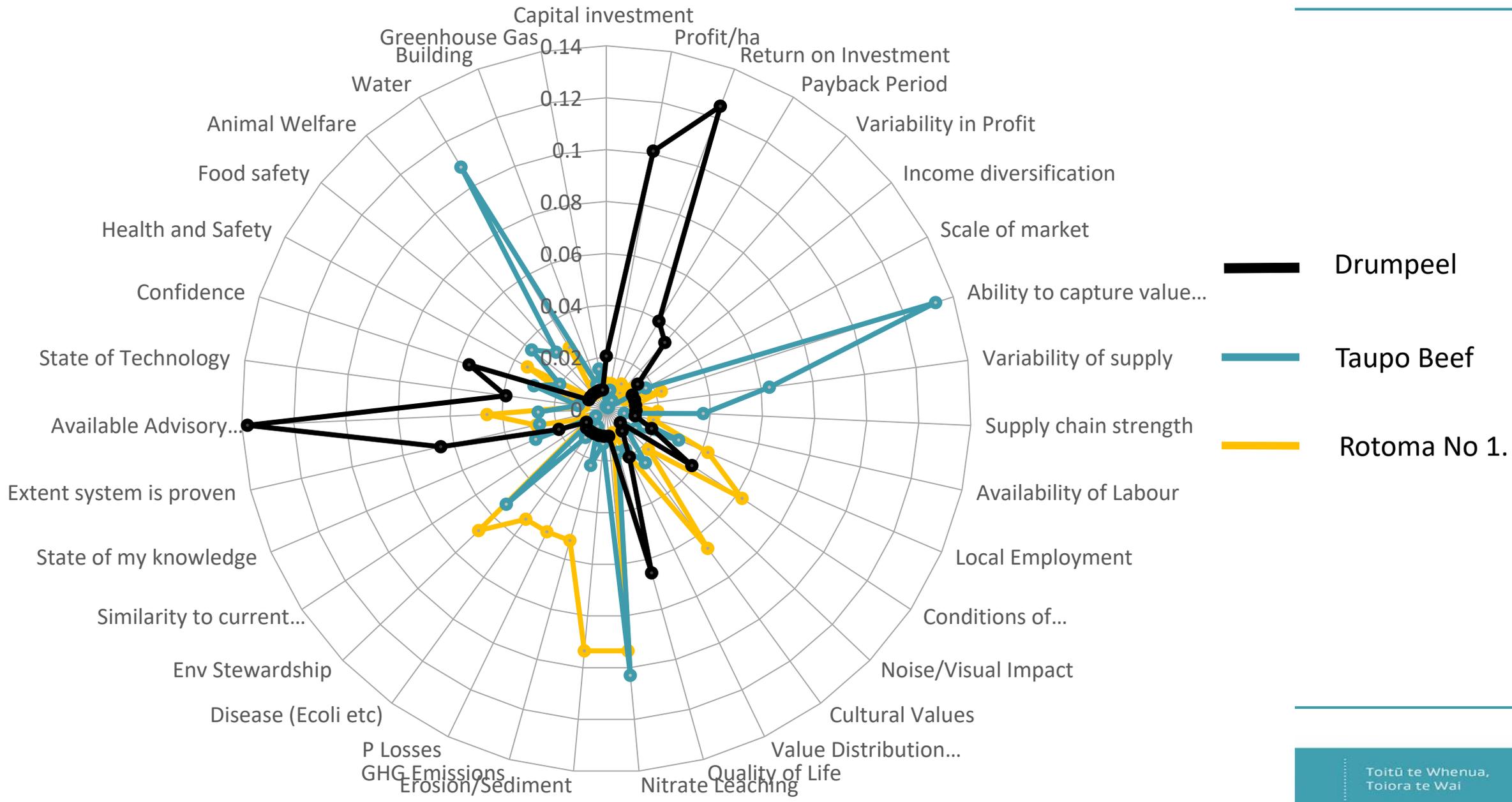
Hugh Ritchie farms Drumpeel Station all, some 1960 hectares are farmed. 700 hectares of crops are planted: barley, herbage seed, sweetcorn, maize, crops such as coriander and carrot.

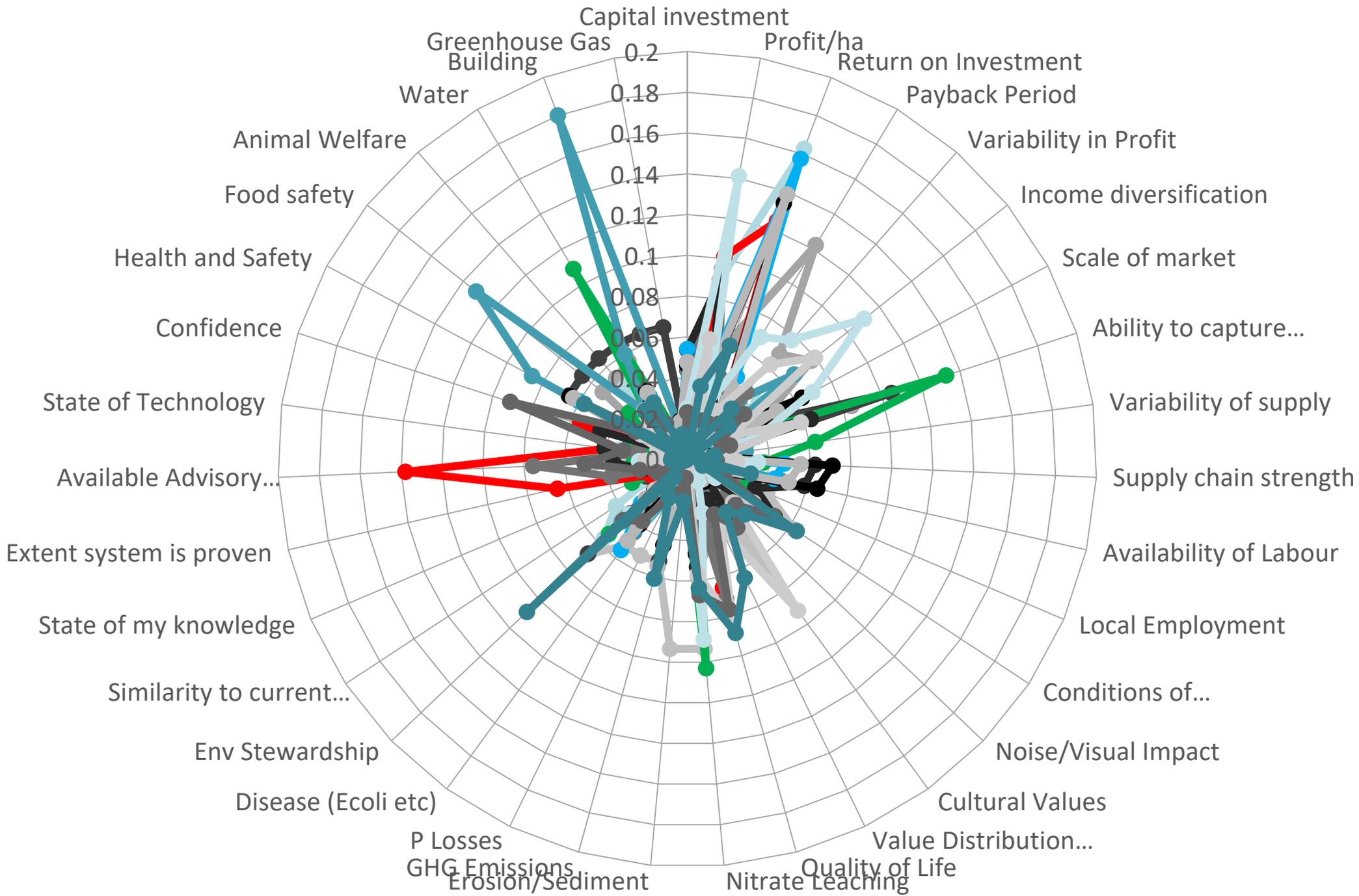
The main cropping area is at Drumpeel on loams and peat. The area is summer operation in the mid-1990s. Irrigation production. The extra water also allows for process sweetcorn.



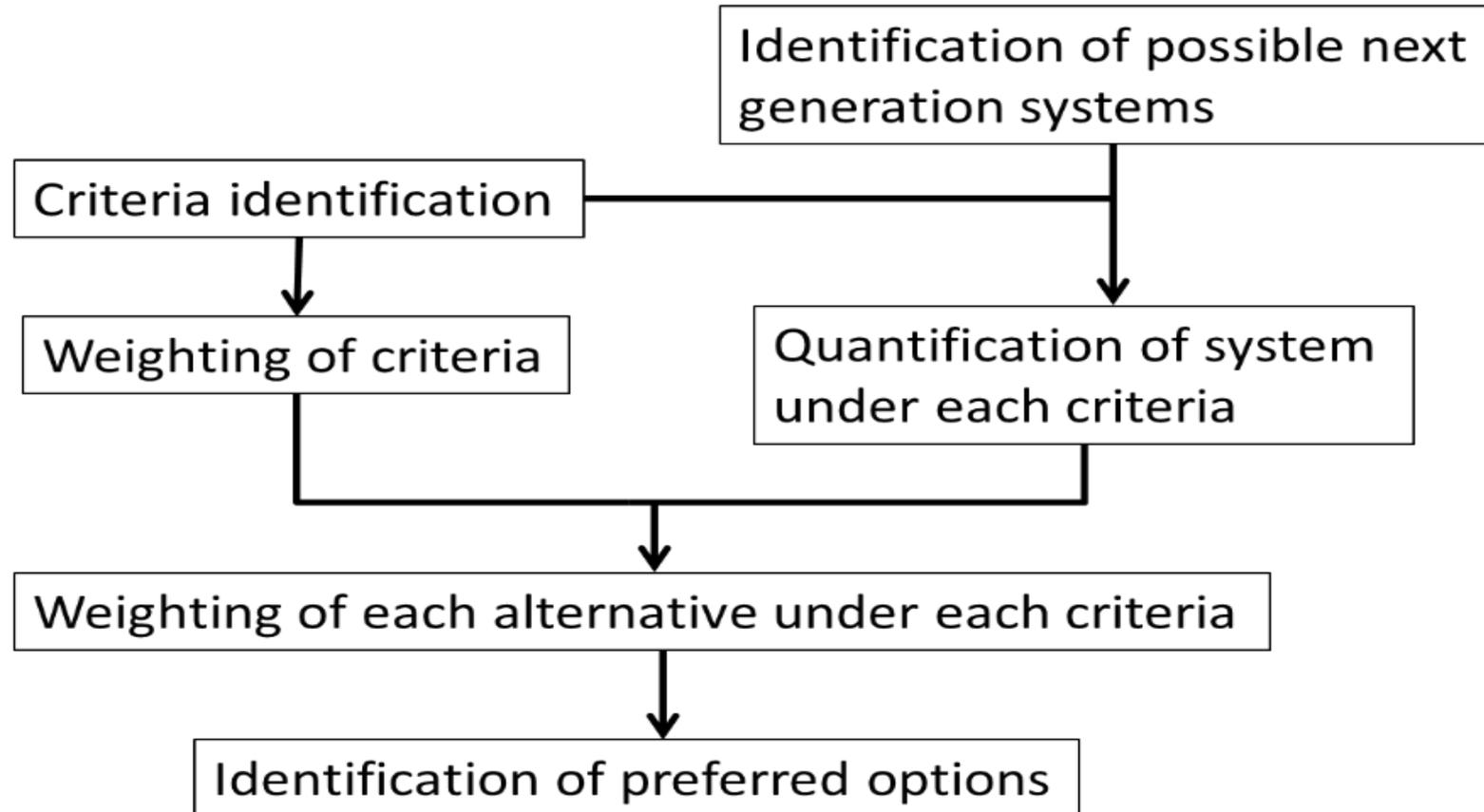
Domain importance for System Change







Next Generation Systems - process



How well does a system fit? An example with two land managers and sheep dairy

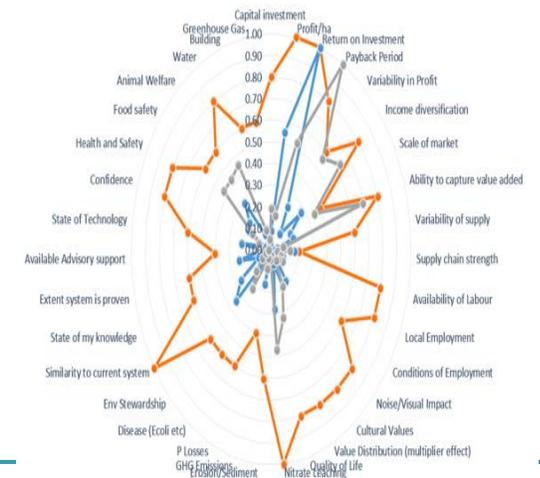
1. Obtain weights for the criteria through framework process
2. Score system(s) according to the criteria (objective or subjective)
3. rating score x weights = overall score for system

e.g. sheep dairy was scored out of 5 for each of the criteria

Land manager scores = 3.69 and 3.79

Orange highlights expert scoring of sheep dairy against criteria

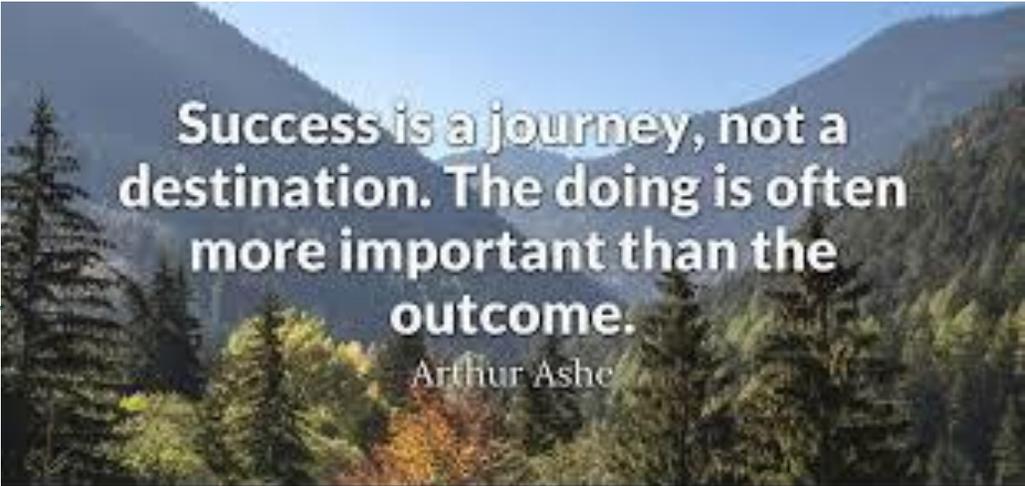
Blue and Grey highlight the results from two land managers



Advantages

The interactive approach (using a graphical interface) for selecting the criteria weights allows a detailed discussion with the land-user about the process of system change.

Reflection on and crystallization of what is driving the land manager decisions



Success is a journey, not a destination. The doing is often more important than the outcome.

Arthur Ashe

Conclusions: Advantages (Uses) of the Framework

- Through identifying the criteria that are important in influencing adoption of new systems, attention is drawn to areas where objective information is required to support decision making.
- Can highlight where there are potential gaps in our knowledge that (transformational) science can be used help fill which in turn can reduce the risks to land managers of adopting new systems.
- The framework can also highlight how well a particular system fits with the land-users' needs and therefore give an indication of the extent of the pressure for change.
- It also can help assess the extent that new technologies etc. can shift systems so that they better meet the criteria set by land managers.
- It may used to consider decision making at different levels, for example regulators (regional councils), land managers and wider stakeholders.

Summary

- New Zealand's model of agricultural growth is coming up against environmental and social (license) limits
- Sustainable intensification / best management practice will not get us far enough
- Transformation occurs at the land-manager level
- It is context specific
 - Spatially varies according to drivers
 - Individual situation
- System change is risky and this can hold up transformation
- Understanding the decision making process gives us insights into what is required to facilitate change:
 - Production Science
 - Supply chain development
 - Market development
- Science may not de-risk land-use transformation but by providing the right information to the right land-managers it may be possible to reduce the risks involved in transformation and speed up the process

OUR LAND AND WATER

Toitū te Whenua,
Toiora te Wai

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Dr Peter Clinton Scion
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Hugh + Sharon Ritchie, Drumpeel Farm
Rotoma No 1.

PI Robyn Dynes
AgResearch

www.ourlandandwater.nz
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National
Science
Challenges

OUR LAND
AND WATER

Toitū te Whenua,
Toiora te Wai

Summary

- Shaping our farming future
 - Urban NZ
 - Global consumers
- Regulation = uncertain future
- Science ; priorities through co-development



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Anna Taylor

Dr Peter Clinton

Scion

National
Science
Challenges

OUR LAND
AND WATER

Toitū te Whenua,
Toiora te Wai

**Wai Ora,
Whenua Ora,
Tangata Ora**

Healthy Water, Healthy Land, Healthy People

"To enhance primary sector production and productivity while maintaining and improving our land and water quality for future generations"

Pressure is building

The Zero Carbon Bill

New Zealand is on the path to a low emission, climate resilient future; the Government aims to reduce our emissions to net zero by 2050.

- The Government is committed to New Zealand becoming a world leader
- It plans to introduce a new Zero Carbon Bill that will set a new emissions
- It also plans to establish an independent Climate Change Commission.

Interim Climate Change Committee Announced

Tuesday, 17 April 2018, 2:14 pm

Press Release: [New Zealand Government](#)

Hon JAMES SHAW

Minister for Climate Change

Tuesday, 23 October 2018 10:12

Farmers under the microscope

Written by Peter Burke

Farming has been under the microscope this month with three weight Government reports — for quality, climate change and coplasma bovis — all coming in just three days.

Farmers vice-president Andrew Hoggard at his response to these challenges was to



The government announces \$118 million grant to help plant one billion trees by 2028

30/11/2018 | Holly Carran

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Shane Jones

Forestry Minister

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Essential Freshwater

Healthy Water, Fairly Allocated

[New Zealand Government](#)

The Vision is Clear - DairyNZ's new waterways movement

1 Nov, 2018 2:15pm

2 minutes to read



DairyNZ has launched a movement to inspire and get involved with looking after New Zealand's waterways.

Fonterra amps up plans for sustainability

November 29, 2018 Remedios Lucio

Dairy cooperative Fonterra has released its second annual Sustainability Report, detailing actions towards its environmental, social and economic goals.

Fonterra CEO Miles Hurrell said that the dairy giant is showing where it's at and where it needs to get to in sustainability.

"There are areas where we're leading the industry."



Farming leaders on board with zero carbon policy

Prime Minister Jacinda Ardern and the Farming Leaders Group - 05:00, Jul 01 2018



Media Release

B+LNZ welcomes launch of One Billion Trees Fund

Beef + Lamb New Zealand (B+LNZ) has welcomed the launch of a \$238 million One Billion Trees Fund that will complement the government's One Billion Trees Fund.

Friday, 30 November 2018

beef+lamb new zealand

BY FARMERS. FOR FARMERS

Knowledge hub

Data & tools

Compliance

Managing stock near water

Agricultural and horticultural on farmers to manage the effluent water.

Holding on to soil

Some soil - or sediment - in a stream can erode and kill freshwater species. It's important to hold on to soil.

Making the most of nutrients

Nutrients are essential for both plants and animals, particularly when it comes to water quality.

Improving biodiversity

Biodiversity refers to the variety of life forms, the healthier that environment, the more diverse it is.

Dung and

Dung - particularly in water - can be a problem for the environment.

CLIMATE LEADERS COALITION

ON A MISSION TO REDUCE EMISSIONS IN NEW ZEALAND

WHO

ACTIONS

NEWS & RESOURCES

Agricultural Policy Return in New Zealand

Almost
non-existent

1960's

increased to
'protect' NZ
from overseas
shocks

1970's

1980-4:
increased to
compensate for
high costs and
low commodity
prices

1980's

Post 1984:
most support
withdrawn

1990's