SUSTAINABLE and LIVEABLE INTELLIGENT BUILDINGS

- **CIB TG 88 JUNE 29 2021**

Professor Derek Clements-Croome
University Reading
www.derekcroome.com

CIB W098 Roadmap

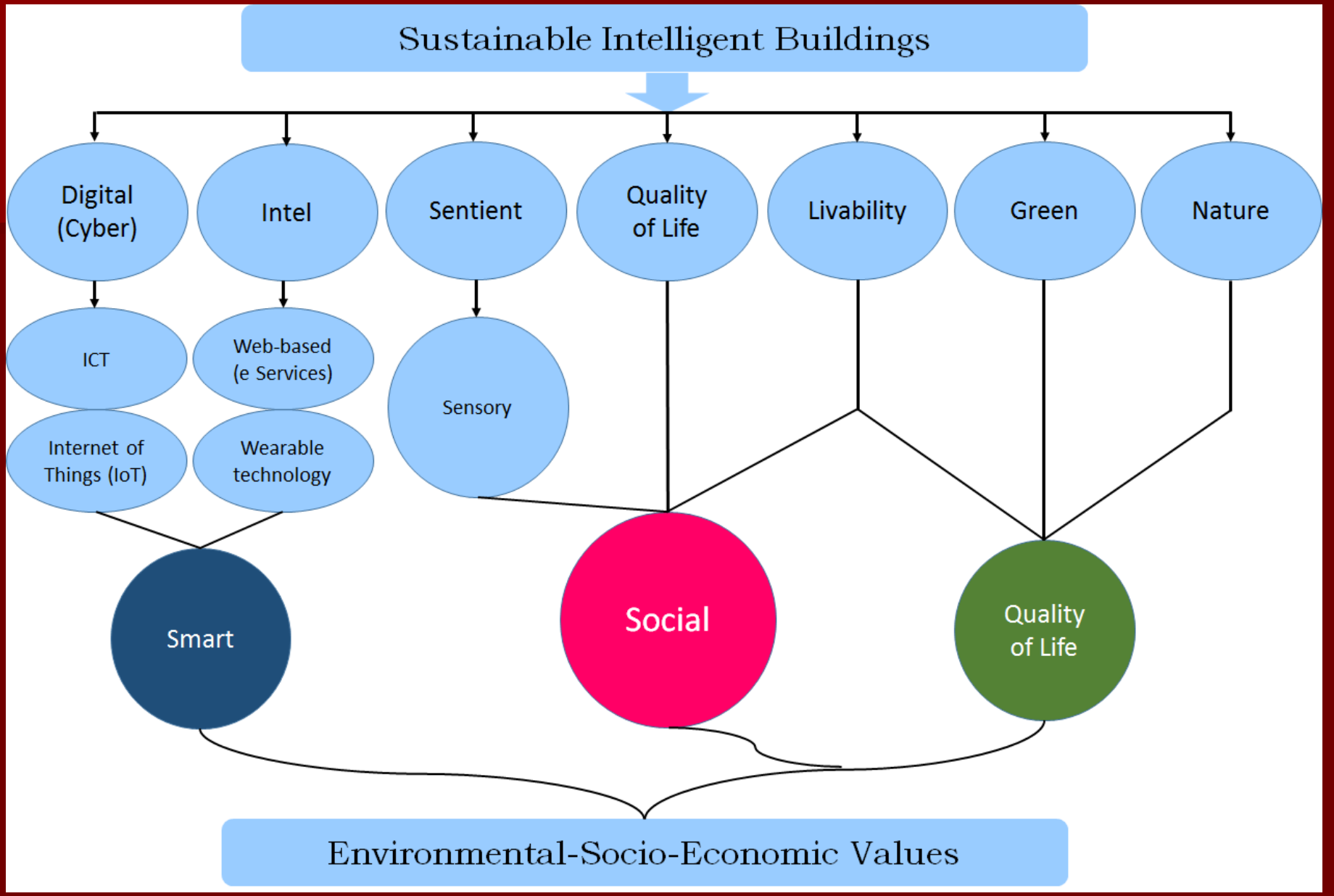
- Framework
- Future of Intelligent Buildings - KPIs
- Health and Wellbeing Oriented Indoor Built Environment for Future Intelligent Buildings
- Technology Aware Workplaces
- Daylight in Intelligent Sustainable Architecture
- Intelligent Infrastructure

https://site.cibworld.nl/dl/publications/CIB_415_W098_RR.pdf

CIB W098 Roadmap

- Sustainable Urban Transportation in Intelligent Cities
- Keeping Abreast with Technology
- Digital Futures
- Upskilling for Technology Enhanced Collaborative Working
- Wellbeing Homes
- Bioelectromagnetic Design

https://site.cibworld.nl/dl/publications/CIB_415_W098_RR.pdf



Key constituents of Intelligent Buildings (Clements-Croome 2013, p. 289)

Atomistic Technical and Holistic Socio-technical Approaches to the Built Environment (based on Munro 2011)

	Atomistic	Holistic
Nature	• Narrow: concentrates on individual elements	• Broad: elements seen as inter-related; interoperability important
Perspective	• Individual systems in isolation • Single discipline outlook	• Whole system • Interdisciplinary and transdisciplinary outlook
Cause and Effect	• Looking only at immediate effects • Short chains of causality	• Separated in space and time • Long chains of causality, ripple effects, unintended consequences, feedback effects

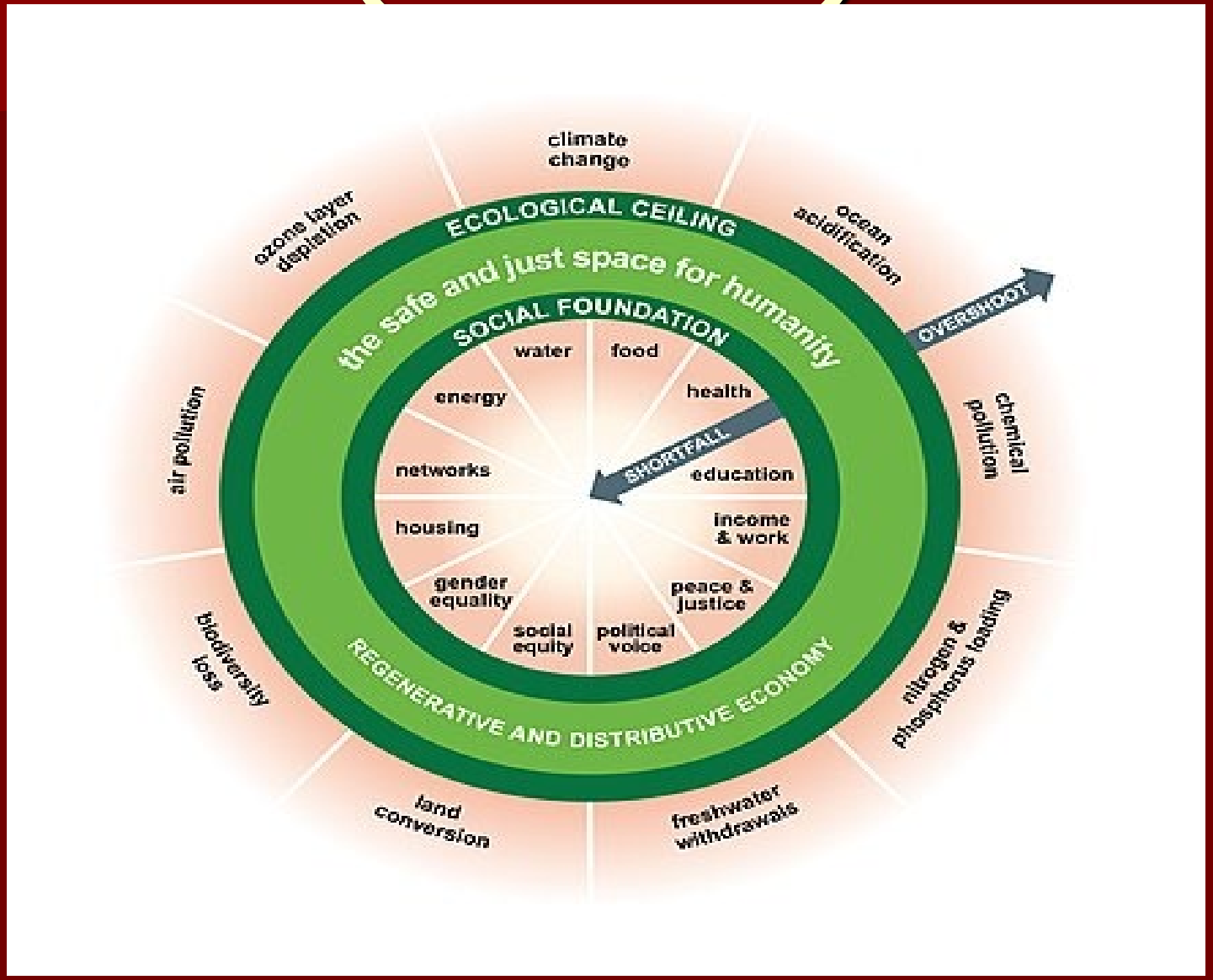
Atomistic Technical and Holistic Socio-technical Approaches to the Built Environment (based on Munro 2011)

Style of Recommendations	• Technocratic • Regulation and compliance	• Socio-technical • Beyond regulations
Results (observed and sought)	• Narrow range of responses to user's needs • Defensive management of risk • Command and control management; frameworks and procedures; squeezing out professional discretion and creativity • Compliance culture • Focus on standardised processes, frameworks and procedures	• Flexible responses to meeting user's needs • Acceptance of irreducible risk • Supportive management encouraging creativity, discovery and enterprise • Comprehensive feedback • Focus on building users their needs with pathways giving high value outcomes such as good well-being and high productivity

DECISION-MAKING

- Use **SOCIAL VALUE**
- **Doughnut Economics by Kate Raworth**
- **Transdisciplinary approach**
- **Decrease Silos: increase Connectivity**
- **Educate for Integration not Fragmentation**

Doughnut Economics (Raworth)



Raworth's 7 Ways to Think

- Go beyond GDP
- See Big Picture
- Nurture Human Nature
- Systems Thinking
- Inclusive Design for All
- Circular Economy Regenerate Reuse
- Question the Limits of Growth

CONCLUSIONS

- Lessons from Nature and Vernacular Architecture
- Buildings are for People in terms of function, sensory delight , health and wellbeing
- Designing, constructing and operating buildings and the behaviour of people within them influence Climate Change significantly
- Technology can help enable effective performance
- Holistic systemic decision-making is key; new mindsets needed e.g Doughnut Economics

CONTRASTING CASE STUDIES

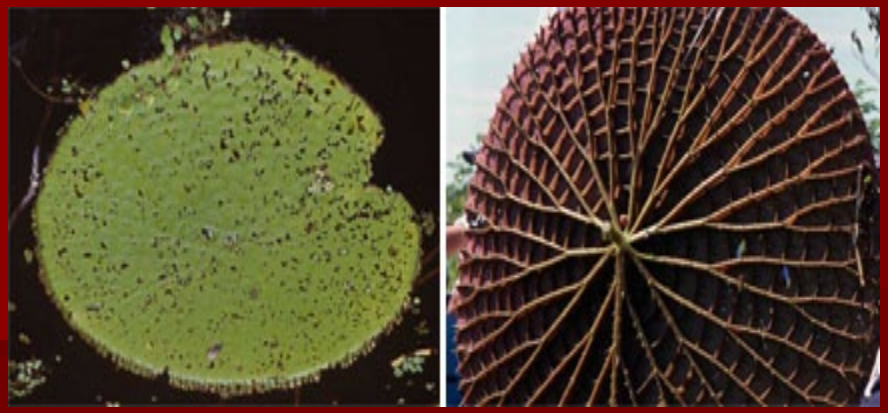
Jean-Marie Tjibaou Cultural Centre in Noumea

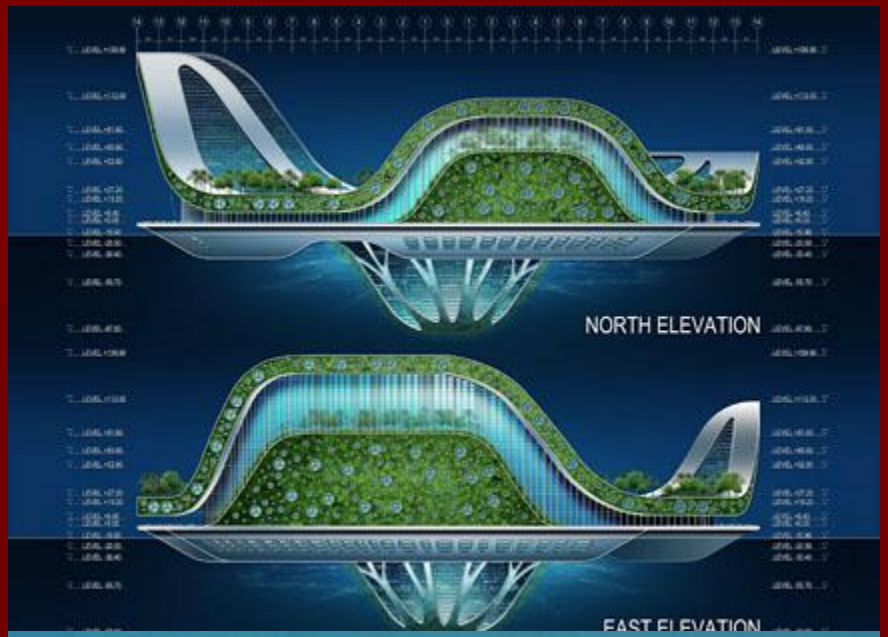




Green Mega City: Lilypads by Vincent Callebaut

http://www.popsci.com/futurecity/plan.html





These Lilypads are constructed with a titanium dioxide skin to absorb CO_2

Green Mega City: Lilypads by Vincent Callebaut

- Titanium Dioxide skin to absorb CO_2
- 2 seater electric pod cars
- Biodiesel/electric buses guided by embedded road magnets
- Footstep energy
- Wind turbines using air movement
- Hydrogen from an Algae Park
- Tidal power from wind from passing car
- Solar energy from paint containing solar nanoparticles

http://www.popsci.com/futurecity/plan.html

Green Mega City: Lilypads by Vincent Callebaut

- Solar energy from paint containing solar nanoparticles
- Clear water from desalination
- Robotic maintenance
- Bubble Houses
- Phase change materials give temperature regulation
- Hydroponic farms
- Plant water from sewage filtered via zebra mussels
- 10 storey concrete tower with embedded photovoltaics
- Geothermal wells for heating/cooling

http://www.popsci.com/futurecity/plan.html

WHAT WE CALL THE BEGINNING IS OFTEN THE END

AND TO MAKE AN END IS TO MAKE A BEGINNING

THE END IS WHERE WE START FROM

T.S.ELIOT-- FOUR QUARTETS-- LITTLE GIDDING