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CELISE Symposium in Warsaw

'Systems Thinking lessons for research & education in sustainability transformation during 2023 CELISE-secondment to Colombia.'

Dr. Kim Stansfield, kimestansfield@gmail.com

VoCATE Ltd, Worcester, UK

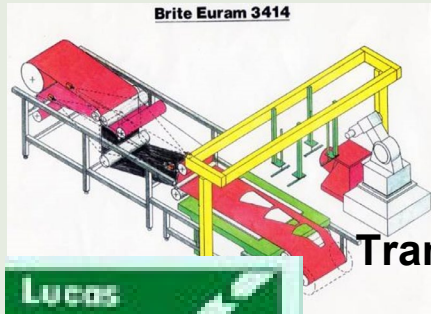
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Kim's BioPic



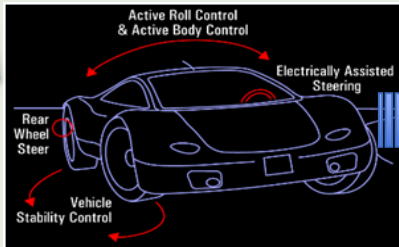
B.Sc. Metallurgy
M.Sc. Molecular Science
of Materials
PhD Aero. Composites



Lucas
Flexible Automation
Systems for
Aerospace
Composites
1990 - 1992



Safe Telematic
Integration 1997-1999



TRW Collision
Avoidance
1999-2001



Associate Prof
Transformational Systems Engineering
2016-2020



'Akao Prize' Winner
2016

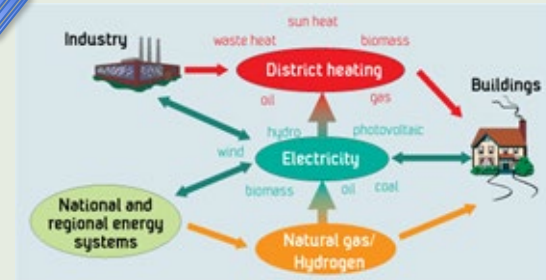


'Toasting' Yoji Akao

2010



Enterprise Systems Transformation
2002-2010



Energy Technologies Institute
Sustainable Energy Systems QFD
2013-2015



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About VoCATE Ltd.



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Voice of The Customer Across The Ecosystem

A Consulting & Education very-Small Enterprise (v-SME) with a **mission** to:

*'Guide and equip commercial, government, non-government and educational clients in transforming products, services, processes and systems to **meet and exceed customer and stakeholder needs and expectations.**'*

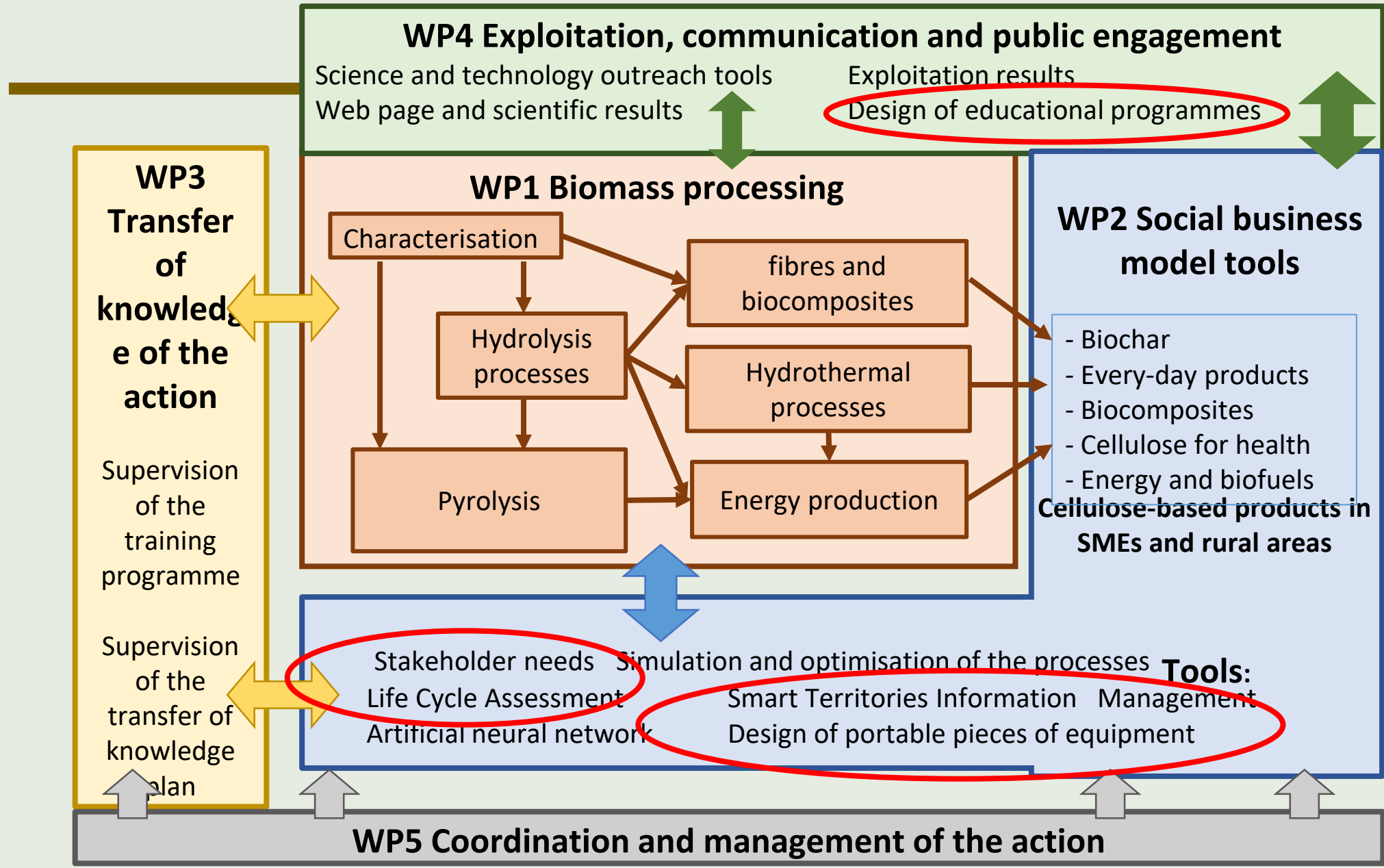
Delivered through **consulting** and/ or **training** staff at all levels in:

1. **Systems Thinking** and **Systems Engineering Leadership Practice**
2. **Modern QFD - New Product/Process/ System Introduction Transformational Business & Enterprise Architecture Design**
3. **Systems Engineering Quality Assurance & Management (SEQAM) approaches**





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Kim Stansfield Secondment UCC Medellin

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- Duration 11 April to 12 May 2023

Task 1.5. Production of fibres and applications.

- To study the stakeholders needs for technologies Commercialisation based on QFD (Quality Function Deployment) and Design Thinking approaches.
 - Provide recommendations on the best methods for identifying technical requirements for the design of solutions.

- Locations:

1. **UCC Medellin Part 1:** Meetings and training with In³, UCC Staff, Research Seedbed; Business Stakeholders – EPM, TIG, LATAM Sustainability Network; MOVA Teaching Innovation Centre
2. **North East Coast Visit:**
 1. Manaure - **La Paz School Visit**, Sustainability NGO;
 2. Santa Marta – UCC Campus, (Simon Bolivar Museum – Socio-Political history);
 3. Cartagena – Marine Botany **Sustainability NGO, Afro-Caribbean community**, UTB University Briefing, Ghenova
3. Medellin Part 2: EPM Hydrogen Hub Workshop, Further UCC staff meetings and In³ teaching and coaching



'A Systems Thinking Framework To Co-create An Education Program Supporting Colombian Transition to a 'Green-Hydrogen' Economy

- Aligning Value Chains and Stakeholder Needs to Deliver High-Impact Outcomes

Presented at the EPM UCC Medellin Workshop:
05th May 2023



Presenter

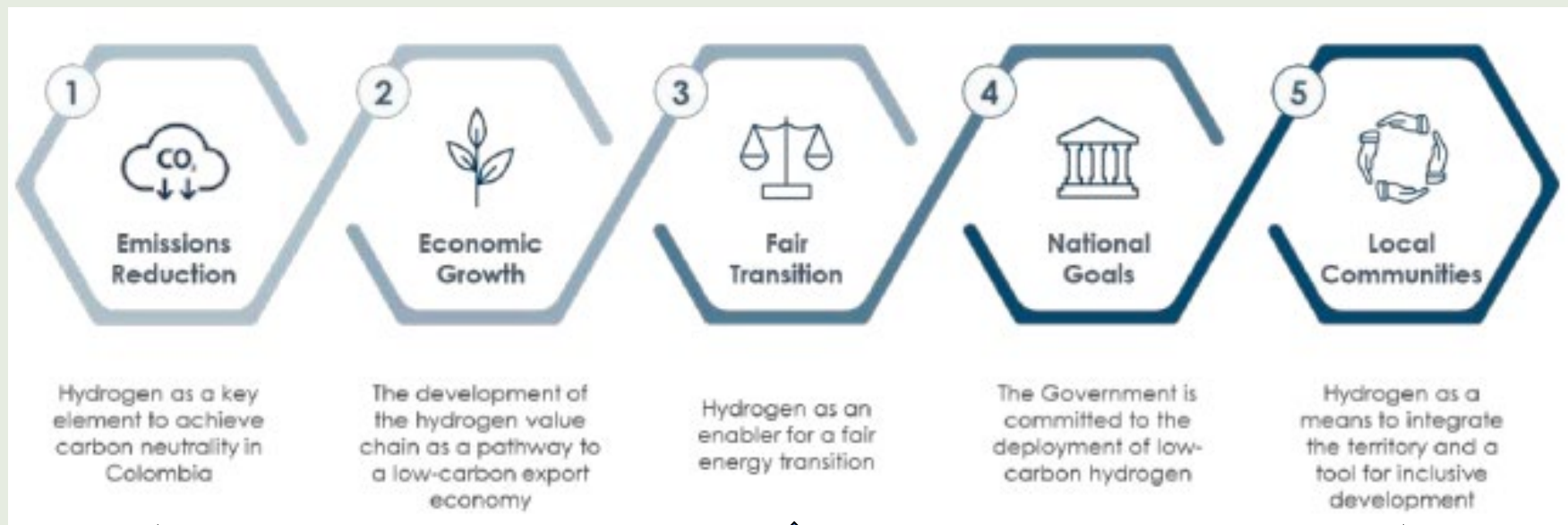
Dr Kim Stansfield, PhD, MSc, BSc, C.Eng., Director VoCATE Ltd., UK, *Akao Prize Winner 2016*





5 Pillars Colombia's Hydrogen Roadmap*

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Delivering a robust transition to a Hydrogen economy is underpinned by a practical education program for **all participants at all stages of education**

'Life-long learning'

* Graphic from pp 23 'Colombia's Hydrogen Roadmap', 2021



Why Hydrogen in La Guajira

- The La Guajira region is a peninsula in North East of Colombia
- A number of indigenous tribes occupy the region including the Wayuu
- La Guajira's economy and employment among the Wayuu relies heavily on coal mining at Cerrejon mines
- 'Colombia's Hydrogen Roadmap' identifies coal as a potential feedstock for production of Hydrogen
- Transitioning the region to the Hydrogen-Economy could provide a boost to the economy & jobs while reducing CO₂ i.e. **improves Economic, Environmental and Social Sustainability/Justice!**



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Potential Local Resources & Associated Needs

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- Source of **hydro/wave, solar & bio** energy to generate green-electricity to support:
 - Generation of green-hydrogen from:
 - Biomass – waste vegetation
 - Coal – fossilised biomass
 - Economic electrolysis of water to H₂ and O₂
 - Production of clean water:
 - Desalination of sea water
 - Decontamination of mine water
- **Local Community Needs:**
 - New approaches that **grow economic sustainability** for community, not destroy economic viability
 - Practical education of local people for sustainable research, operation, and entrepreneurial skills and capabilities

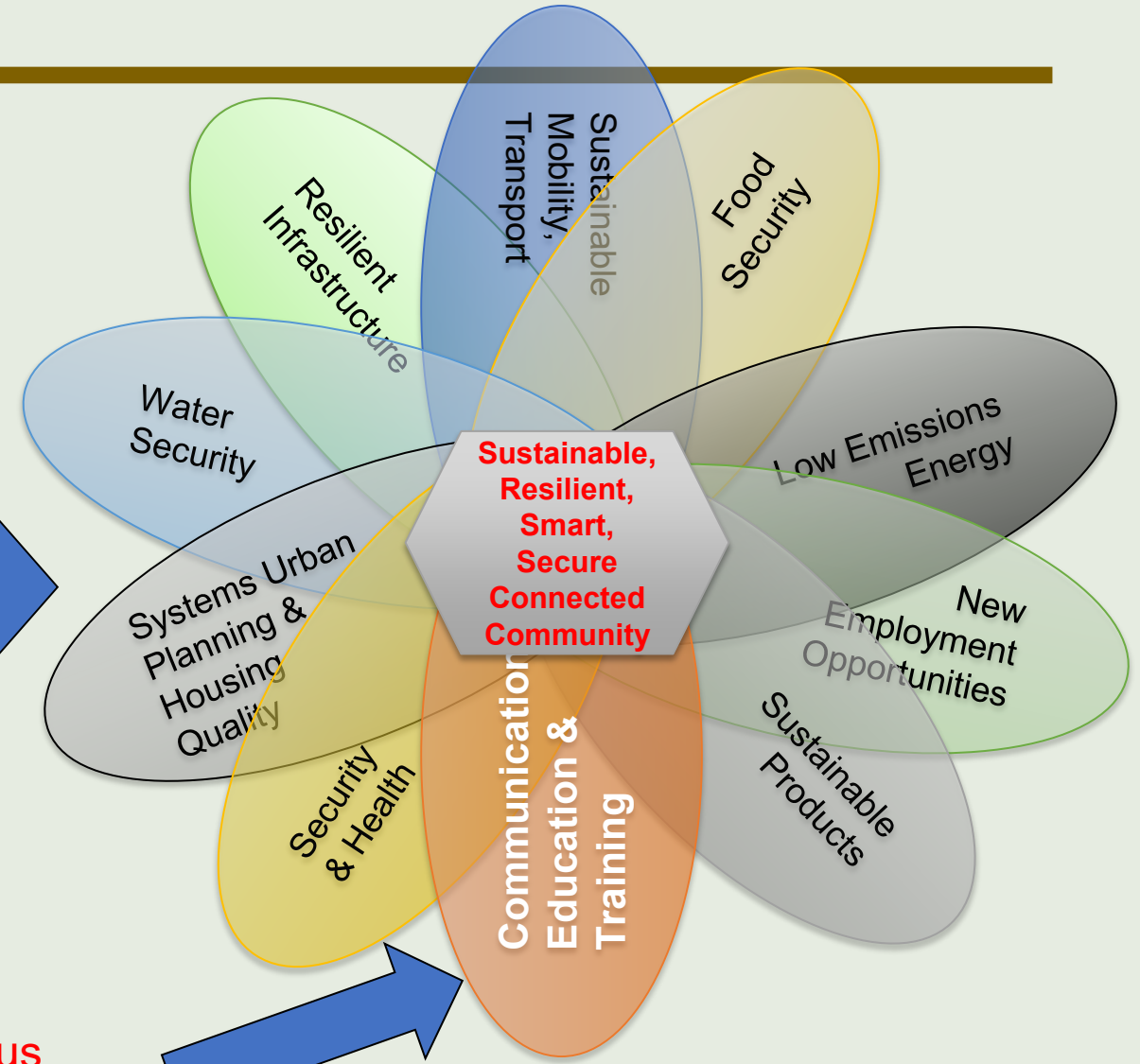


.. community sustainability is a complex socio-technical challenge!

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Complex socio-technical system development interactions leading to sustainable, resilient communities



Focus
Today

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Why is a **Systems Thinking** approach critical?

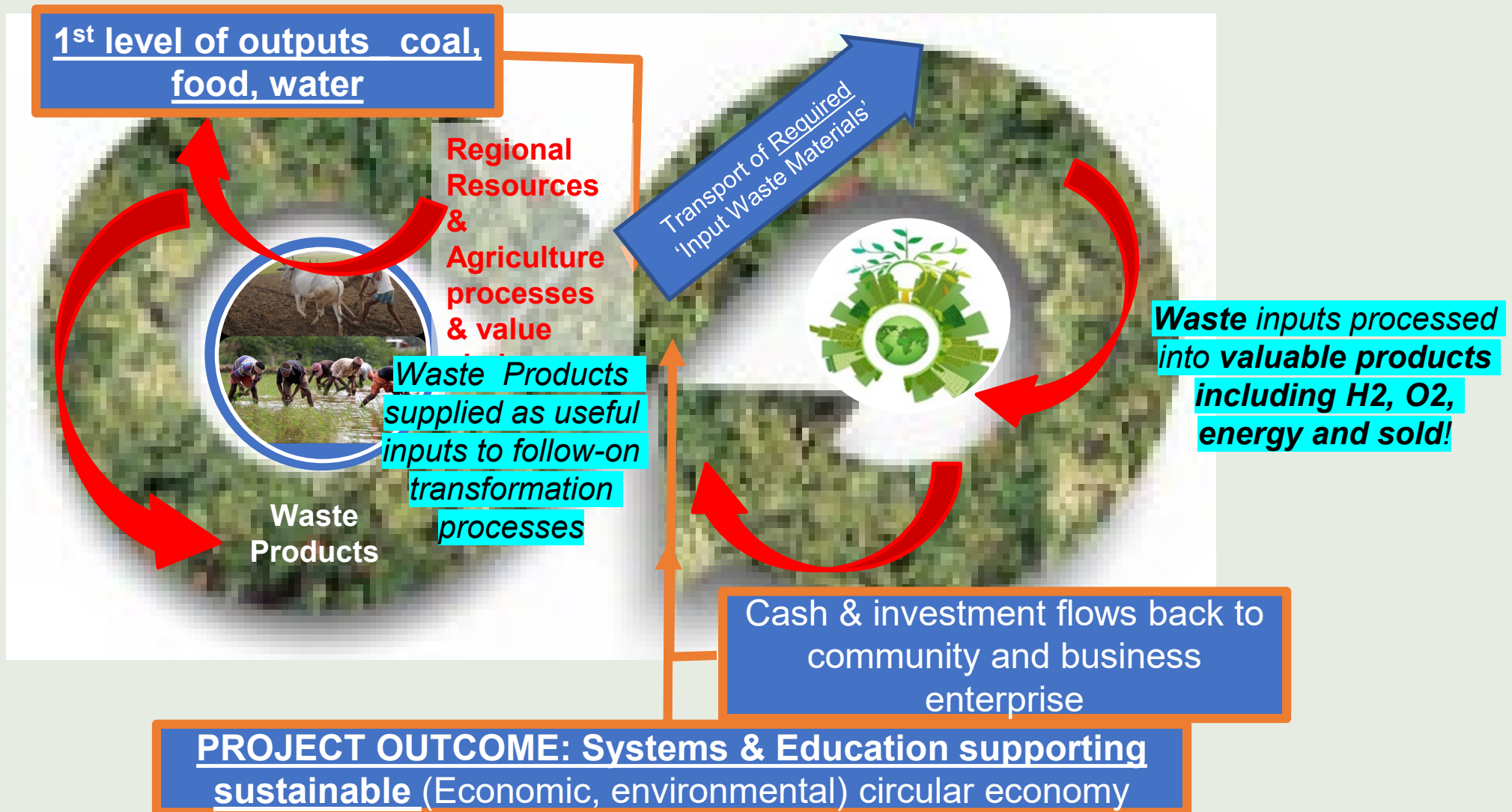
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- To deliver such a complex transition we need a framework & methods that can help developers:
 - Analyse complex problem spaces and align system & technological concepts
 - Identify and engage key stakeholders and the value-chains they support 'As-Is', & in the future, 'To-Be'
 - Systematically capture, prioritize and analyse problems and needs
 - Bring the different voices together to '**co-create high value/ quality, integrated** socio-political, socio-technical and business model solutions
- The methods described are not exhaustive, but are key steps for initial transition planning



Circular Economy Concept *'Waste from one process becomes valuable input for another process'*

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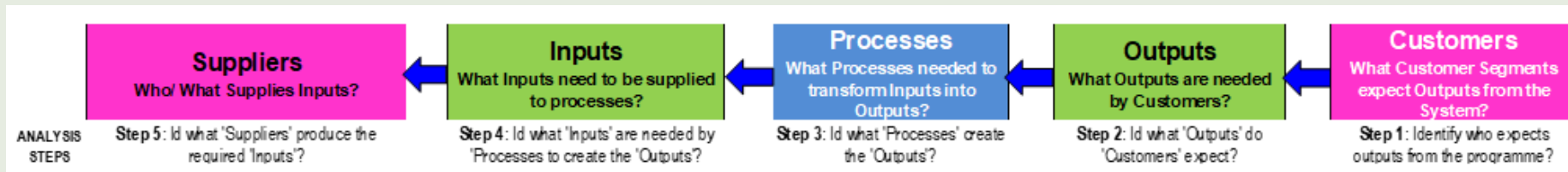




Clarifying program 'value supply chain' SIPOC

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- Simplified 'To Be' SIPOC for La Guajira Coal Mining Operations



'To Be' – Coal to H2



Colombian Communities

Colombian Energy Supply Businesses

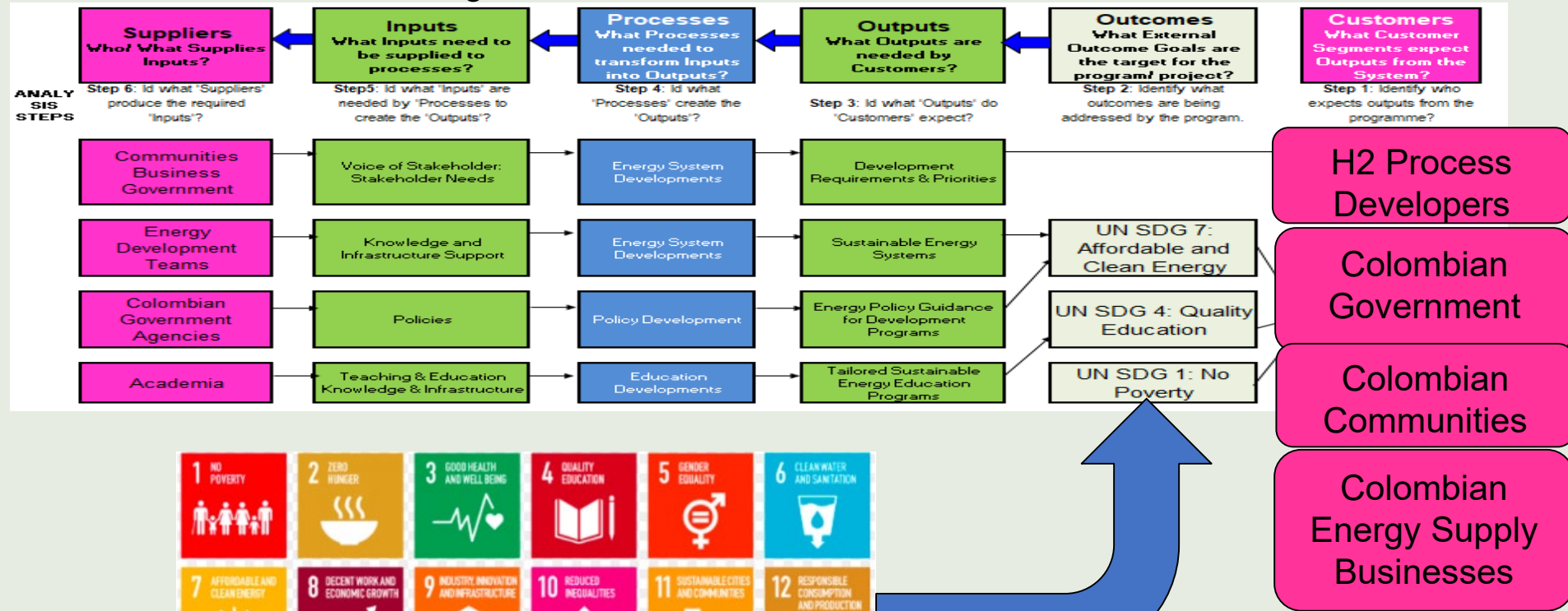
'To Be' – Waste vegetation to H2



Colombian Government & Society

SIPOOC includes Outcomes i.e. social impacts targeted by the program

- For complex socio-political, socio-technical sustainability programs the team have modified SIPOC to SIPOOC, adding Outcomes/ UNSDGs!



Which of 17 UN SDG's are enabled by the program SIPOC?



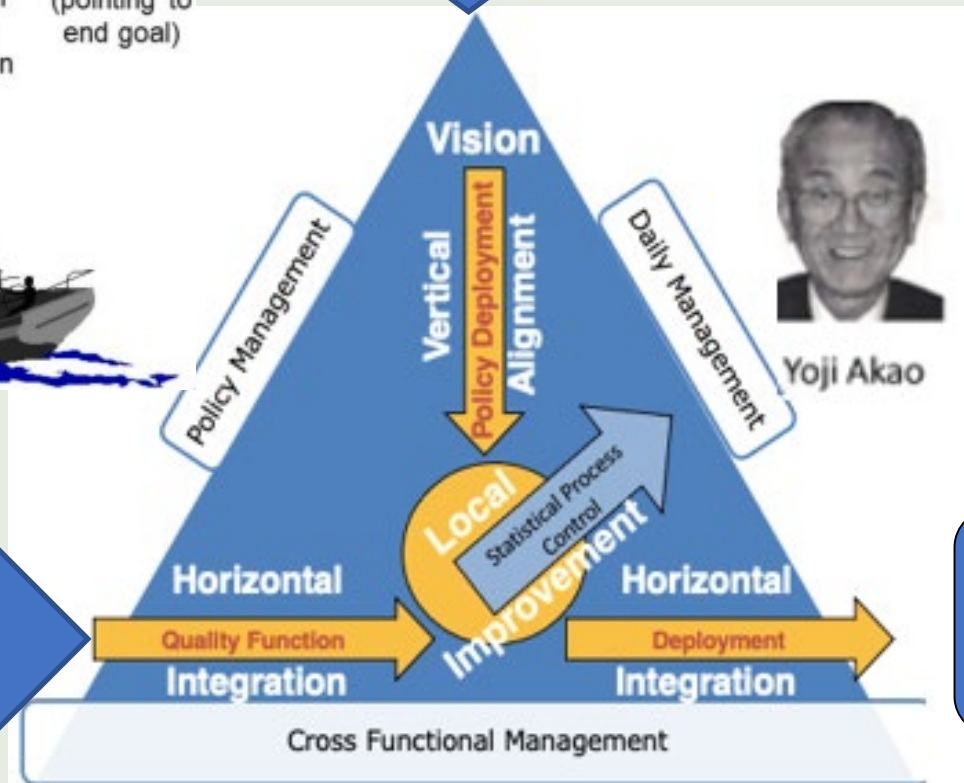
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Aligning system development to Policy and Voice of the Customer: Key Concepts: 1968

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Yoji Akao



'Toasting' Yoji Akao
2010

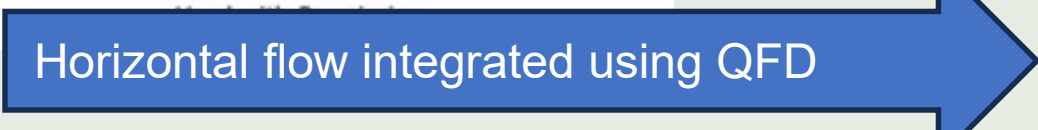
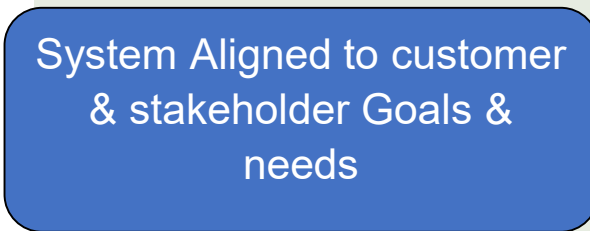
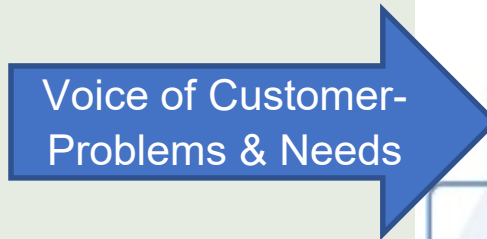


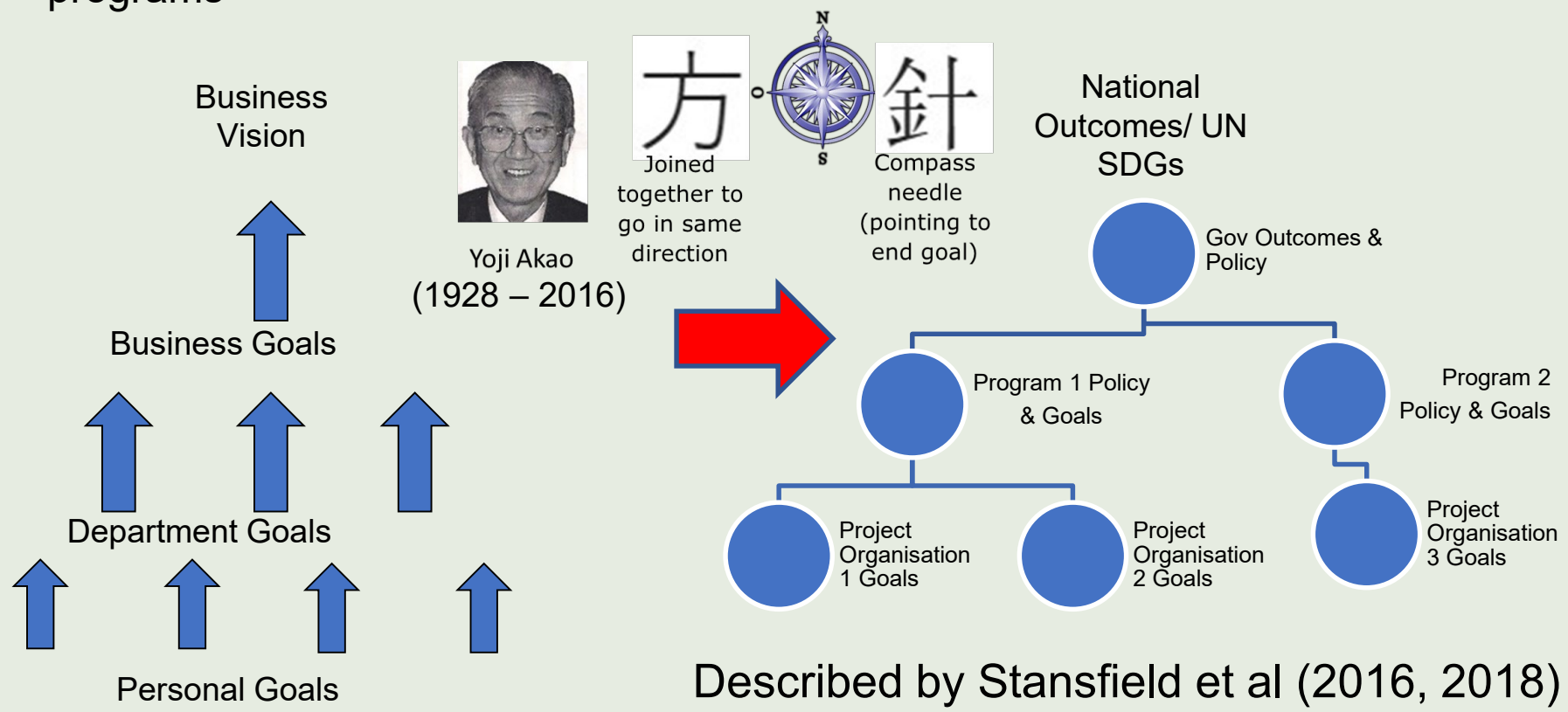
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Strategy deployment using Hoshin Kanri - from business to national programs

- Originally aligned Personal & Departmental goals to support a few critical business goals
- Stansfield et al (2016) showed how this can be deployed on National Sustainability programs



Manaure –La Paz School Visit ‘Systems Thinking Lessons



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- During visit In³ researchers demonstrated VR of gamified Digital Twin of Exeter Retort Pyrolysis of Cocoa waste plus drone mapping of site
 - Teachers and students queued up to participate!
 - Excitement level of both groups raised – desire to find out more
- School needs 20k litres of clean water a week for 500 pupils and staff
- We were shown to desalination plant – not working for 5 yrs.
- Offer by UCC Medellin to fix plant blocked by local politician
- After 6 months apparent that **no local solution available** as originally stated by the politician
- So school **buys 20k litres of clean water/week!**





Systems Thinking Lessons from visit

- When mapping the **'As Is'** SIPOOC, current beneficiaries of value chain must be identified - or they become blockers
- **'To Be'** SIPOOC must ensure that As Is beneficiaries can see they will benefit from new solution! E.g. school becomes low-cost supplier of clean water to their supplier
- Process of **fixing the desalination plant** and digital twin approach could educate and **build skills of teachers and students**
- **Local vegetation** offers further **source of bioproducts** that offers **practical chemistry**, process technology and design **education** and capability development for **pupils and teachers**
- Understanding **needs of teachers and pupils** underpins development



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Cartagena –Systems Thinking Lessons From Visit

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- Visit to Cartagena's Afro Caribbean community
- **Ignored by council** and local government
- Area just up from holiday beaches in relative squalor
- Superb seafood cooking, prepared with love
- But community feel they are outside 'justice'
- **Natural marine resources, marine energy & human needs & potential being ignored**
- As with Manaure – a **tailored system solution that listens to community needs** and builds energy capture, circular economy, practical education for sustainability **could transform this area** by for example **building a local 'eco-tourism' value chain**





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THANK YOU



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