Systems Engineering Vision 2035 – Turning Fiction into Fact

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The Argument

1. Vision 2035 is a worthy ambition for SE
2. A great opportunity if we get it right this time
3. But it seems like we've been down this way before …
4. So, what is needed?
5. And how can the vision be achieved?
6. Critical Systems Thinking (possibly)
7. But it is a big ask …

A Worthy Ambition for SE

SE VISION - 2035 – Engineering solutions for a better world:

- SE applied to major societal challenges to meet human and societal needs
- Ensure the pieces work together to achieve the objectives of the whole
- Architect balanced solutions that satisfy diverse stakeholder needs
- Adapt to evolving technology and requirements
- Manage complexity and risk

Opportunities for SE: An Example

Supporting a 'Mission Economy' (Mazzucato, 2021)

- Taking inspiration from the Apollo Programme to manage the social and environmental challenges we face today
- Problems of inequality, ageing, new technologies, pollution, climate change, health, etc.
- A mission/project-oriented approach led by government and engaging public, private and third sectors, and civil society

The UK Government's 5 missions

Mazzucato argues that, nevertheless, significant changes are needed to the 'systems management' approach of Apollo to cope with the 'wicked problems' faced today, which encompass behavioural, social, economic, political, environmental as well as technical issues

Seems like we've been down this way before …

What was tried?

- Association with the Apollo programme bathed SE in 'moonglow'
- Aim was to transfer the approach to social problems, waste, crime, welfare, transportation, information management, urban problems, the Vietnam war
- US Department of Defence; all Federal Government Departments; by 1966, 25 States and 19 cities running projects

What happened?

- Largely a failure, as has been well documented
- Hoos (1974) looking at the readiness of SE and SA to deal with problems that are essentially human and social concluded:

'The findings indicate that in their present condition they are not. And the direction in which they are developing promises little improvement'

- Set back the cause of systems thinking in the social domain for a generation
- 'Incomplete and often incorrect methodology' (Tomlinson and Kiss, 1984)
- Warfield, Checkland, Jackson – INCOSE 'pioneers'

A lesson not apparently learned in SE Vision 2035

What is needed to realise the ambition?:

Virtually nothing according to SE Vision 2035!!

- Theoretical and methodological foundations discussed on one page (p.42) of the 66 page main document
- Pays lip service to what is necessary:

  ‘Additional foundations are still being derived from physical, social, and systems sciences, and will be integrated into a more cohesive set of SE theoretical foundations’

What is needed? Lessons from Our house on the Segura River ....

‘By the 1990s, the Segura had become one of the most polluted rivers in Europe, due to the canning industry and urban and agricultural residues originating in the densely populated area in the medium and lower areas of the basin.....Public outcry peaked in 2001, with a demonstration gathering 40,000 people’

(Wikipedia)

The Segura River Reclamation Project

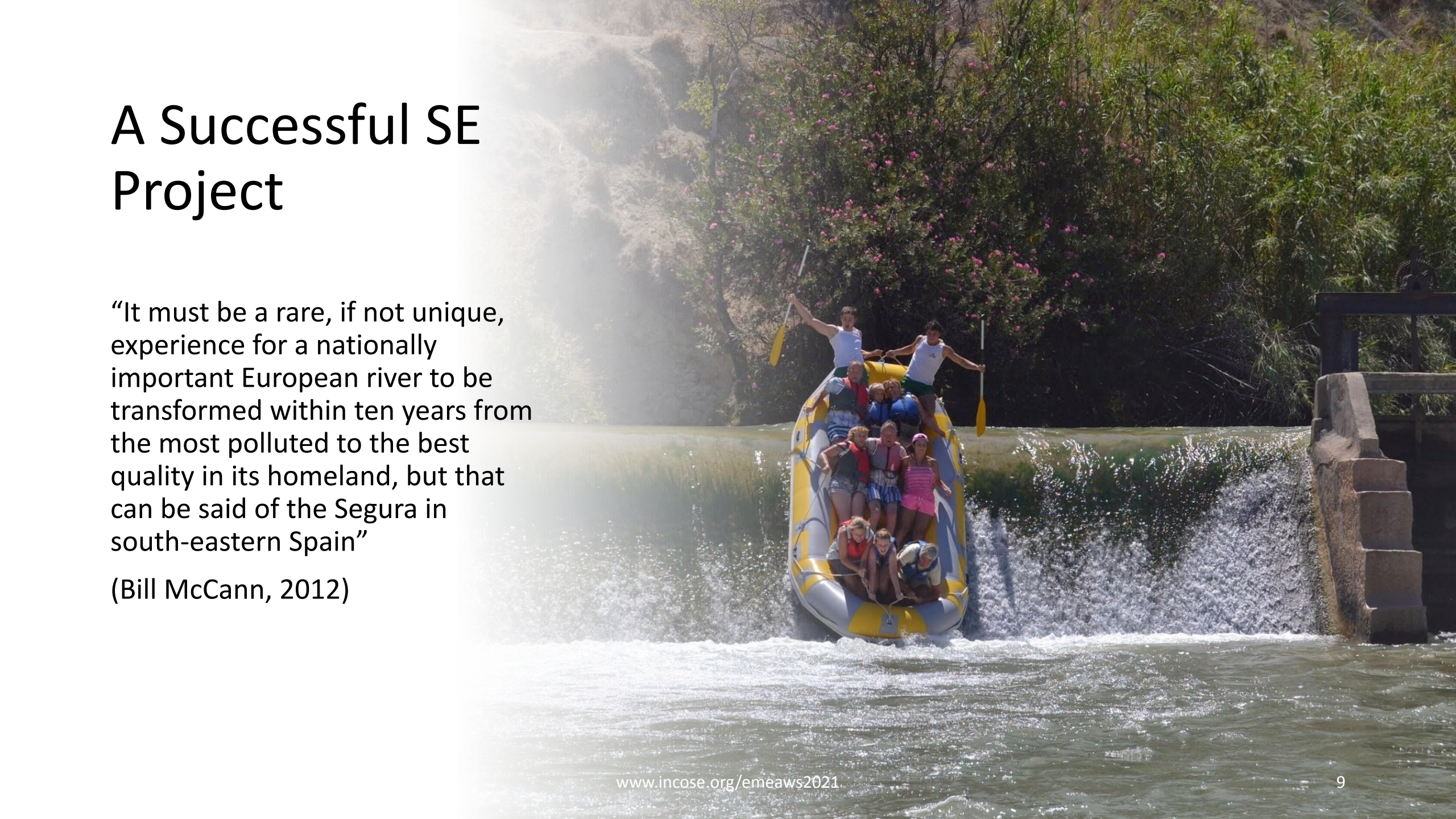
"The Integrated Urban Reclamation and Reuse System in the Murcia Region represents an example of the modern engineering approach: Systems Engineering.....It is the right approach for solving problems of such complexity as the environmental restoration of a great river within a structural water deficit scenario, or the integrated management of water scarcity"

(Spanish Society of Systems Engineers, 2011)

A Successful SE Project

“It must be a rare, if not unique, experience for a nationally important European river to be transformed within ten years from the most polluted to the best quality in its homeland, but that can be said of the Segura in south-eastern Spain”

(Bill McCann, 2012)



2016 European River prize Winner – Segura River, Spain

What Circumstances are Conducive to the Success of SE Projects?

- When pre-planning is possible (study of advanced treatment plants, public consultations, environmental impact assessment)
- When technical expertise is necessary and available (best treatment plants, scheduling of primary, secondary and tertiary facilities)
- When the power to decide corresponds/can be made to correspond to the boundaries of the problem-situation
- When the requirements of different elements of the project (e.g. increasing water availability, water treatment, environmental concerns) are in harmony
- When stakeholder support is widespread and overwhelming
- When it is possible to overcome any political barriers to success (local authorities, opposition to the discharge levy)

Can't rely on these being present with Complex Sociotechnical Systems…..

(M.A. Rodenas, M.C. Jackson, Lessons for SE from the Segura River reclamation project, *Systems Research and Behavioral Science*, 2021)

How can the vision be achieved: Critical Systems Thinking and Practice (possibly)

- A pragmatist approach to multidimensional complexity
- Multiperspectival
- Multimethodological
- Flexible
- An approach that seeks to bring about multidimensional improvement

What is Critical Systems Thinking?

Critical Systems Thinking is Multiperspectival:

Some Useful ‘Systemic Perspectives’ for Engaging with Complexity

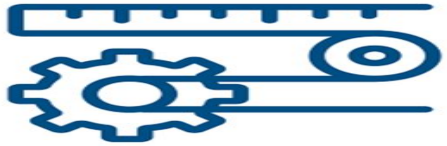
‘Successes of cognition’, ‘creative discoveries of generations’ (Pepper, 1942); ‘experiential gestalts’ (Lakoff & Johnson, 1980); social theories

Mechanistic
Interrelationships
Organismic
Purposeful
Societal/Environmental

“The gears grind, the lights flicker, and the lenses distort. Nevertheless, we do seem to get some idea of our world from these vehicles, and without them we should have to walk pretty much in the dark” (Pepper, 1942)

Systemic Perspectives

Mechanistic



Interrelationships

Organismic

Purposeful

Societal/Environmental

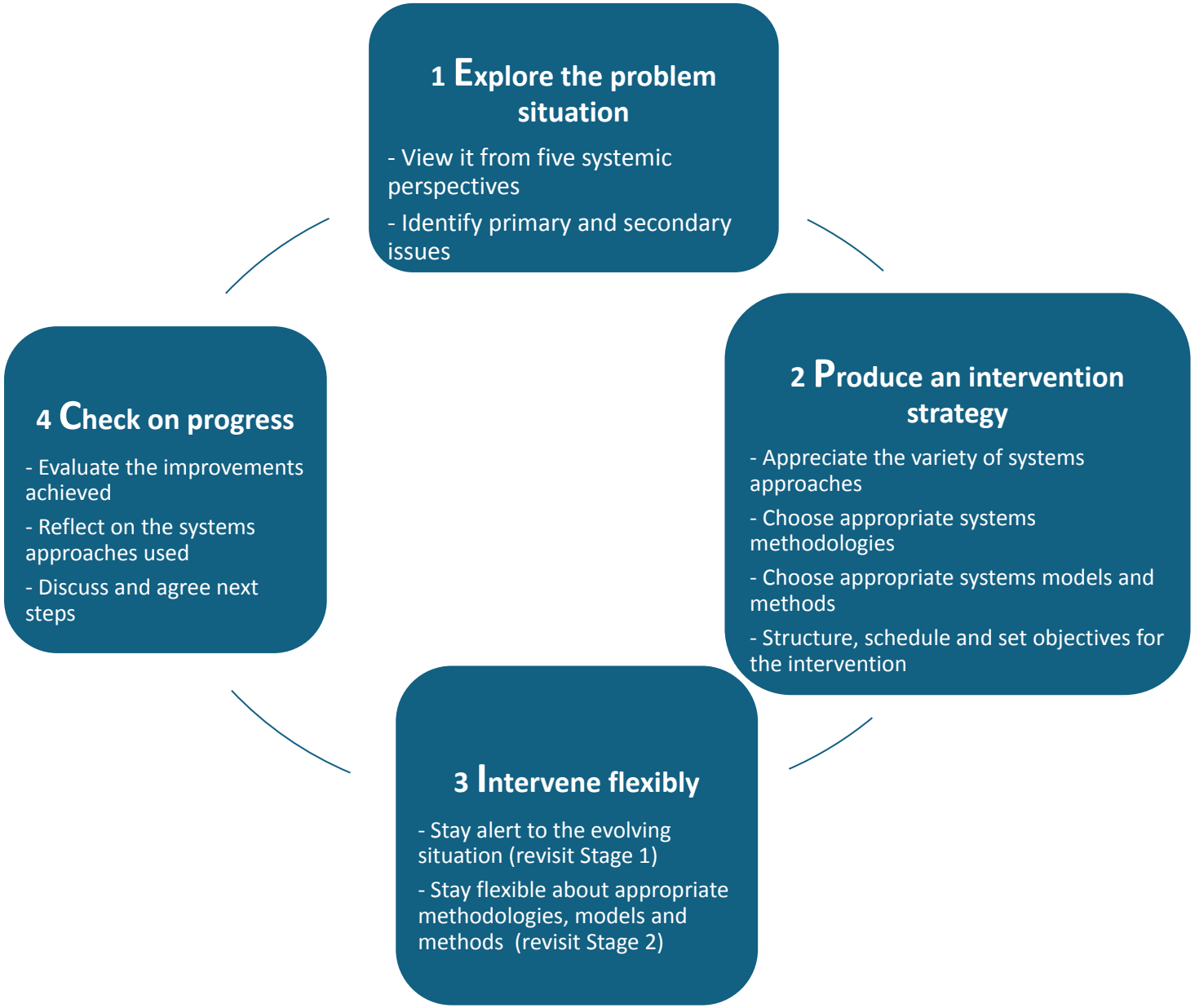
They offer ‘adequate’ partial truths

What is Critical Systems Thinking?

Critical Systems Thinking is Multimethodological – it offers ways of responding to issues raised by looking at the world through the five perspectives:

- Mechanistic issues – efficacy and efficiency – **Systems Engineering**
- Interrelationships issues - multi-causality, unintended consequences, leverage points – **System Dynamics**
- Organismic issues – viability and resilience – **The Viable System Model**
- Purposeful issues – learning, mutual understanding and accommodation – **Soft Systems Methodology**
- Societal/environmental issues – who or what is advantaged or disadvantaged – **Critical Systems Heuristics**

Critical Systems Practice : The *EPIC* Cycle



How Can Critical Systems Thinking be of Use to SE?

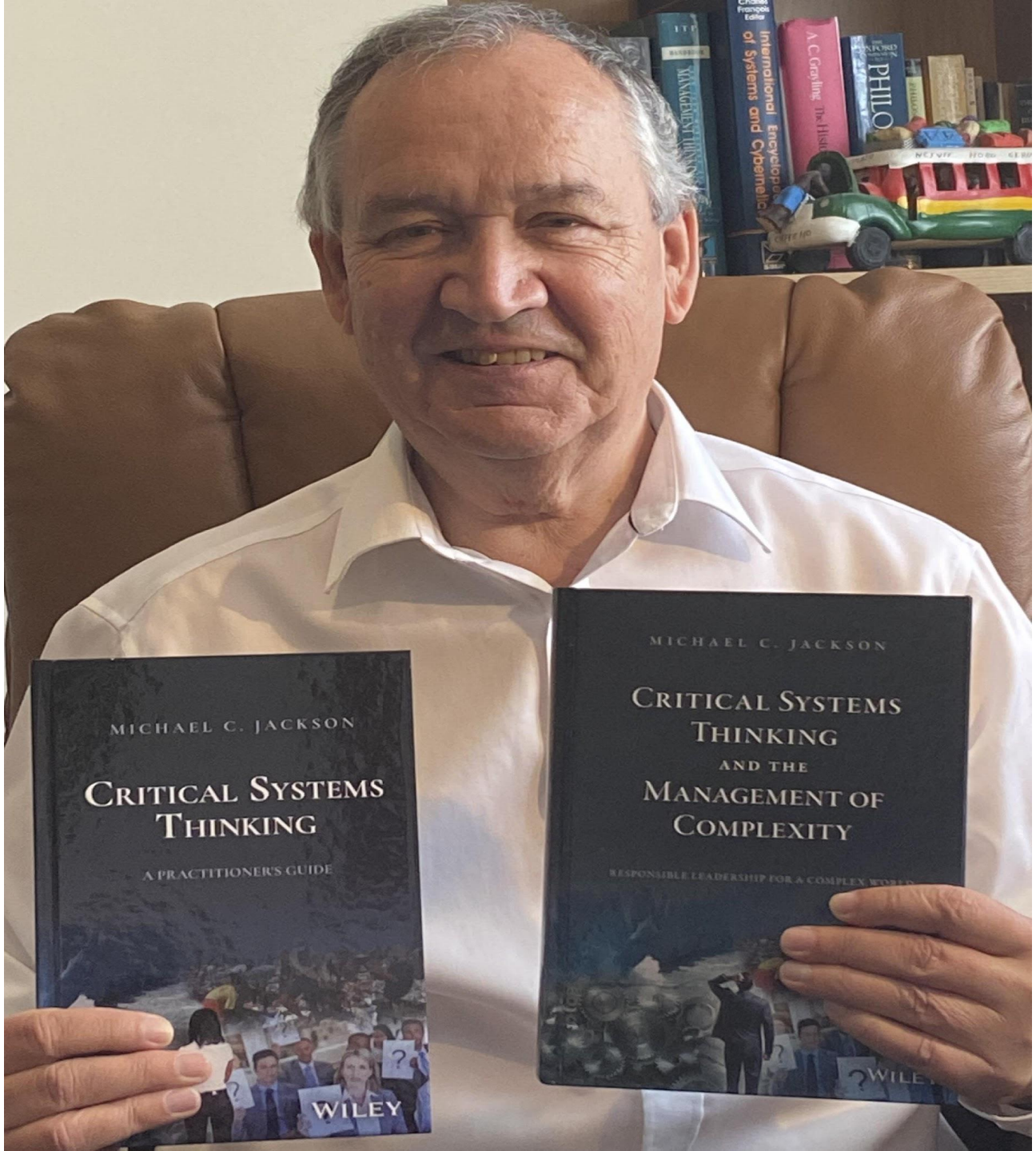
If SE embraced Critical Systems Thinking, it would be:

- **More capable of addressing major challenges in a broader range of application domains (industry sectors, societal and environmental issues)**
- **More capable of engineering solutions for a better (more 'balanced') world**
- **Better supported by a more encompassing foundation of theory and sophisticated methodologies and model-based tools**
- **More able to enhance its educational infrastructure to equip future Systems Engineers prepare for the challenges they will face**

(SE Visions 2025/35)

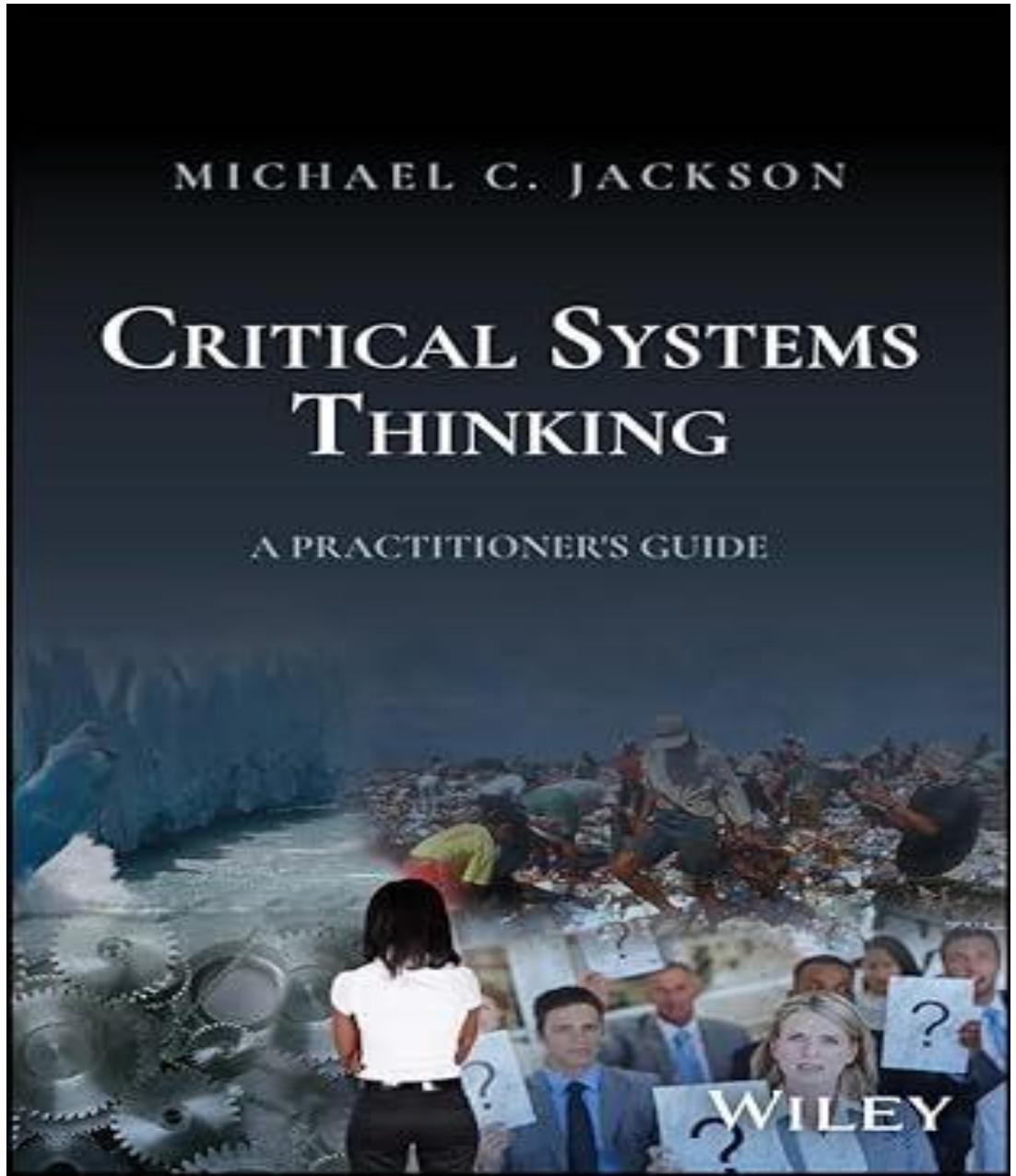
BUT … it is a big ask

- SE VISION 2035 is overwhelmingly mechanistic in its orientation
- Embracing new worldviews and thereby paying equal attention to interrelationships, organismic, purposeful, and societal/environmental concerns (and using the associated systems methodologies) requires significant shifts in thinking and demands considerable mental agility
- But … it is essential if SE is truly to contribute to addressing major societal and environmental challenges and **turn the SE Vision 2035 from fiction into fact**


MICHAEL C. JACKSON
CRITICAL SYSTEMS THINKING
A PRACTITIONER'S GUIDE
WILEY
MICHAEL C. JACKSON
CRITICAL SYSTEMS THINKING
AND THE
MANAGEMENT OF COMPLEXITY

Thank You!

Practitioner’s Guide and Relevant Conference



2026 Conferece

SYSTEMS THINKING SYSTEMS PRACTICE

24TH - 26TH MARCH 2026
UNIVERSITY OF HULL

CALL FOR ABSTRACTS

Whether you're a seasoned systems thinker or currently only systems curious this conference is for you. To make it happen, we are now seeking high quality abstracts for the conference sessions at the University of Hull, 24th-26th March 2026.

This conference aims to do things differently, bringing together in lively debate systems academics and public and private sector systems practitioners. We're looking for 250-word proposals for:

- Introductory training sessions for the systems curious
- Interactive workshops using systems thinking to address real-life predicaments
- Case studies showing systems thinking in practice
- Papers advancing systems theory and systems methodologies
- Poster presentations demonstrating systems thinking in practice

Preference will be given to proposals that bring together theory and practice in innovative and engaging ways suitable for a conference that combines researchers and practitioners of varying levels of experience.

DEADLINE FOR SUBMISSION: 12TH DECEMBER 2025

Submissions are by email, please send your name, affiliation, and abstract, alongside any queries to:
Systems.Conference@hull.ac.uk

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