



Constraints and solutions to sustainable wood production

Daniel Mendham and Sadanandan Nambiar
CSIRO Land and Water, Canberra

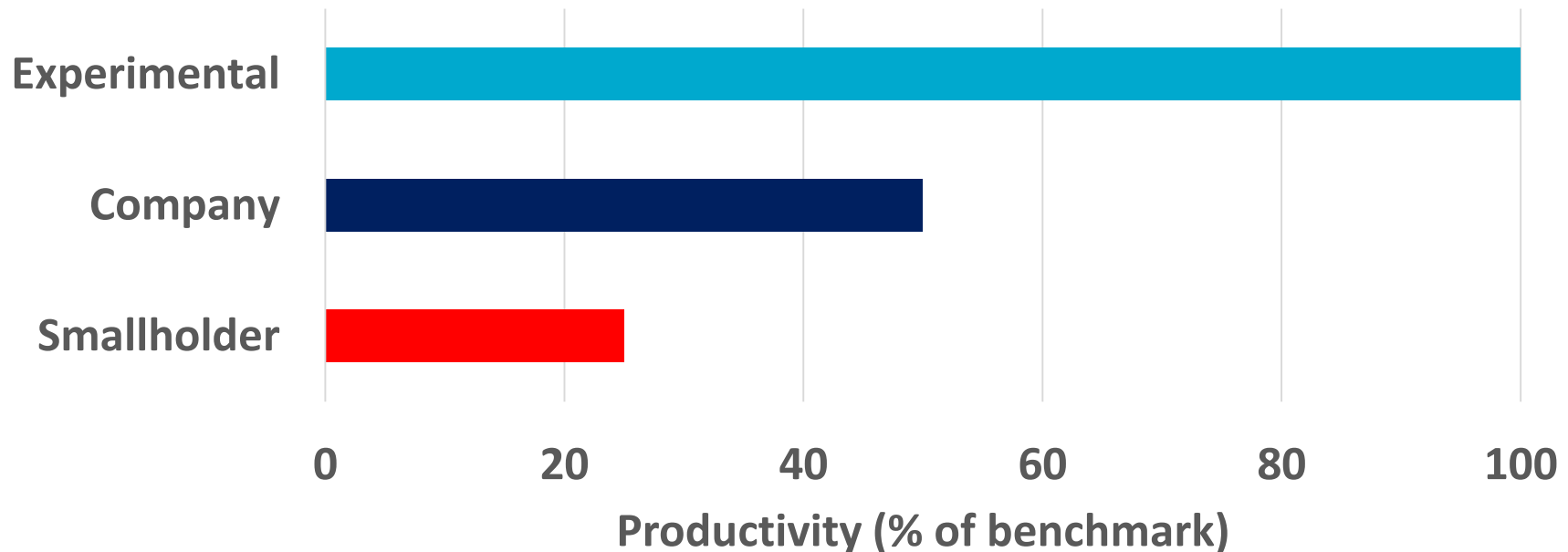
Introduction

- Two options to increase wood supply:
 - Expanding the landbase, or
 - Increase productivity of existing land
- Increased and sustained production from existing plantations is important:
 - More wood = sustained income and profits for both small and large growers.
 - Increased wealth and improved livelihoods in rural and regional areas
 - Greater and more reliable supply of sustainable feedstock for processing – large and small scale, reducing the demand on native forests



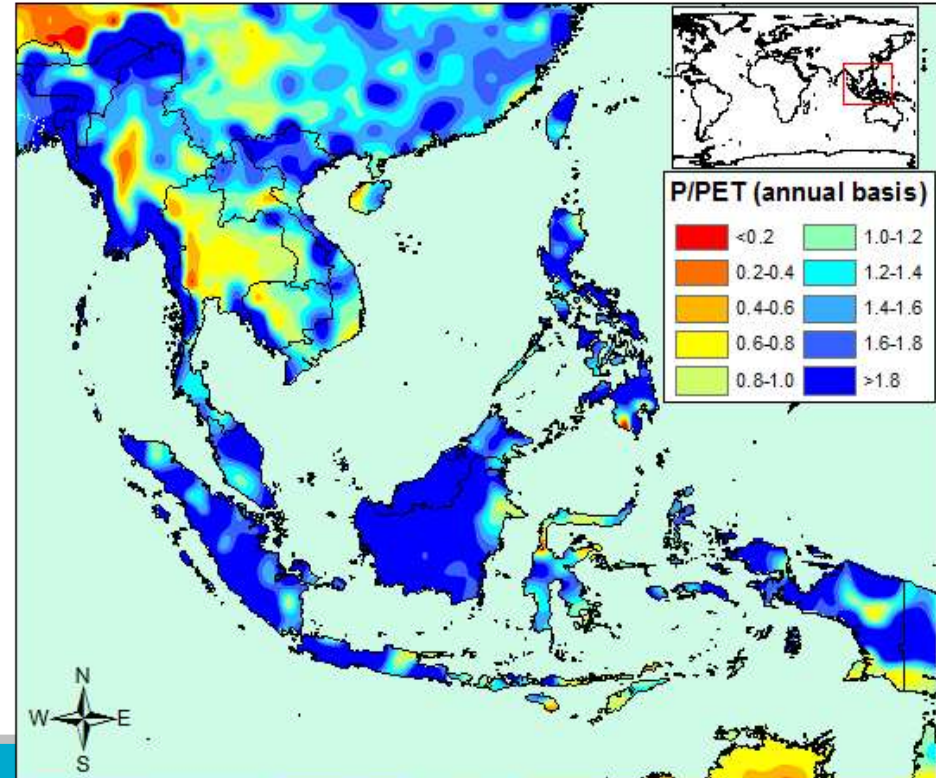
We have a 'yield gap' = opportunity!

- The productivity of most operational plantations falls significantly below benchmark
 - In one study, we found that operational company plantations achieved about 50% of experimental yields, and smallholder plantings achieved 25% of experimental yields
 - I expect that company yields are greater than 50% in many cases, but still well short of 100%



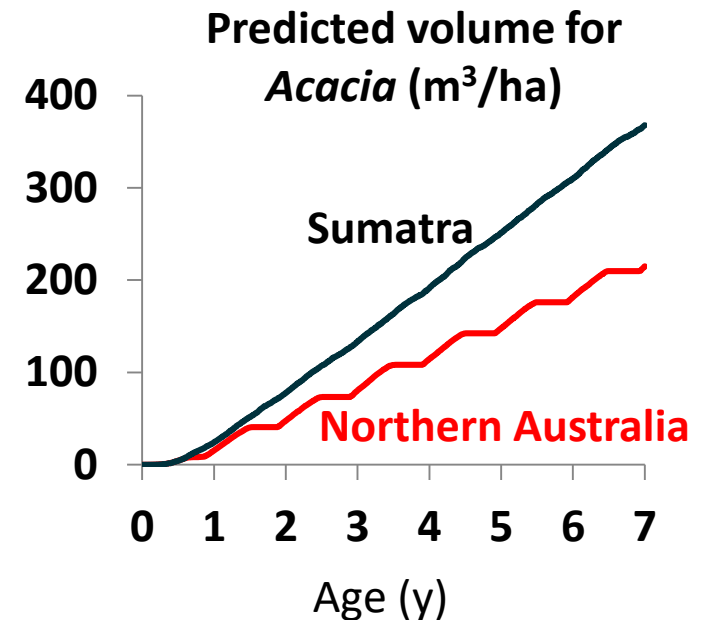
Available water often drives the upper limit of production

- In the wet tropics, water is less of a limitation:
 - Where rainfall is close to, or exceeds potential evaporation, productivity is likely to be light limited.
 - Water limiting only in shallow soils
 - Includes most of Sumatra, Kalimantan and Malaysia
- The seasonally dry tropics is where water limitations become more evident
 - Includes Vietnam, Laos, parts of eastern Indonesia, northern Australia
 - Much deeper soils are needed to store water



What is my maximum production?

- Productivity is the result of a complex interplay between site, genetics, climate, management and pests and disease
- Paired plots or research plots can provide good insight
- Process-based models can help to define the upper limit
 - But these need good knowledge of site characteristics, especially soil depth, and expertise to run them



Why aren't we achieving maximum production?

- Choosing the best species that grows well given the site and soil conditions, and is resistant to disease
- Nutrition is important but we know what to do in most situations
- Weed competition – we know we need to manage it but there can be a gap between theory and practice. Is it important?
- Site degradation can be an issue - cultivation and extractive harvest practices
- Pests and disease – are a big factor, especially in the wet tropics
- Fire
- **'R&D and Operations Gap'**



(Nambiar et al, 2018)

Nutrients

- **We now have simple guidelines in tropical acacia and eucalyptus plantations:**
 - **All sites need a small amount of starter fertilizer (P)**
 - **Almost no sites need followup/mid-rotation fertilizer**
 - **(Specific nutrient deficiencies may become evident at a small number of sites)**



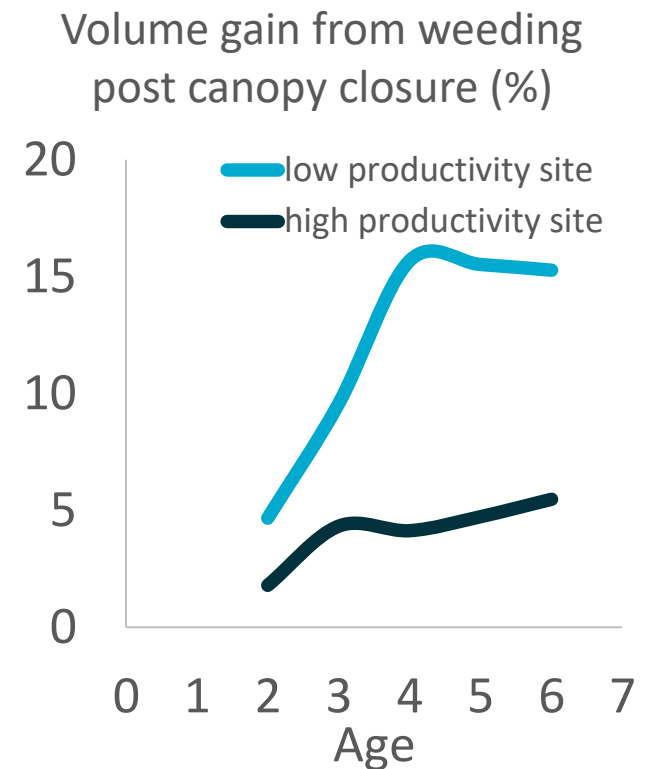
Site degradation is avoidable... but it still happens

- The inter-rotation period is when the site is at most risk
- We know what best practice looks like: no burning, minimum cultivation, residues retained
- Many growers are adopting conservative site practices, but burning and cultivation are still being practiced



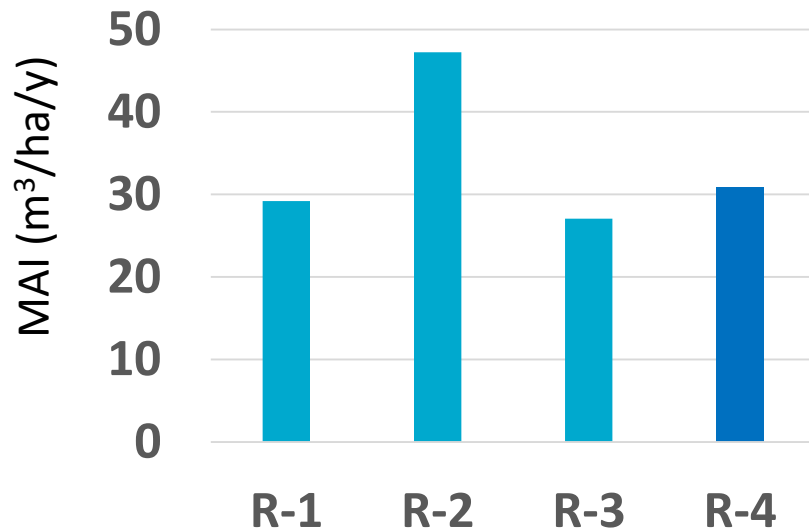
Weed control – important... but mostly known

- Full weed control up until canopy closure is important to maximise productivity
- Beyond canopy closure, small gains only

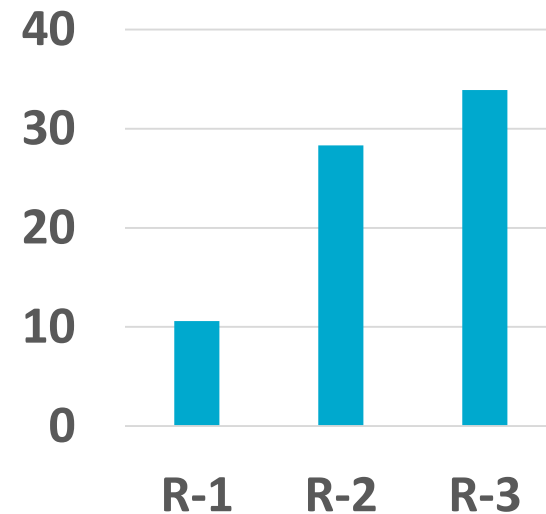


Maintaining productivity over successive rotations

- With good management, site quality can be maintained or improved
 - Adaptive management is key – transitioning from acacias to eucalypts has been critical
 - Coppice shows promise in eucalypts as long as stocking levels are maintained



Hardiyanto, Inail and Nambiar, 2021
(South Sumatra).



Huong et al., 2015 (Vietnam)

So, why is there still a yield gap?

- In most cases, simple guidelines will allow us to reach maximum productivity
 - Further R&D is important for continuous improvement
 - but will likely gain us no more than 5-10% more productivity at many sites
 - SOP's tend to be well researched and written and cover the basics well.
- Much of the gap is now driven by *operational challenges*
 - Timing of operations
 - Getting the right materials and right people onto the right site at the right time



Is the problem due to poor managers?

- **No! Growers are generally doing the best they can within the constraints they are given.**
- **Constraints are often in availability of skilled and unskilled labour**
 - **Workers and contractors should be rewarded in line with the value of their work**
- **It is a social, technical and operational issue**
- **It is also a researchable issue!**



Cover image via The Malaysian Times

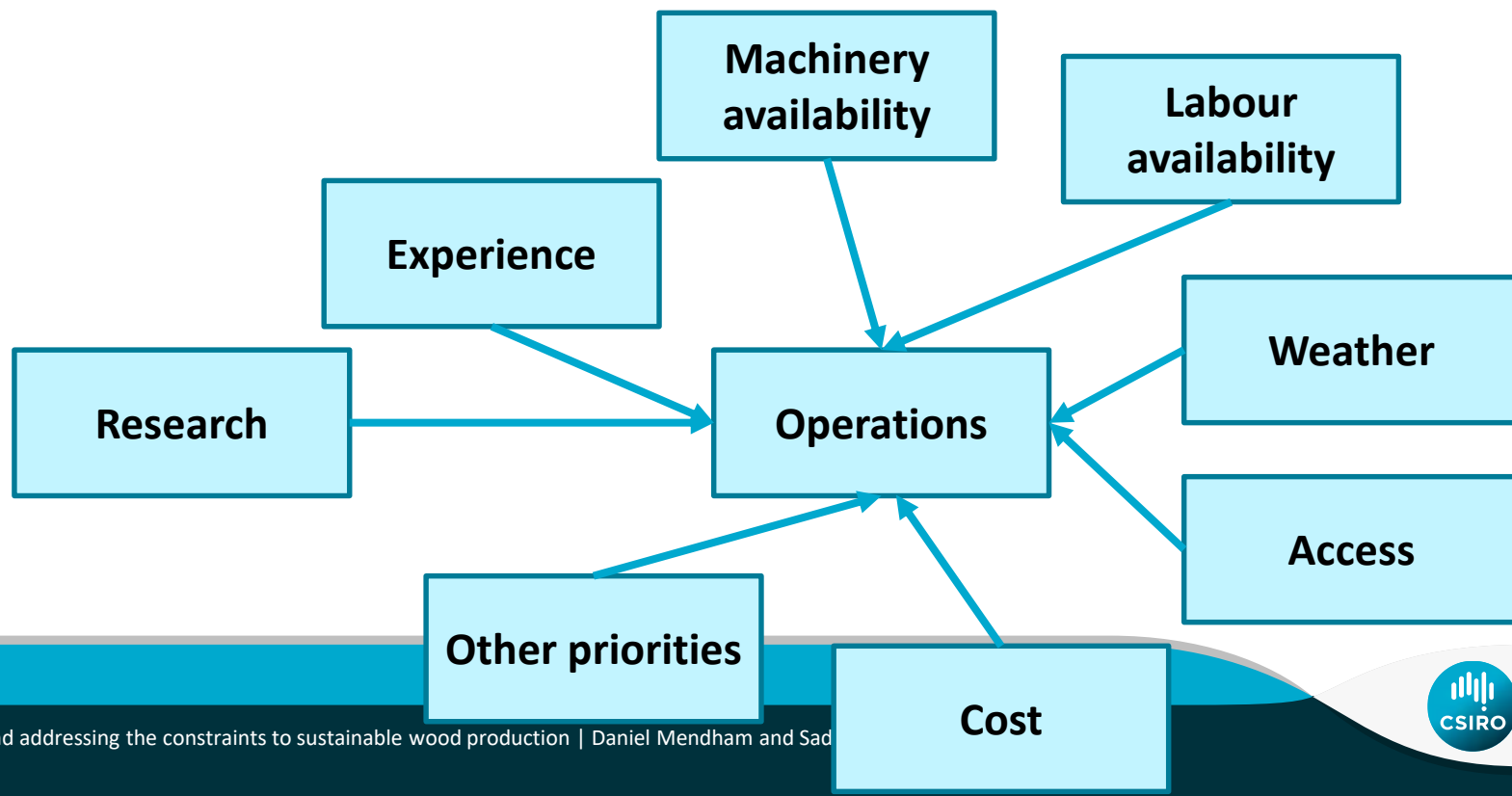
Interaction between social, technical and operational dynamics: It is a researchable issue!

- Our pathway to adoption as researchers is often linear



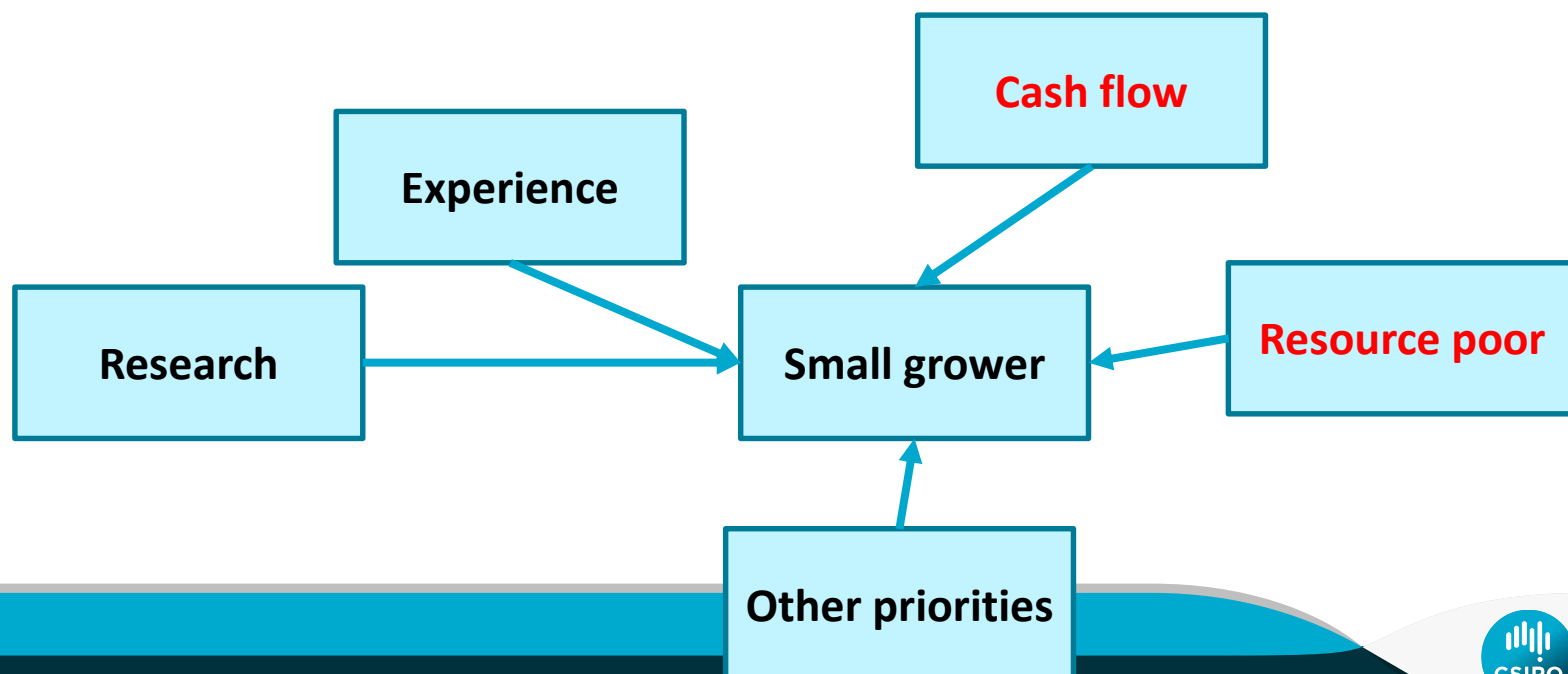
Interaction between social, technical and operational dynamics: It is a researchable issue!

- Our pathway to adoption in research is often linear
- Managers are making decisions based on many interacting factors



Interaction between social, technical and operational dynamics: It is a researchable issue!

- Linear approaches to R&D application don't work well – more than giving out a prescription!
- Small growers are also making decisions based on many interacting factors

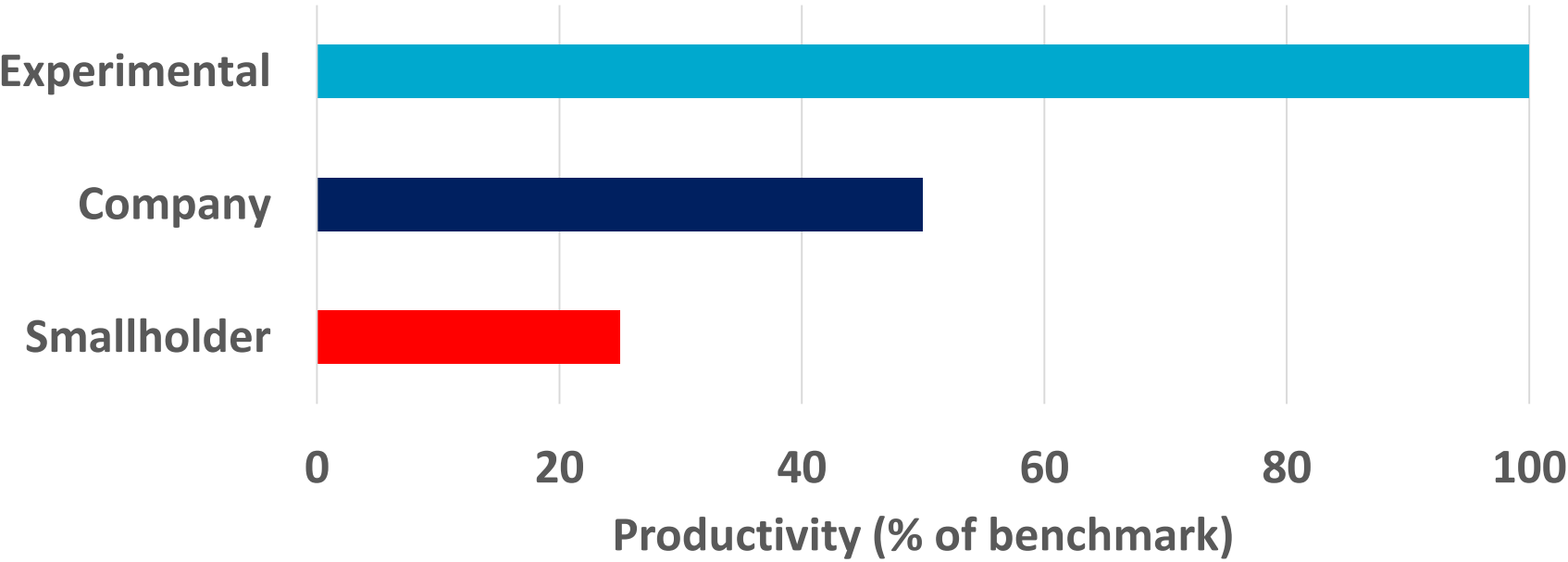


Interaction between social, technical and operational dynamics: It is a researchable issue!

- The answer lies in embedding research more deeply into operations and growing so that researchers and growers can:
 - Share each others insights
 - Develop a better whole of system understanding
 - Find solutions that are easy to implement and be adopted
 - Use action-learning principles to try, learn, adapt and repeat



We can solve this yield gap



Pathway forward

- Understand site limits and work to them. Paired plot type approach and/or process-based modelling
- Plan for best practice management – requires adaptive management and industry-wide information sharing
- Match available materials to the requirement
- Match and reward labour and skills to the task
- Develop a systems understanding among researchers and managers – including policy and social system
- Researchers and managers learn from each other – **a shared vision**

Conclusion

We have the tools to help us understand the yield gap and the resources to solve the problem, but it will take:

Researchers to think more like managers

Managers to think more like researchers

