



HOListic Management of Brownfield
REgeneration (HOMBRE)



The Brownfield REMIT/RESPONSE Brownfield Regeneration Systems Tool (BR2)

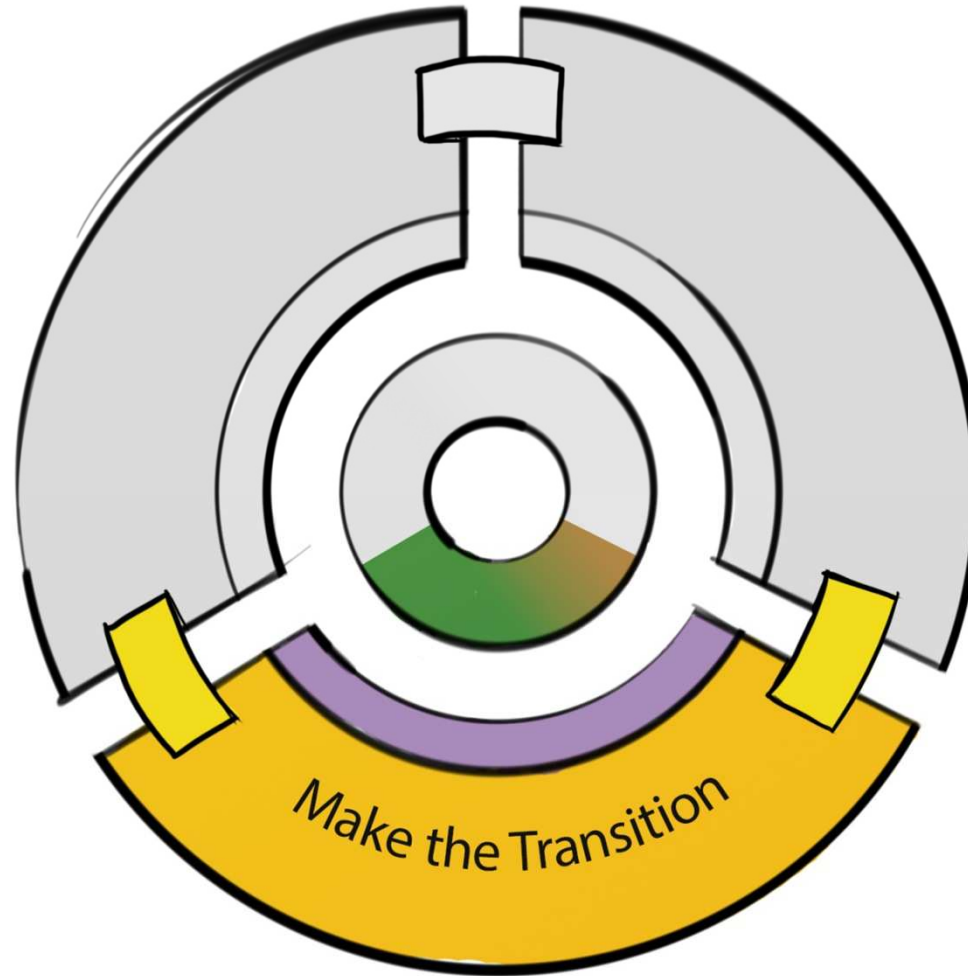
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Paul NATHANAIL (University of Nottingham)



HOMBRE

Land Management Cycle





Complex Systems

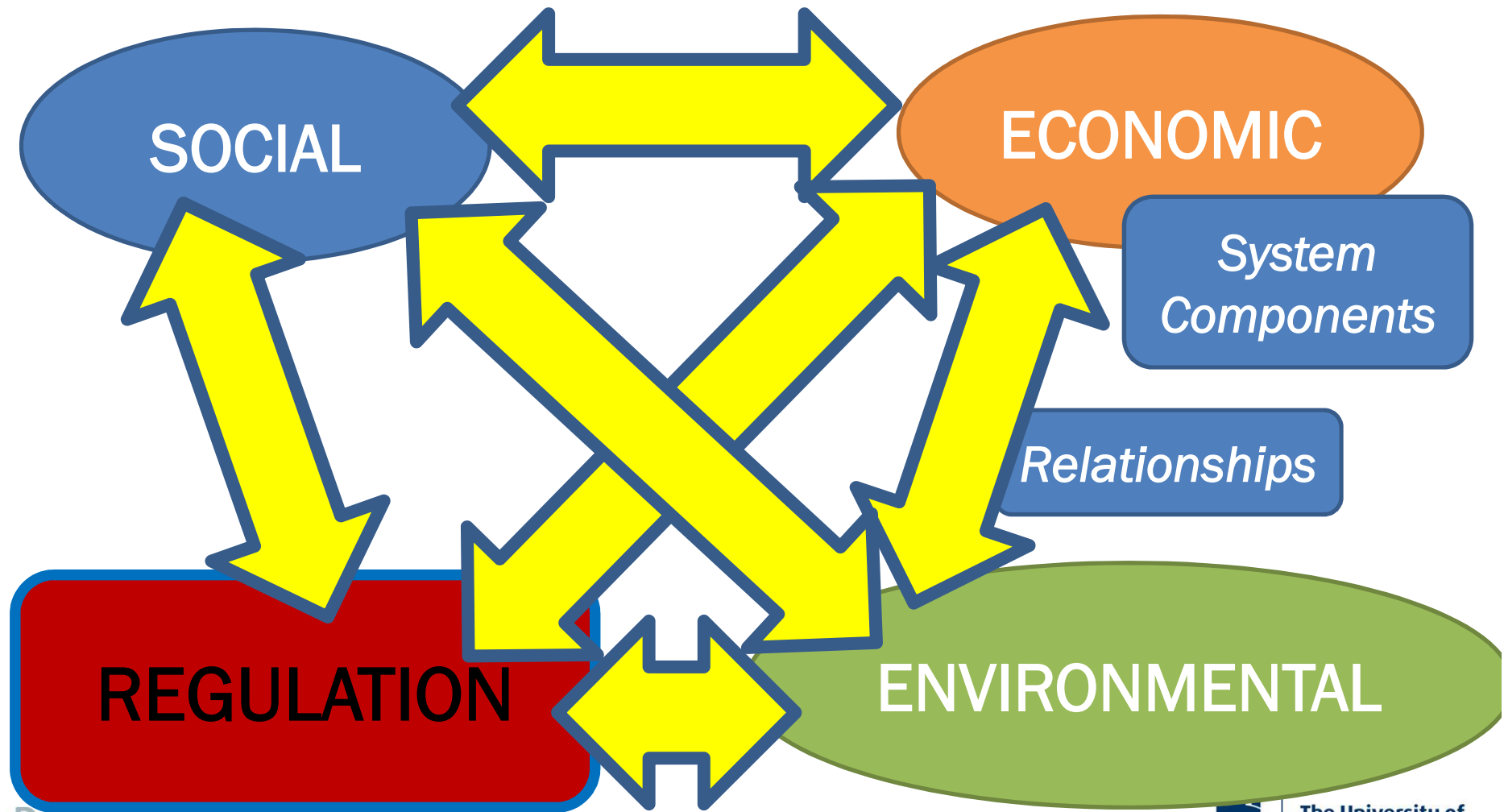
Oxford English Dictionary:

- *A set of things working together as parts of a mechanism or an interconnecting network; a complex whole.*

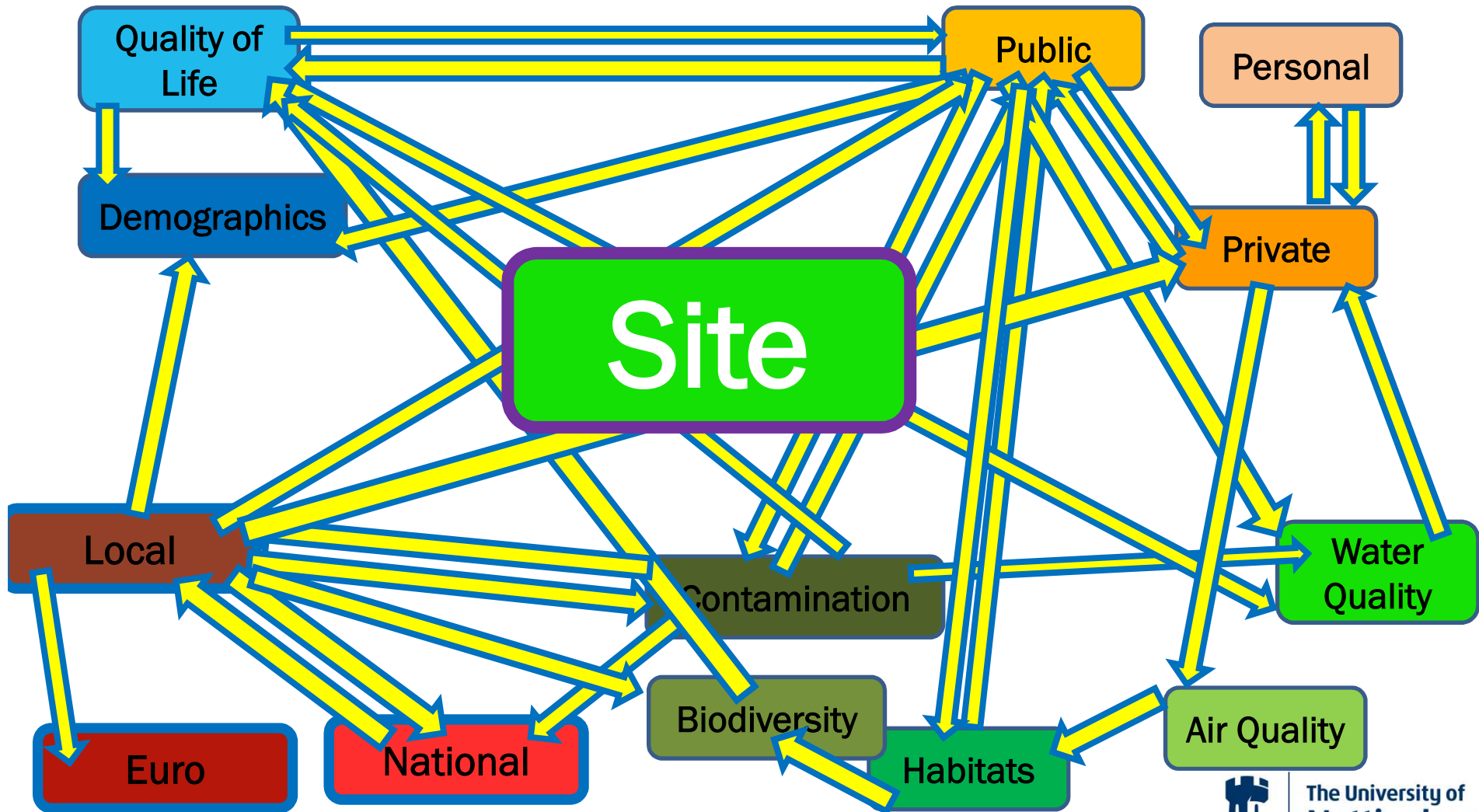
Urban Systems

- *Social, Environmental, Economic and Governance Components form a 'complex whole'.*
- *A Brownfield site (and its redevelopment) affects, and is affected by, the wider system.*

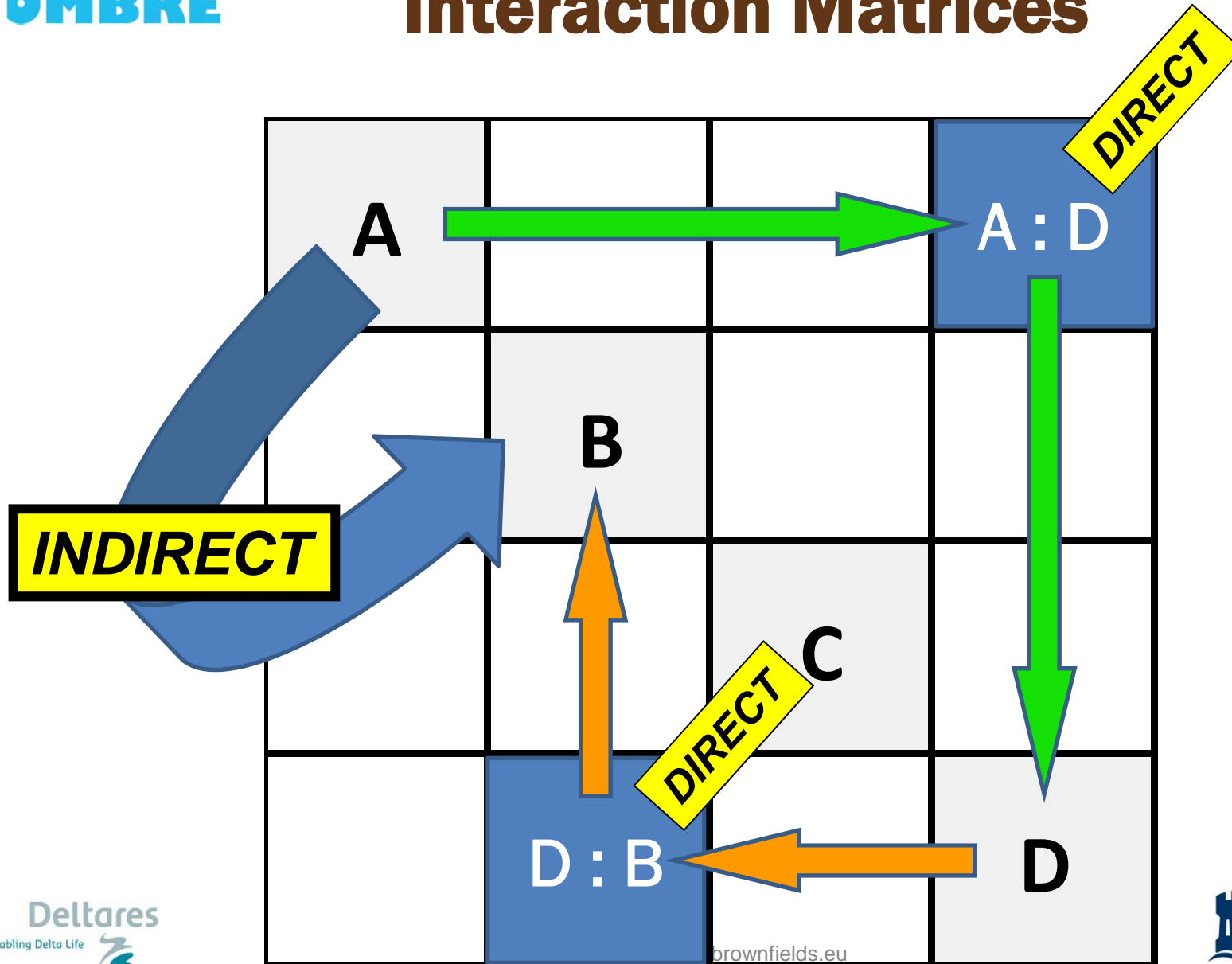
Urban Systems



Urban Systems



Interaction Matrices



Relationship Coding

	1,2	1,3	1,4
FUEL	Radiation	Radiation	Radiolysis
2,1	CANISTER	2,3	2,4
Confinement		Pressurizing Expansion	Ion release
3,1	3,2	SMECTITE/ BUFFER	3,4
	Canister movement Mech, Impact Shearing		Diffusivity Phys. state Diss./prec. Ion exchange Colloid form. Sorption Flow in buffer Suction
4,1	4,2	4,3	BUFFER PORE- WATER
	Corrosion Pressurizing canister	Buffer swelling Smectite diss. Prec. of sec. minerals Ion-exch./sorp. Conv. of smectite Microstruc.	
5,1	5,2	5,3	5,4

Text/colour coding

Binary

Semi-Quantitative

Simple function

Numerical solutions

Numerical analysis

Pers et al (1999)

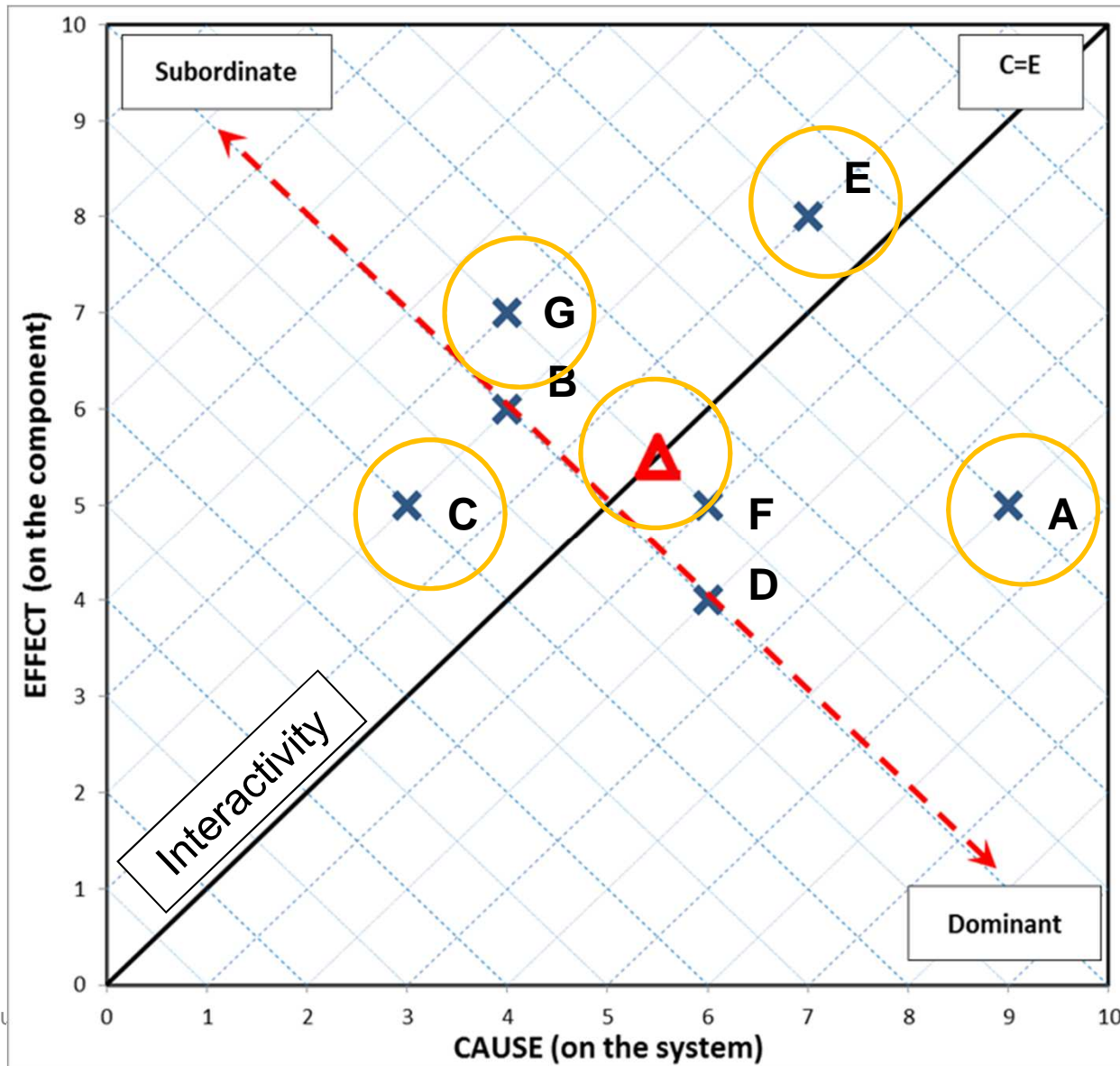
Binary Coding

	Natural Environment	0	0	
	1	Built Environment	1	
	1	1	Demographics	

Σ = “Cause”

Σ = “Effect”

Cause-Effect (C-E) diagrams



- Impression of Relative Importance of Relationships:

0-4 Scale

- 0
- 1 Weak
- 2 Medium
- 3 Strong
- 4 Critical

±2 Scale

- -2 Strong Negative
- -1 Weak Negative
- 0
- +1 Weak Positive
- +2 Strong Positive



BR2 Tool



- Spreadsheet-based
- Generic Components
- Sequential Coding:
 - Indicates the types of relationships to be assessed
 - Binary and Semi-Quantitative Coding
 - Explanation/evidence
- Interaction Matrices and C-E Plots populated automatically



BR2 Tool Process:



- Define system boundaries
- System/Site “Conceptual Model”:
 - Environmental
 - Geotechnical
 - Flood risk
 - Air quality
 - Planning Policies
 - Population
 - Demographics
 - Transport infrastructure
 - OBJECTIVES**
- *Identify alternatives for the site*
- Cross-section of Stakeholders: BR2 relationship coding



BR2 Tool

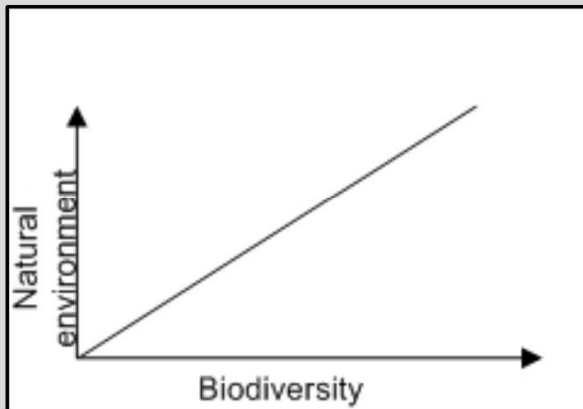


Generic System Components

- Biodiversity
- Natural Environment
- Built Environment
- Demographics
- Quality of Life
- Public Economic
- Private Economic
- Individual Economic
- Local Institutional Controls
- Central/EU Institutional Controls

		BCM	±ESQ	+ESQ	
1 BIODIVERSITY Flora, Fauna, Habitats	2 NATURAL ENVIRONMENT	0	0	0	0
	3 BUILT ENVIRONMENT	0	0	0	0
	4 DEMOGRAPHICS	0	0	0	no identified interaction mechanis
	5 QUALITY OF LIFE	0	0	0	0
	6 PUBLIC ECONOMIC	0	0	0	no identified interaction mechanis
	7 PRIVATE ECONOMIC	0	0	0	no identified interaction mechanis
	8 INDIVIDUAL ECONOMICS	0	0	0	no identified interaction mechanis
	9 LOCAL INSTITUTIONAL CONTROLS	0	0	0	0
10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	0	

1 BIODIVERSITY	2 NATURAL ENVIRONMENT				
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how does biodiversity affect the value of the natural environment?

will biodiversity affect eg air quality, flood mitigation, remediation of contaminants in soil and groundwater?,

eg will (possible) presence of great crested newts delay remediation?

eg will remediation of metal contamination adversely affect wild flowers?

[return to list](#)

1 BIODIVERSITY	3 BUILT ENVIRONMENT				
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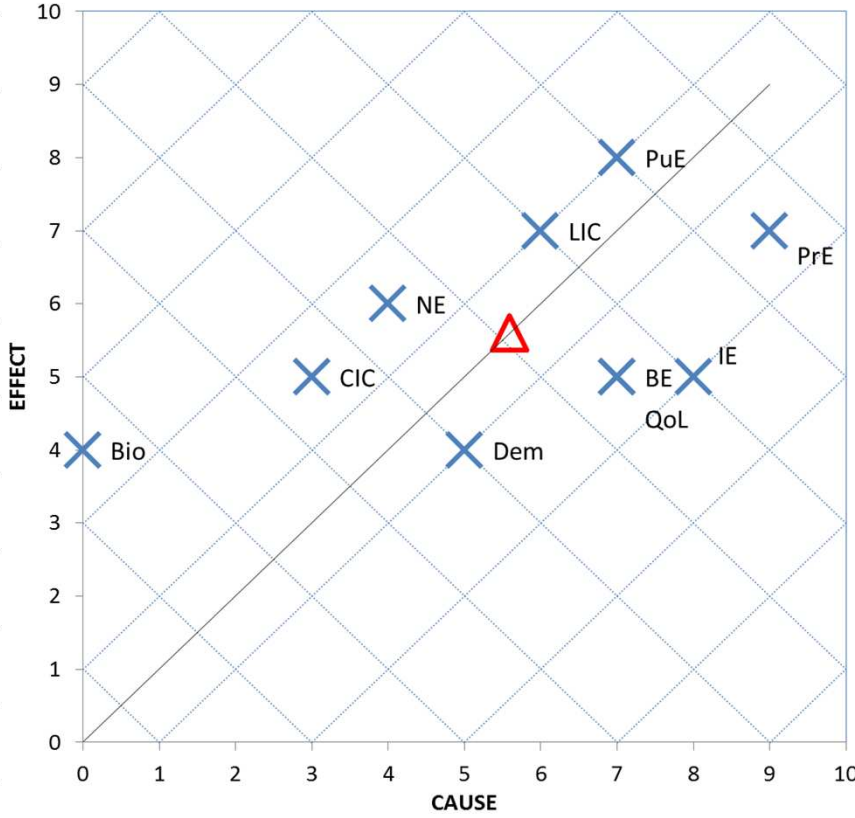
[return to list](#)

1 BIODIVERSITY	4 DEMOGRAPHICS				no identified interaction mechanis
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Outputs:

Bio	0	0	0	0	0	0	0	0	0	0
1	NE	0	0	0	1	0	0	1	1	4
1	1	BE	0	1	1	1	1	1	0	7
0	1	0	Dem	1	1	1	1	0	0	5
0	0	1	1	QoL	1	1	1	1	1	7
0	1	1	1	1	PuE	1	0	1	1	7
1	1	1	1	1	1	PrE	1	1	1	9
1	1	1	1	1	1	1	IE	1	0	8
0	1	1	0	0	1	1	1	LIC	1	6
0	0	0	0	0	1	1	0	1	CIC	3
4	6	5	4	5	8	7	5	7	5	
EFFECT										



- C-E Plots

- Interaction Matrices

Markham Vale





System Conceptual Model



Site

- former colliery
- >120 Hectares to be developed
- >100 Hectares spoil tips
- Motorway bisects site (though no junction)
- Minor contamination and stability issues
- Some flood mitigation required
- Visual blight



System Conceptual Model



System

- 3 planning authorities:
 - Chesterfield, Bolsover, NE Derbyshire
- Above average unemployment/depravation
- Below average qualifications/skills
- lack of quality jobs

Markham Vale Employment Growth Zone

Objectives

“Create 5000 jobs in a sustainable environment”



Redevelopment Options



Option 1

- New Motorway Jn
- 3 Employment Areas
- Tip Areas:
 - SRC
 - Public Open Space
 - Habitats

Option 2

- New Motorway Jn
- 3 Employment Areas



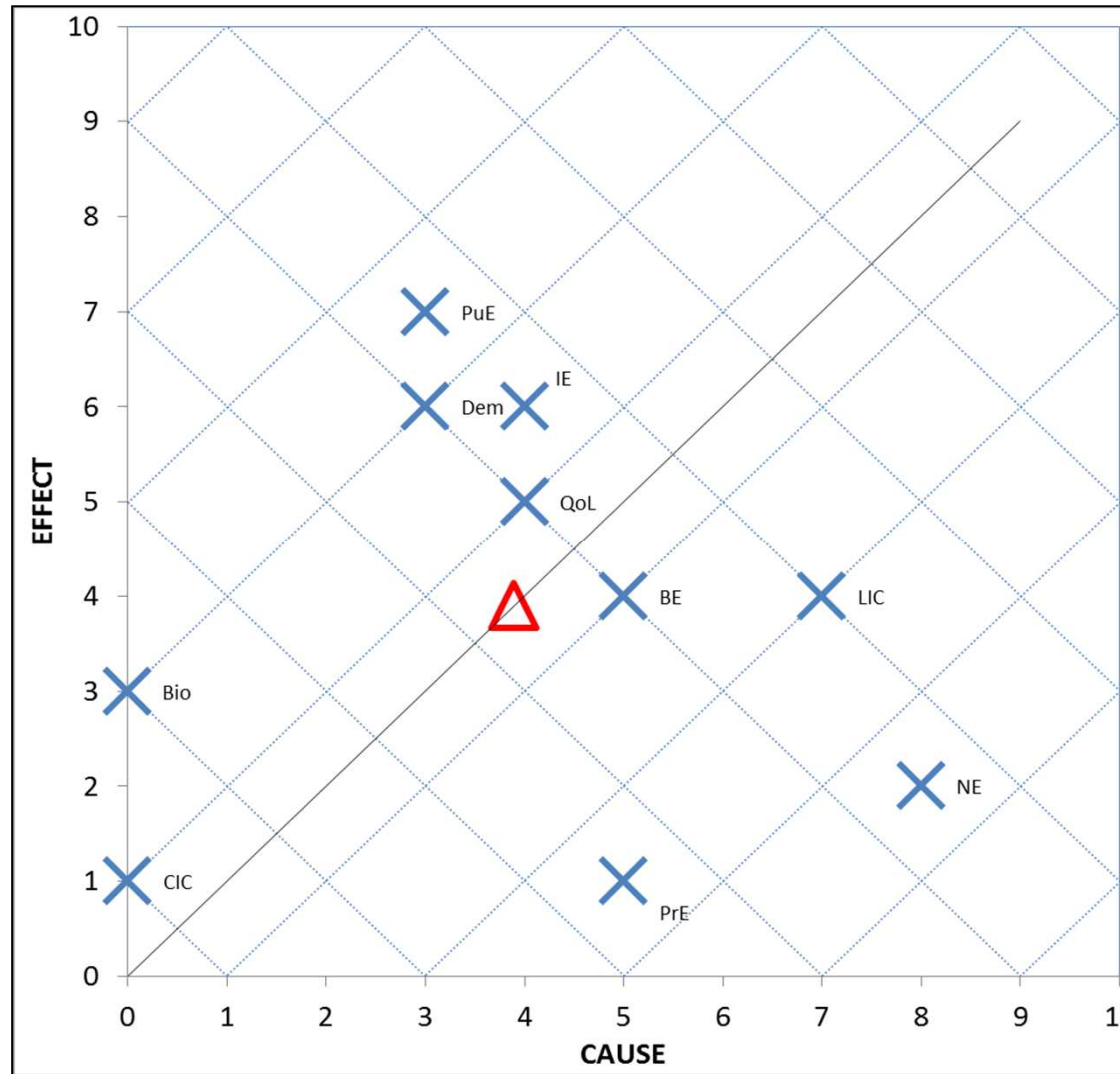
Remember...



- Scoring for the whole system, not just the site,
- Concentrate on DIRECT relationships,
- DIRECTION of the interaction

Bio	0	0	0	0	0	0	0	0	0	0	CAUSE	
1	NE	1	1	1	1	0	1	1	1	8		
1	0	BE	1	1	1	0	1	0	0	5		
0	0	0	Dem	0	1	0	1	1	0	3		
0	0	0	1	QoL	1	0	1	1	0	4		
0	1	1	1	0	PuE	0	0	0	0	3		
0	0	1	0	1	1	PrE	1	1	0	5		
0	0	1	1	1	1	0	IE	0	0	4		
1	1	0	1	1	1	1	1	LIC	0	7		
0	0	0	0	0	0	0	0	0	CIC	0		
3	2	4	6	5	7	1	6	4	1	EFFECT		
										3.9	3.9	AVERAGE

Markham Binary C-E *before*





Bio	0	0	0	1	1	0	0	1	1	4
1	NE	1	0	1	1	1	1	1	1	8
1	1	BE	1	1	1	1	1	1	0	8
0	1	1	Dem	1	1	1	1	0	0	6
1	1	1	1	QoL	1	1	1	1	1	9
1	1	1	1	1	PuE	1	1	1	1	9
1	1	1	1	1	1	PrE	1	1	1	9
1	1	1	1	1	1	1	IE	1	0	8
1	1	1	1	1	1	1	1	LIC	1	9
1	1	0	0	0	1	1	0	1	CIC	5
8	8	7	6	8	9	8	7	8	6	
EFFECT										
CAUSE										

7.5	7.5	AVERAGE
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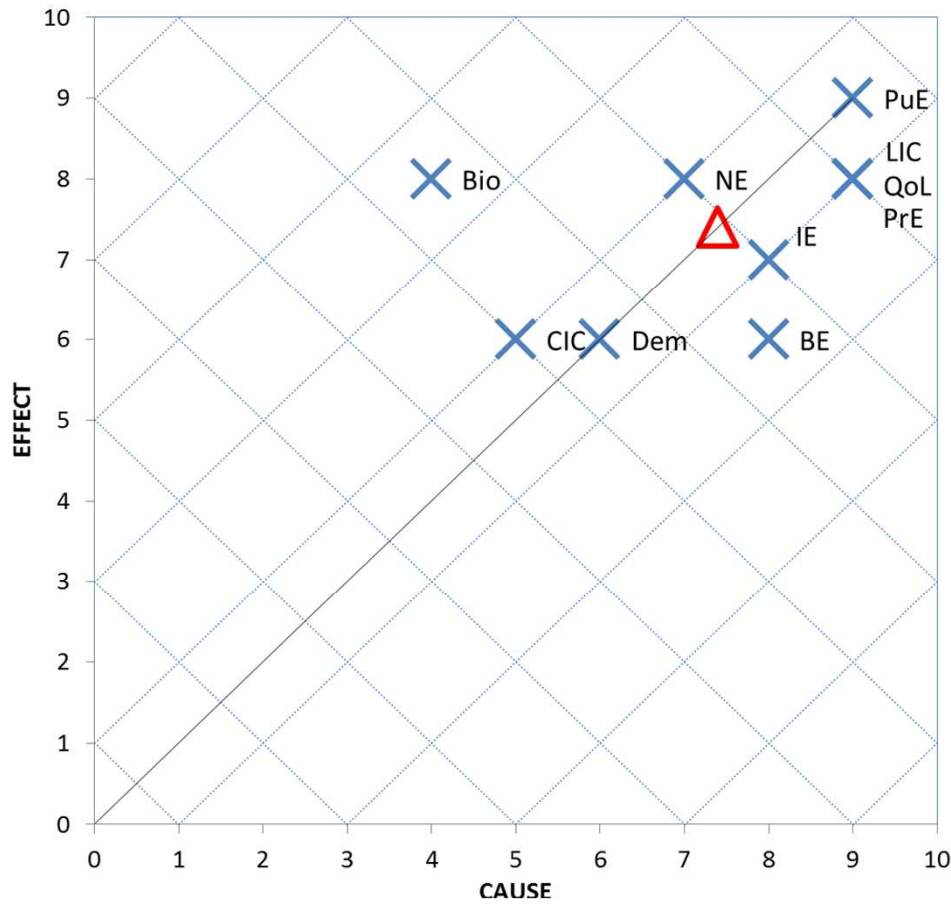
Option 1

Bio	0	0	0	0	0	0	0	0	0	0
1	NE	0	0	0	1	0	0	1	1	4
1	1	BE	0	1	1	1	1	1	0	7
0	1	0	Dem	1	1	1	1	0	0	5
0	0	1	1	QoL	1	1	1	1	1	7
0	1	1	1	1	PuE	1	0	1	1	7
1	1	1	1	1	1	PrE	1	1	1	9
1	1	1	1	1	1	1	IE	1	0	8
0	1	1	0	0	1	1	1	LIC	1	6
0	0	0	0	0	1	1	0	1	CIC	3
4	6	5	4	5	8	7	5	7	5	
EFFECT										
CAUSE										

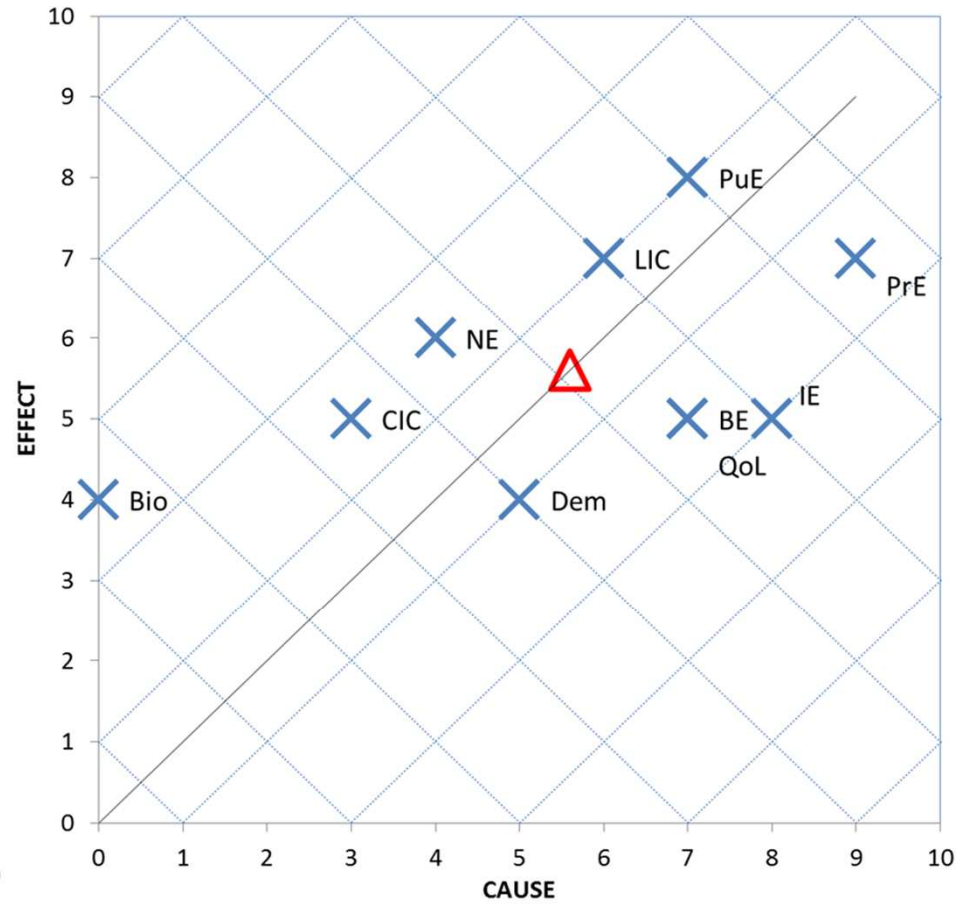
5.6	5.6	AVERAGE
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Option 2

Binary C-E plots



Option 1



Option 2

±2ESQ Matrices

Bio	0	0	0	1	-1	0	0	1	1	2
2	NE	0	0	1	-1	-1	1	-1	-1	0
1	2	BE	1	2	-2	2	2	-2	0	6
0	-1	1	Dem	1	1	1	2	0	0	5
1	1	1	1	QoL	2	1	2	1	1	11
2	2	2	1	2	PuE	2	1	-1	1	12
-1	-2	1	1	1	1	PrE	2	1	1	5
1	-1	1	1	1	2	1	IE	1	0	7
2	2	2	1	1	-2	2	1	LIC	2	11
1	1	0	0	0	1	1	0	1	CIC	5
9	4	8	6	10	1	9	11	1	5	
EFFECT										

Option 1

Bio	0	0	0	0	0	0	0	0	0	0
1	NE	0	0	0	-1	0	0	-1	-1	-2
1	2	BE	0	1	-1	2	1	-2	0	4
0	-1	0	Dem	1	1	1	1	0	0	3
0	0	1	1	QoL	1	1	1	1	1	7
0	2	1	1	1	PuE	2	0	-1	1	7
-1	-1	1	1	1	1	PrE	1	1	1	5
1	-1	1	1	1	1	1	IE	1	0	6
0	1	1	0	0	-2	2	1	LIC	2	5
0	0	0	0	0	1	1	0	1	CIC	3
2	2	5	4	5	1	10	5	0	4	
EFFECT										

Option 2

0-4 ESQ Matrices

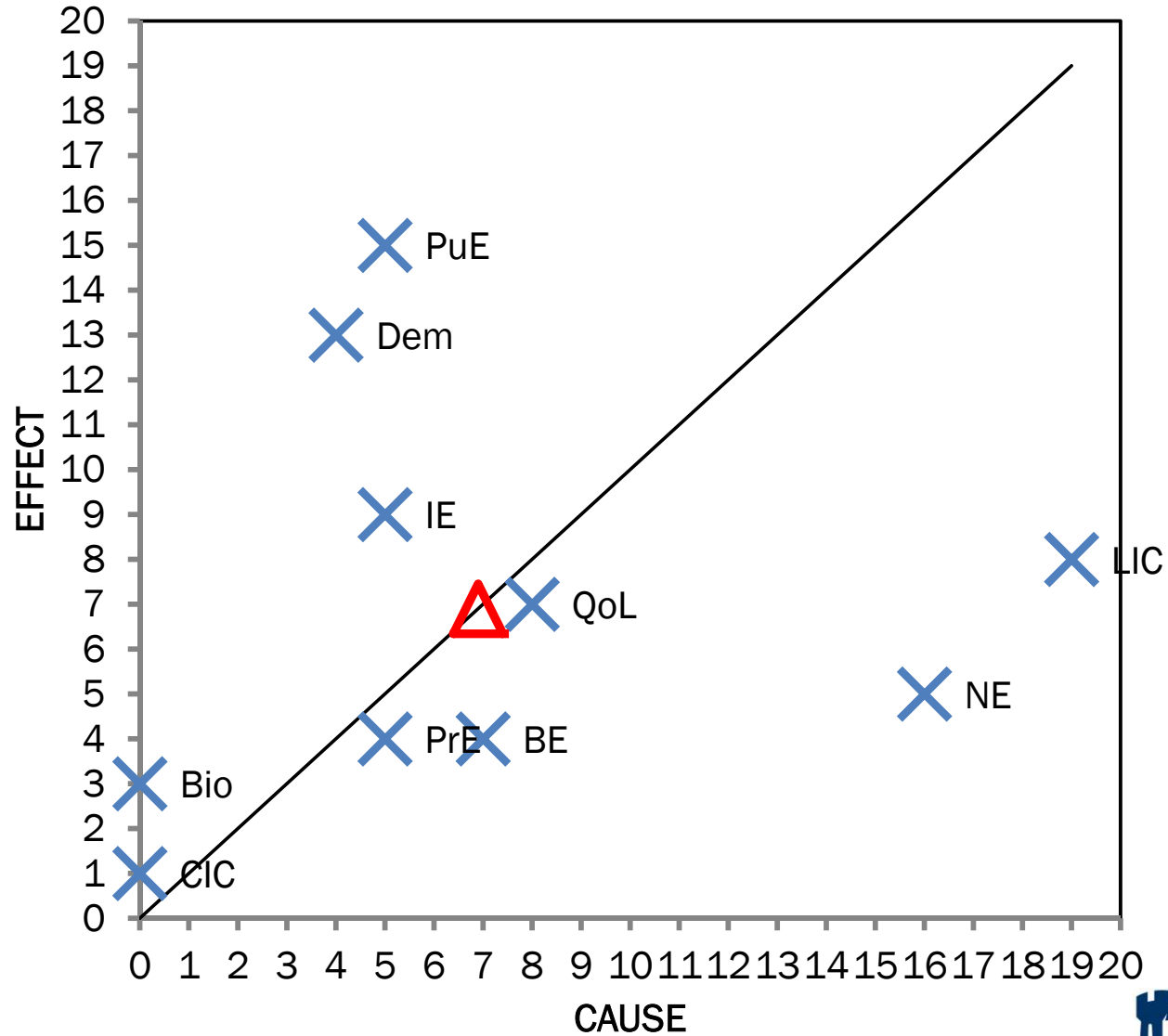
Bio	0	0	0	1	2	0	0	1	1	5
3	NE	0	0	2	1	1	1	1	1	10
2	3	BE	2	2	4	4	4	4	0	25
0	1	1	Dem	2	1	2	3	0	0	10
1	1	2	1	QoL	2	2	2	1	1	13
3	4	4	2	4	PuE	4	1	2	2	26
1	2	3	2	2	3	PrE	3	2	1	19
1	2	1	2	2	2	2	IE	1	0	13
3	3	3	2	3	4	4	2	LIC	1	25
1	2	0	0	0	2	2	0	3	CIC	10
15	18	14	11	18	21	21	16	15	7	
EFFECT										

Option 1

Bio	0	0	0	0	0	0	0	0	0	0
1	NE	0	0	0	1	0	0	1	1	4
1	2	BE	0	1	2	4	3	4	0	17
0	1	0	Dem	1	1	1	1	0	0	5
0	0	1	1	QoL	1	1	2	1	1	8
0	4	2	1	3	PuE	4	0	2	2	18
1	2	1	1	1	3	PrE	2	1	1	13
1	2	1	1	1	1	1	IE	1	0	9
0	1	1	0	0	4	4	2	LIC	4	16
0	0	0	0	0	2	2	0	3	CIC	7
4	12	6	4	7	15	17	10	13	9	
EFFECT										

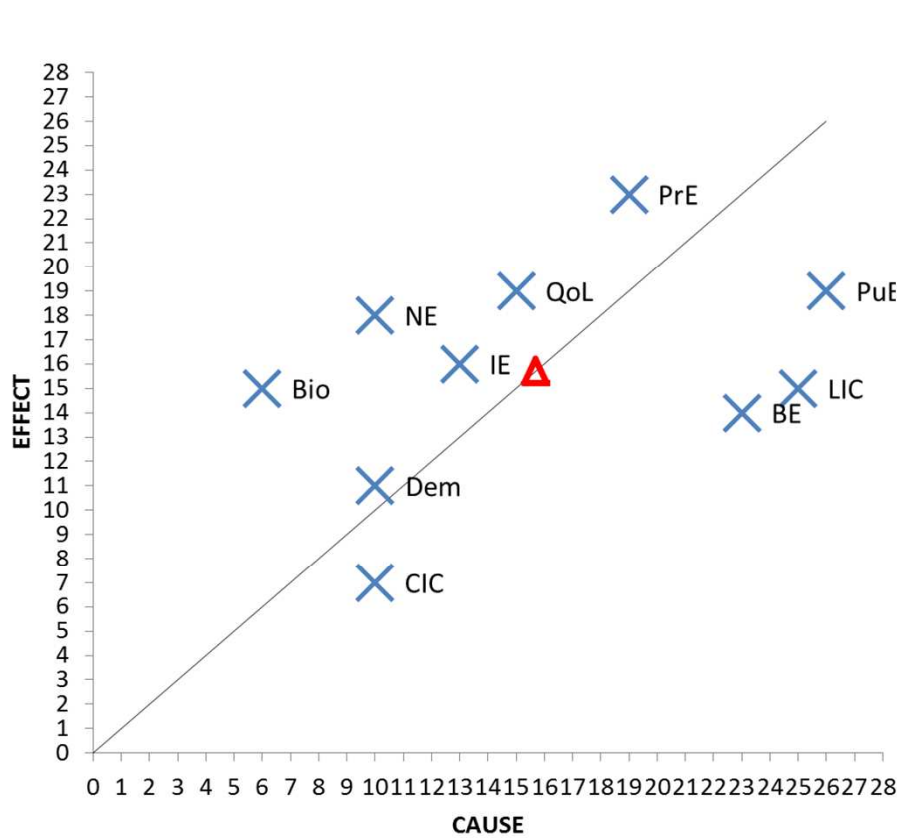
Option 2

0-4 ESQ C-E Plot

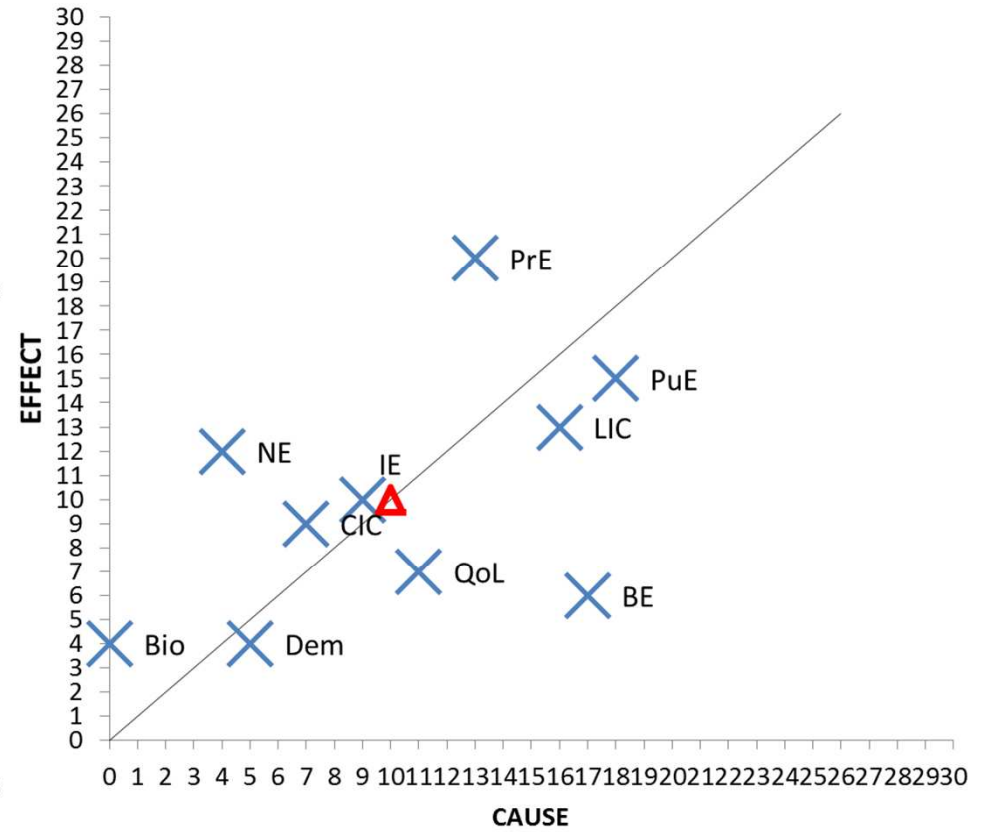


www.zerobrownfields.eu

0-4 ESQ C-E plots



Option 1



Option 2

Conclusions

- Both options lead to a more interactive system than the pre-development situation
- Public finances, Built Environment, Local policies and regulations are dominant in both options.
- Option 1 gives an interactive system with no components isolated or dominant
 - Biodiversity is much more prominent in the system
- Option 2, Bio and NE more isolated in the system
 - Opportunity matrix



Remarks



Positive reaction from MEGZ team:

- As a communication/presentation tool when:
 - Planning permission for Brownfield sites
 - Presenting to public stakeholders
 - Structured discussion between stakeholders
 - Central tool



Thanks...



- MEGZ team
Peter Storey
- Linda Maring Deltares (*Rotterdam* case study)
Nirul Ramkisor

- Forrester JW (1969) *Urban Dynamics*, The MIT Press, Cambridge, MA
- Hudson, JA. *Rock Engineering Systems: theory and practice*, Ellis Horwood, Chichester. (1992)
- Leney, AD (2008) *A systems approach to assess the redevelopment options for urban brownfield sites*. Ph.D. Thesis. The University of Nottingham.
- McLoughlin JB, Webster JN (1970) Cybernetic and general-system approaches to urban and regional research: a review of literature. *Environment and Planning* 2(4) 369-408
- Pers, K. Skagius, K. Södergren, S. Wiborgh, M. Hedin, A. Morén, L. Sellin, P. Ström, A. Pusch, R. Bruno, J. Technical Report TR-99-20 SR 97 – Identification and structuring of process. Swedish Nuclear Fuel and Waste Management Co. December 1999 <http://www.skb.se/upload/publications/pdf/TR-99-20.pdf>
- White R, Engelen G (1993) Cellular automata and fractal urban form: a cellular modelling approach to the evolution of urban land-use patterns" *Environment and Planning A* 25(8) 1175-1199