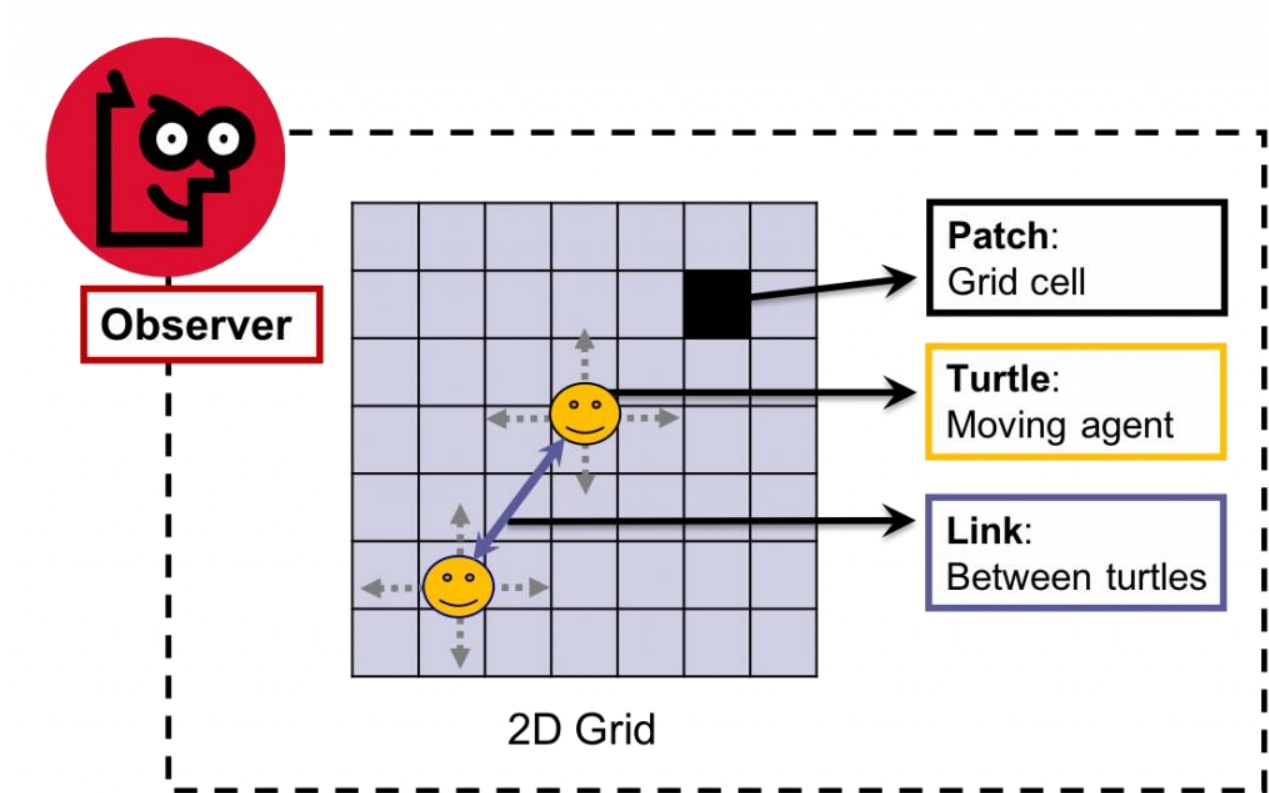
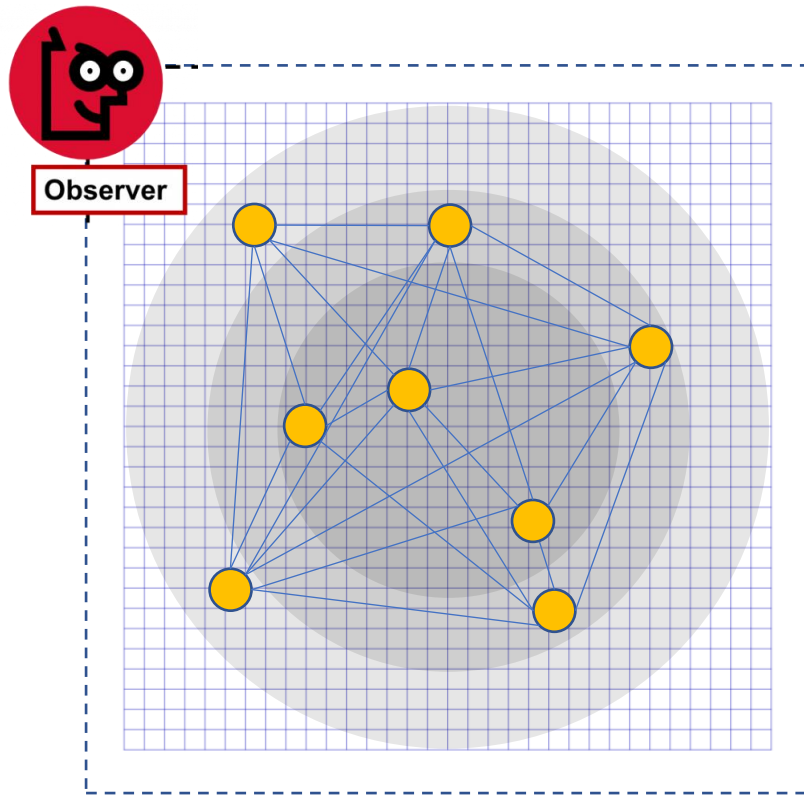


# NetLogo



Source: Izquierdo et al., 2019



## Lecture 2:

Using actor-network theory (ANT)  
and ABM to conceptualise  
pro-health urban development  
decision-making system

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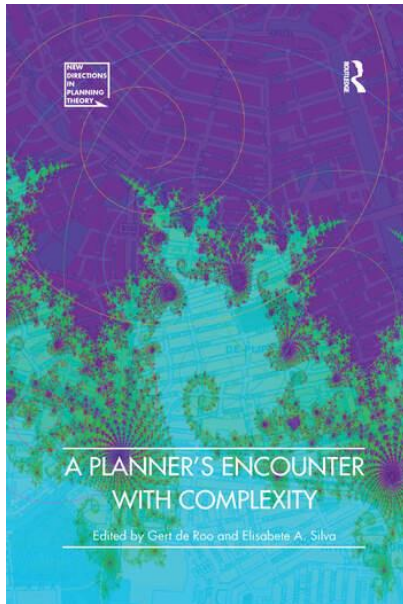
[heeseo.kwon.10@ucl.ac.uk](mailto:heeseo.kwon.10@ucl.ac.uk)

Note: Slides are based on Kwon's postdoc research conducted at University of Reading with Prof. Kathy Pain in a Medical Research Council-funded project

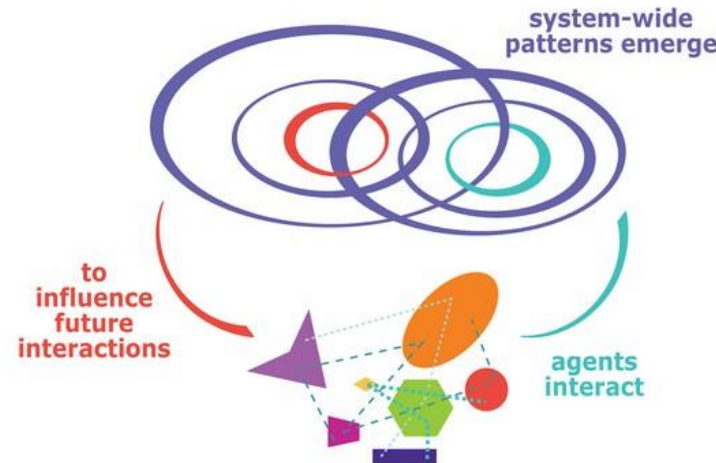
Establishing a robust theoretical framework is very important for modellers

What we mean by “pro-urban development decision-making behaviour” in this project:

- To what extent health factors are considered when **real estate actors and planners** make **investment** and **development** decisions



— Complex Adaptive System (CAS) —



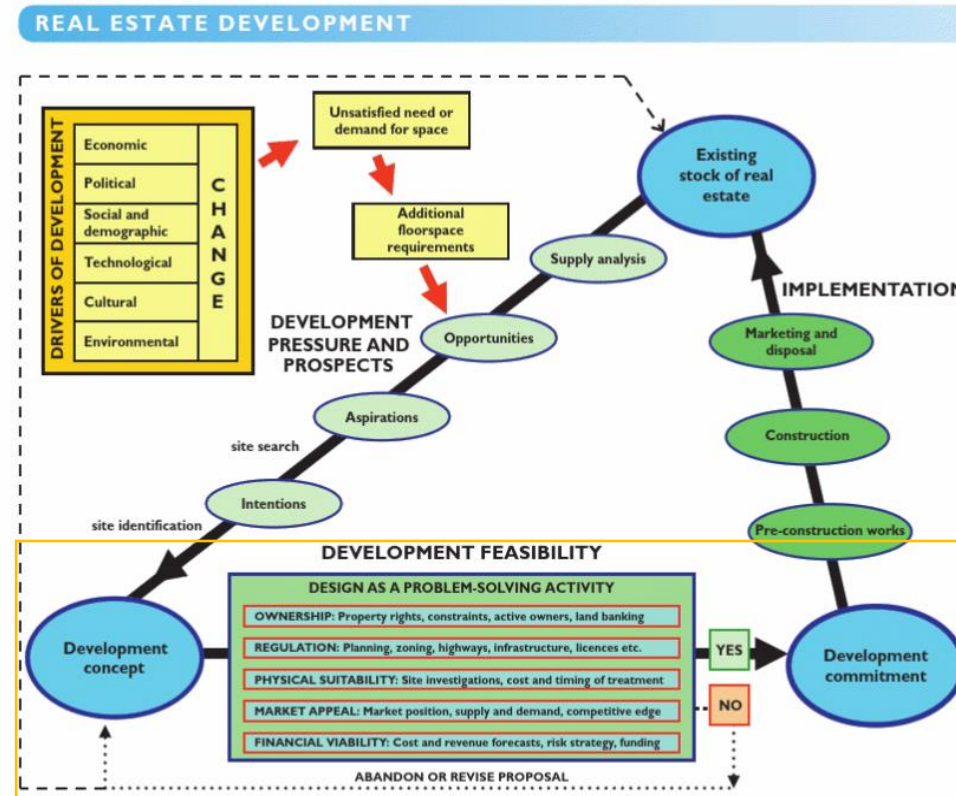
Relevant theories in the discipline

Relevant social and behavioural theories  
(from psychology, sociology, economics...)

# Models of urban development process

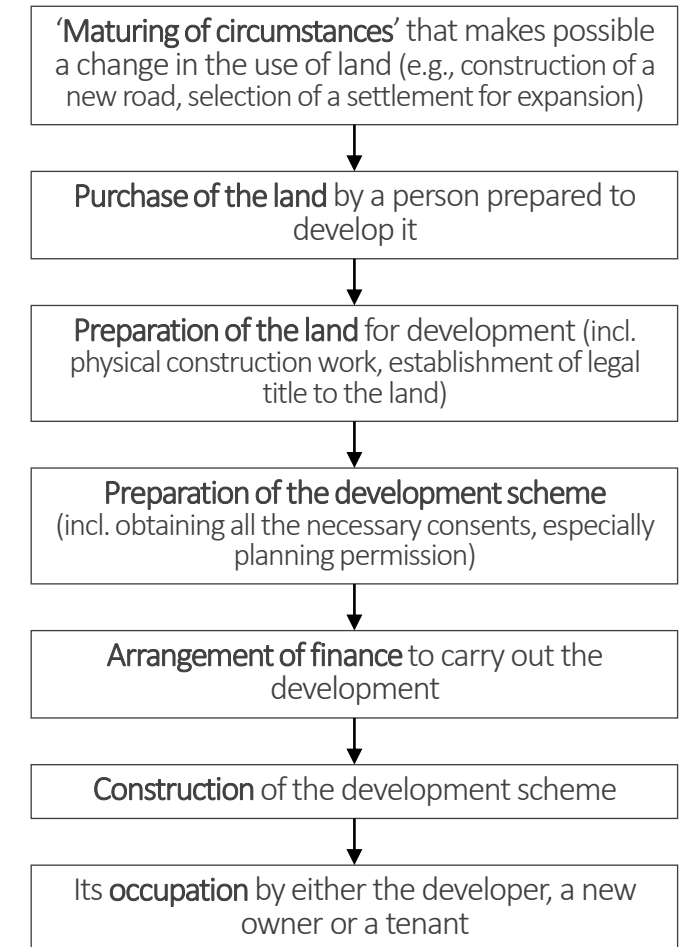
- Healey (1992:36) defines the **development process** as “the transformation of the physical form, bundle of rights, and material and symbolic value of land and buildings from one state to another, **through the effort of agents with interests and purposes in acquiring and using resources, operating rules and applying and developing ideas and values.**”

- Equilibrium models:** neo-classical economics, demand and supply, treats decision agents as rational actors (e.g., J Harvey, 1981; Fraser, 1984). Limitations in taking account of the non-economic interests and complexity of the development process...
- Event-sequence models:** unpacks development process into constituent events, tends to focus on potential blockages to development activities (e.g., Goodchild and Munton, 1985)



Source: Adams & Tiesdell, 2013

## An event-sequence model of the development process



Source: Goodchild and Munton, 1985:65

# Models of urban development process

3. **Agency models:** behavioural or institutional point of view, focus on the **actors** in the development process and their **relationships** (e.g., Kaiser and Weiss, 1970; Drewett, 1973; Barrett et al., 1978; Bryant et al., 1982)
4. **Structure models:** urban political economy, focus on the **forces and power relations**, tend to focus on the broader dimensions of capital-labour, capital-landowner, and state-market relations (e.g., Boddy, 1981; Ball, 1983, D Harvey, 1985, Ambrose, 1986)

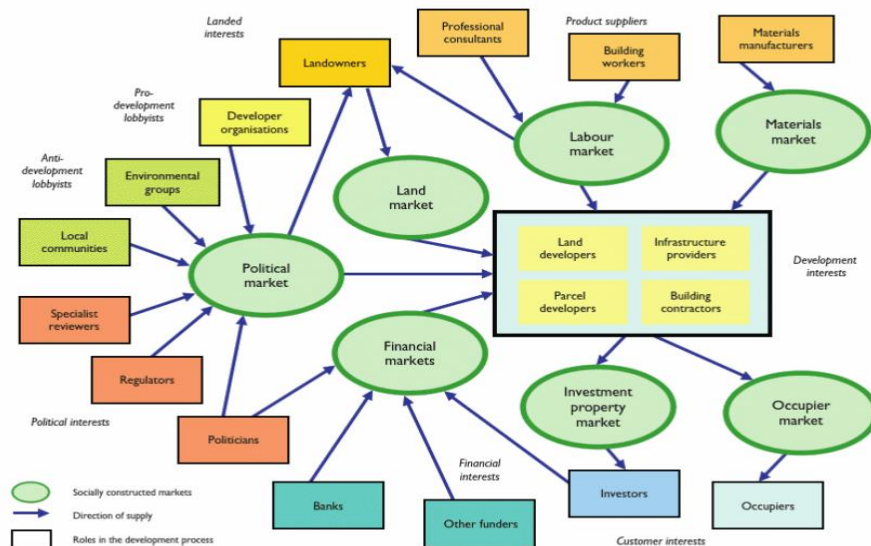
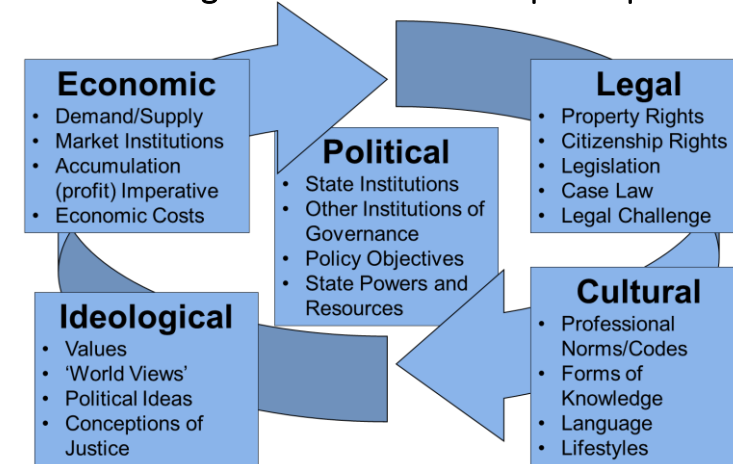


FIGURE 5.8 A role-based model of the real estate development process.

Source: Adams & Tiesdell, 2013

## Forces acting to structure the development process



Source: Parker & Doak, 2012

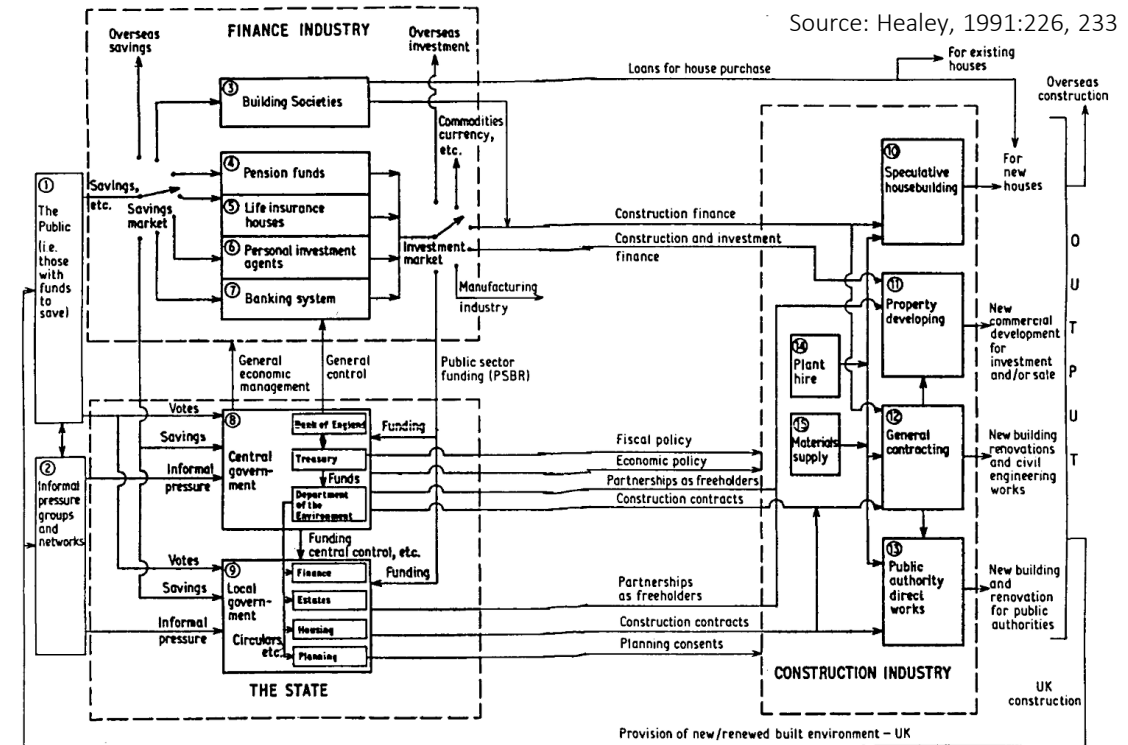
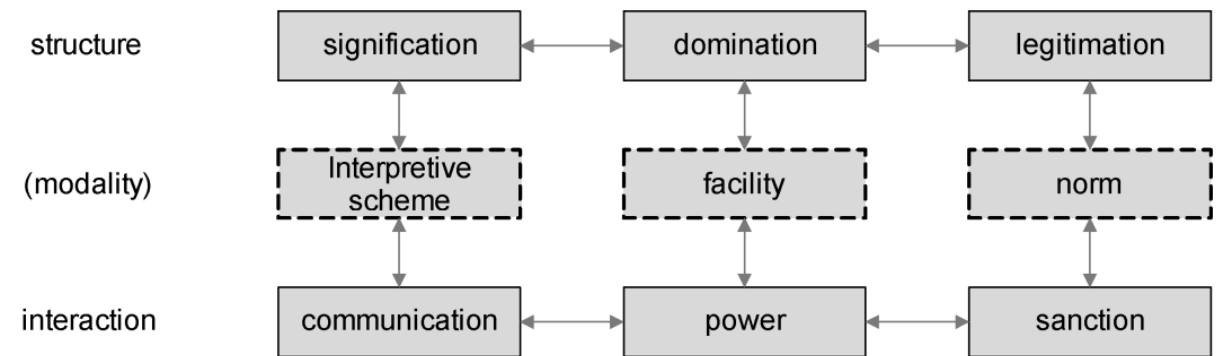


Fig. 8. The development system in the UK (Ambrose, 1986, pp. 68–9)



# Social/behavioural theories for conceptualising the urban dev. decision-making process

- Social theory of practice (Bourdieu, 1990)
  - Concepts of **practice** and the **habitus**: The habitus is understood as a city’s “embodied history ... what gives [actor] practices their relative autonomy with respect to external determinations of the immediate present” (Bourdieu, 1990: 56)
  - The development process can be understood as socially embedded within specific urban markets comprising **complex networks of actors with practices that are framed by and frame prevailing norms and regulations.**
- Communities of practice (CoP) theory (Lave & Wenger, 1991)
  - The **built environment is shaped by the CoPs of corporate, technical and state actors** (e.g. developers, investors, occupiers, professional intermediaries) with **particular ways of seeing buildings and cities with frames of references and relations** influenced by the regulatory and policy environment (Guy & Henneberry, 2000:2400)
- Structuration theory (Giddens, 1984)
  - Relevance for considering the **iterative relationship between structures and actor practices** in the development process.
  - The **structural properties of a social system** can be characterised by the aspects of **signification** (manifest in interaction through communication of meaning), **domination** (i.e., use of power interaction), and **legitimation** (i.e., moral constitution of interaction through the application of norms) (Moos & Dear, 1986:233)



Source: Giddens (1984, p. 29)

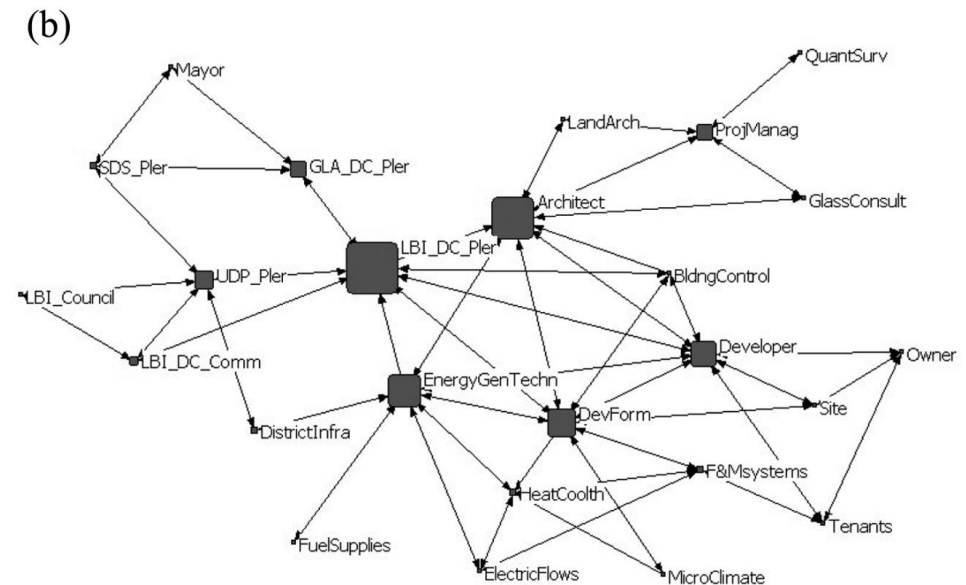
Source: Dumay, 2018:520

# Actor-network theory and ABM for conceptualising the urban dev. decision-making process

- Actor-network theory (ANT) (Callon et al., 1984; Latour, 1990)
  - An **actor**: human or non-human (i.e., social or material)
  - A **network**: both material and semiotic (i.e., relations between things and between concepts)
  - **ANT** is about tracing this network and “understanding the dynamic ways in which relationships between actants are forged, negotiated and maintained” (Rydin, 2013:25)
  - Actor network positions and roles include **closeness, betweenness, centrality** and **broker, bridge, gatekeeper, isolated**.
  - ANT “**black-box**”: Black-boxing creates areas within networks where “relationships between actants are taken for granted and unchallenged” (Rydin, 2013:26). Research into the black box of hidden deal-making is important for establishing what is in the actor’s mind (Callon et al., 2009; Scofield, 2011)
  - ANT “**sociology of translation**” (Callon, 1986) refers to the mobilisation of social change via a forum/central network, by innovators representative of all “calculative agents” acting as a single agent. Can inform intervention design.

# Actor-network theory and ABM for conceptualising the urban dev. decision-making process

- For example, Rydin (2013) applied ANT in examining a low-carbon commercial development in London
  - Three aspects: “planning policy documents as intermediaries, the planning consent as an obligatory passage point, and the energy-modelling exercises as a form of black-boxing.” (Rydin, 2013:32)
  - **Human actors:** London Plan policy planners, GLA (Greater London Authority) planners handling planning applications, building control officers, project managers, landscape architects and quantity surveyors
  - **Non-human actors:** District heat infrastructure, energy generating technology, fuel supplies, electricity flows, development form, facilities and management systems, micro-climate, and heat and coolth flows



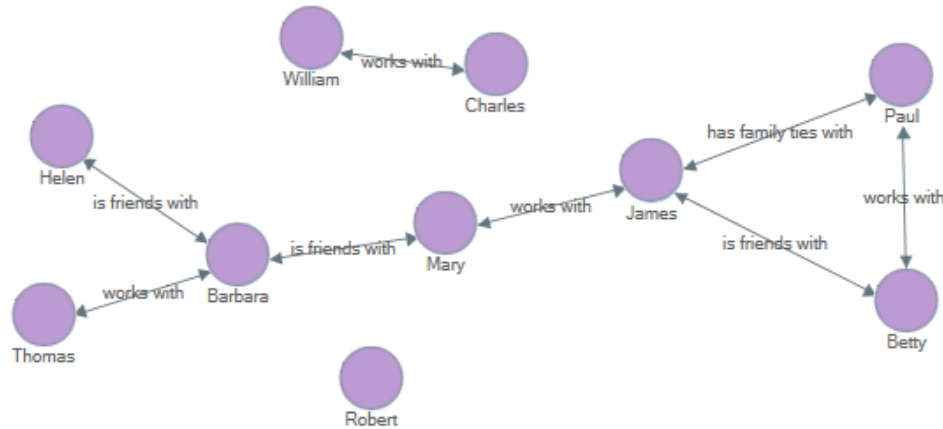
**Figure 2.** Network of all actants in commercial office development in Ropemaker Place. (a) Base network and (b) nodes weighted by betweenness score for actants.



# Network sociogram and sociogram centrality measures (example)

## Network sociogram

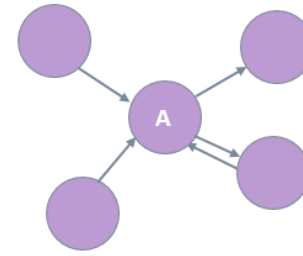
Made up of vertices (cases) and edges (relationships)



## Sociogram centrality measures

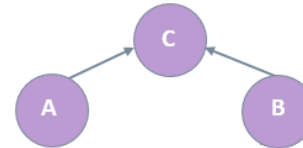
**Degree centrality** is the “count of the number of vertices a vertex is directly connected to” and measures popularity and influence.

*How many people can this person reach directly?*



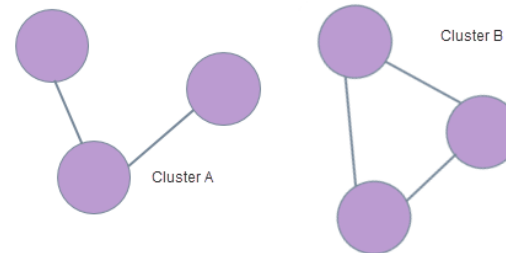
**Betweenness** measures “how often the vertex lies on the shortest path between two other vertices”. Shows which cases function as communication paths between other cases and determine points where the network would break apart.

*Which person is more likely to have the most information flowing through them?*

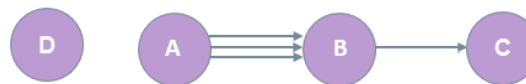


**Closeness** measures the reach (“the speed with which information can reach other cases from a given starting point”. Indicates who has the easiest and quickest access to information in the network.

*How fast can this person reach everyone in the network?*



**Density** is “the count of vertex pairs that are connected in a diagram, divided by the total number of possible connections that could exist” shows the level of connectedness in the network



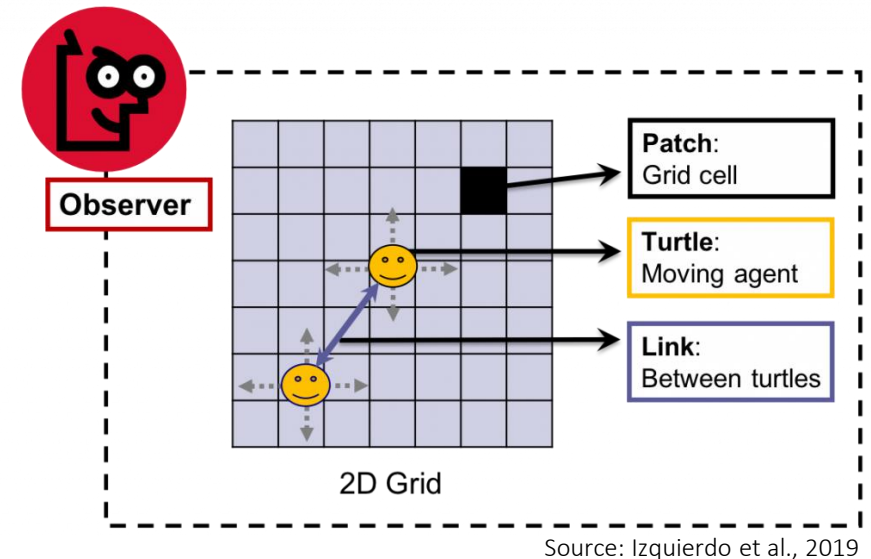
**Reciprocity** shows the percentage of edges in the directed networks that are reciprocated.

*Are there relationships in the opposite direction between the same people?*

Relationships		
From Name	Type	To Name
Interview Participants\William	works with	Interview Participants\Charles
Interview Participants\James	is friends with	Interview Participants\Barbara
Interview Participants\James	has family ties with	Interview Participants\Paul

# Actor-network theory and ABM for conceptualising the urban dev. decision-making process

- Complex systems approach and ABM can be a useful technique for conceptualising and experimenting with the theoretical urban development decision-making system
  - Can model the **ecology of networks** as well as **complex systems** with the concepts of nonlinearity, emergent behaviour, self-organisation and feedback loop (Epstein, 1999; Taylor et al., 2016) and shed light to the “black box”
  - Follows Giddens’ concept of co-evolution of agency and structure (**structuration theory**): collective behaviour of agents in relation to the social structure and the environment generate emergent patterns, and these patterns can in turn affect the individual agent behaviour (Fuchs, 2003; Mendez-Fajardo et al., 2018)
  - ‘Equilibrium states’, ‘thresholds’, ‘tipping points’ to identify development transitions – ‘Regime shift’ can identify ‘critical transitions’ as ‘symmetry breaks’ (De Roo, 2018)

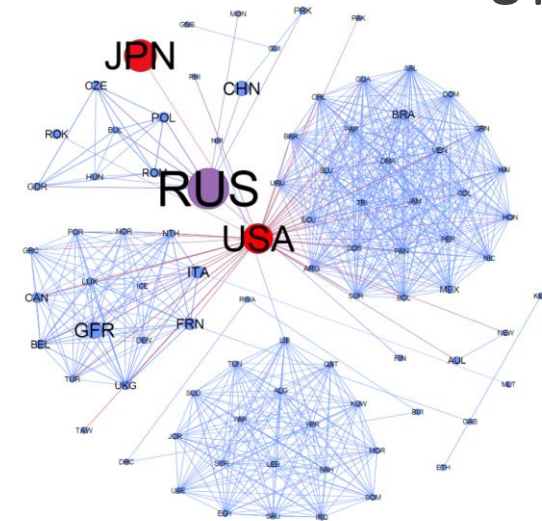
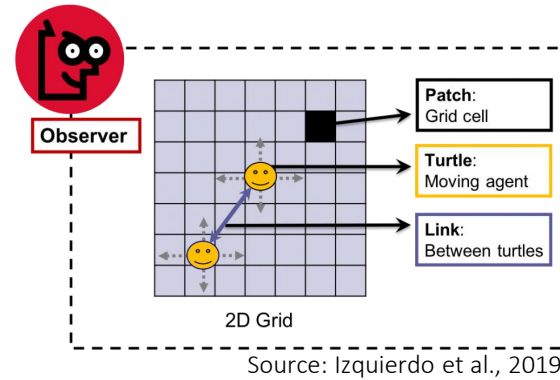


- Undirected or directed “links” are drawn as lines to connect two turtles (these turtles are also called **nodes**)

# Actor-network theory and ABM for conceptualising the urban dev. decision-making process

- Agents and the environment

- Environment: Can represent a hypothetical environment of interaction.
- Walbert et al. (2018) modelled the global network of countries and examined the ramifications of defence agreements between countries..



Links between countries with properties (e.g., level of alliance, years allied)

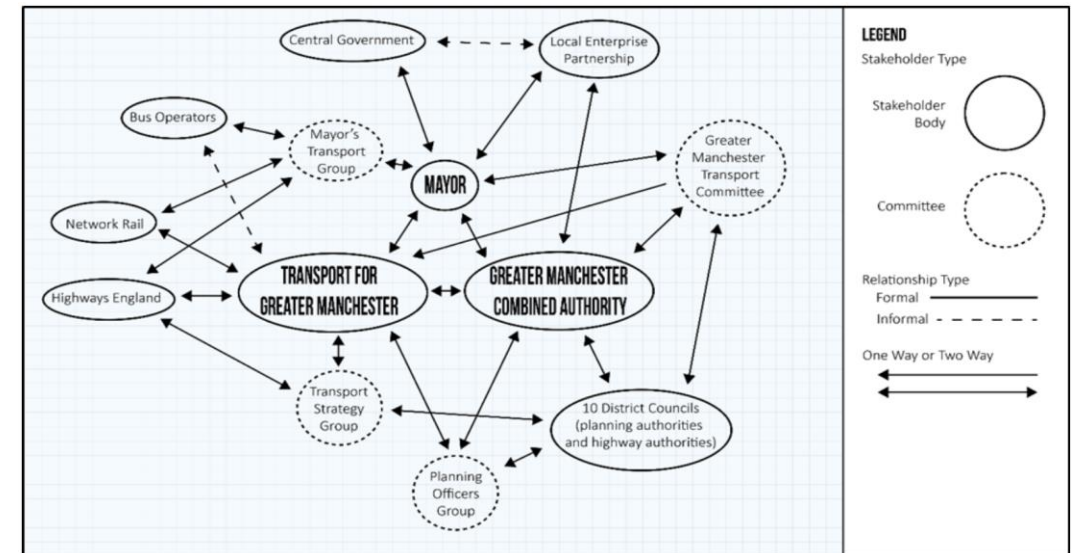
Source: Walbert et al. 2018

Figure 8: U.S. Defense Agreements and Japan Shown in Red Russian Defense Agreements Shown in Purple. Defense Network: 1980; Node Size = Wealth.

- Agents in ABM and actor-network (A-N) in ANT

- Human and non-human A-Ns as agents in ABM
- Macro-level phenomena ('more stable networks') in ANT as emergent patterns in ABM (Mendez-Fajardo et al., 2018)

## Stakeholders in GMCA transport developments



# Actor-network theory and ABM for conceptualising the urban dev. decision-making process

## Good reference for setting link properties

- Taşan-Kok et al. (2020)'s exploration of the **fragmentation of public accountability** through **hybrid contractual landscapes of governance** that involve mixed, evolving and dynamic relations

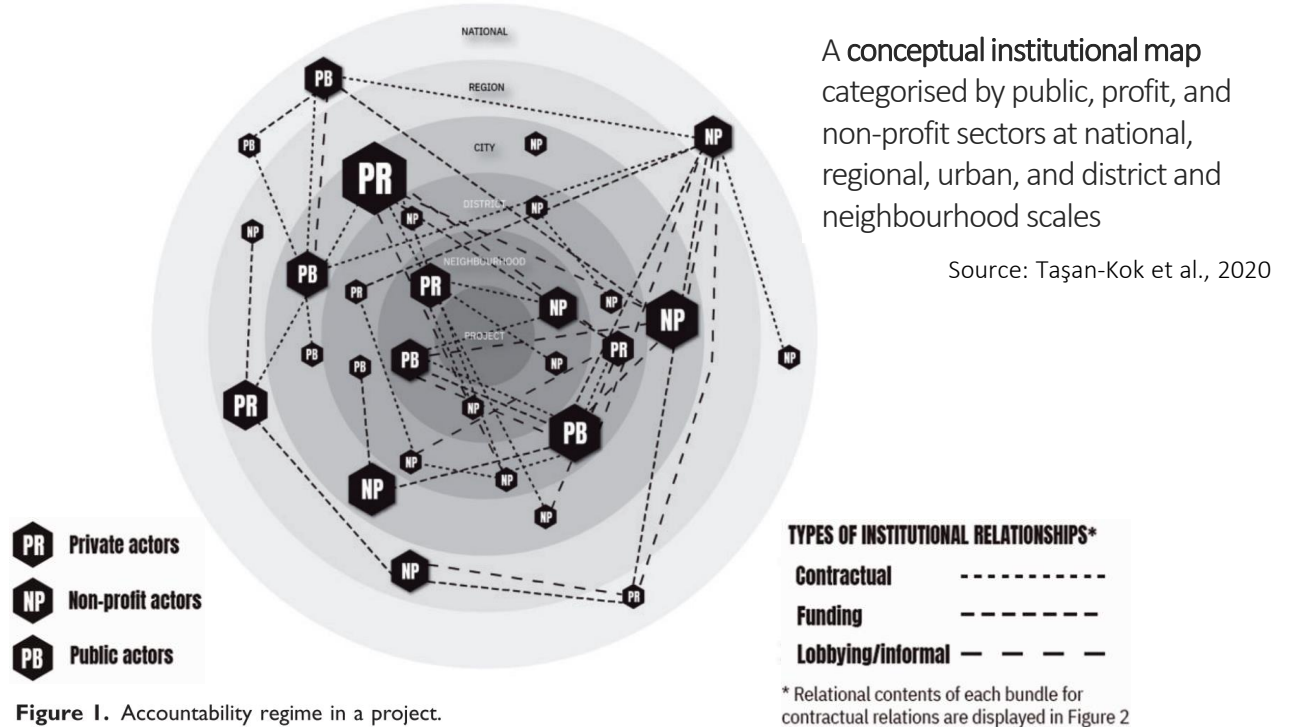


Figure 1. Accountability regime in a project.

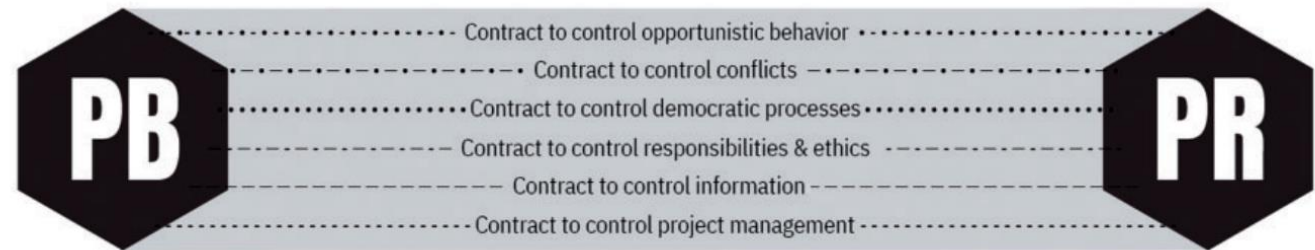


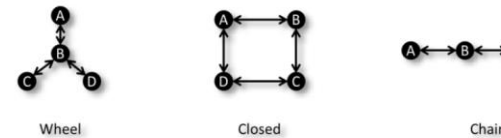
Figure 3. Illustrative contents of contractual relations.

Source: Taşan-Kok et al., 2020

# Actor-network theory and ABM for conceptualising the urban dev. decision-making process

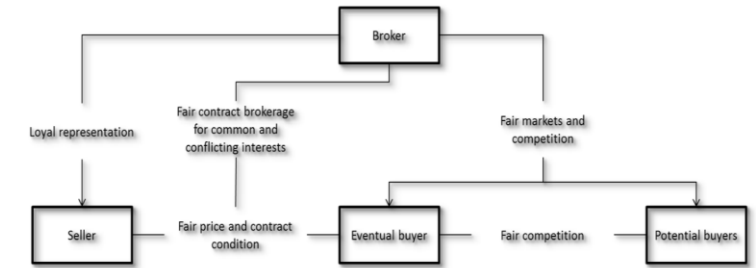
- Can apply social network analysis methods:
  - Structural holes** (Burt, 1992): represent parts of the social network where actors are unconnected. Brokers see opportunities to fill structural holes by constructing 'bridges'.
  - Network centrality** gives actors the opportunity to influence the flow of information.
  - Brokers** were found to exploit cognitive, organisational, and social proximities within their social networks through **building social capital and network homogeneity** – can be extended to examine private-public actor network relations in urban development decision-making.

Figure 4-1: Types of Network Structures



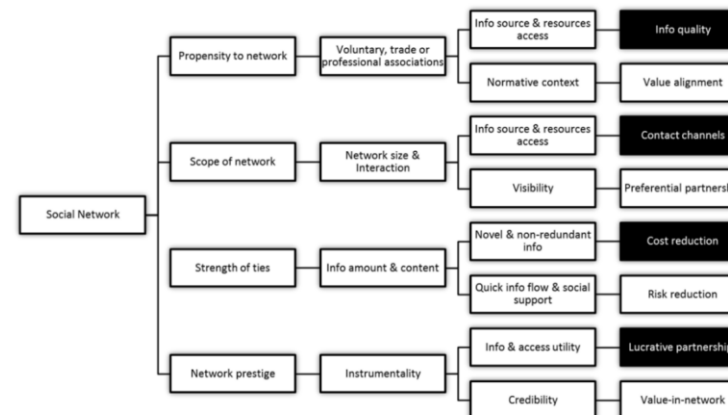
Source: Borgatti et al. (2009)

Figure 3-11: Broker's potential conflicts of interest



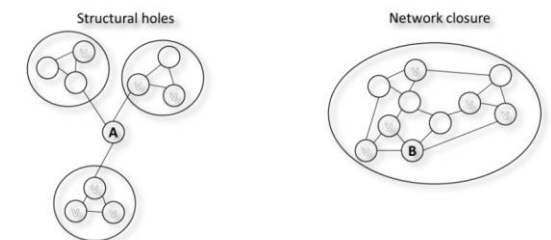
Source: Adopted from Brinkmann (2009)

Figure 4-10: Social Network Attributes that influence inter-firm alliance



Source: BarNir and Smith (2002)

Figure 4-6: Illustration of Structural Holes and network closure

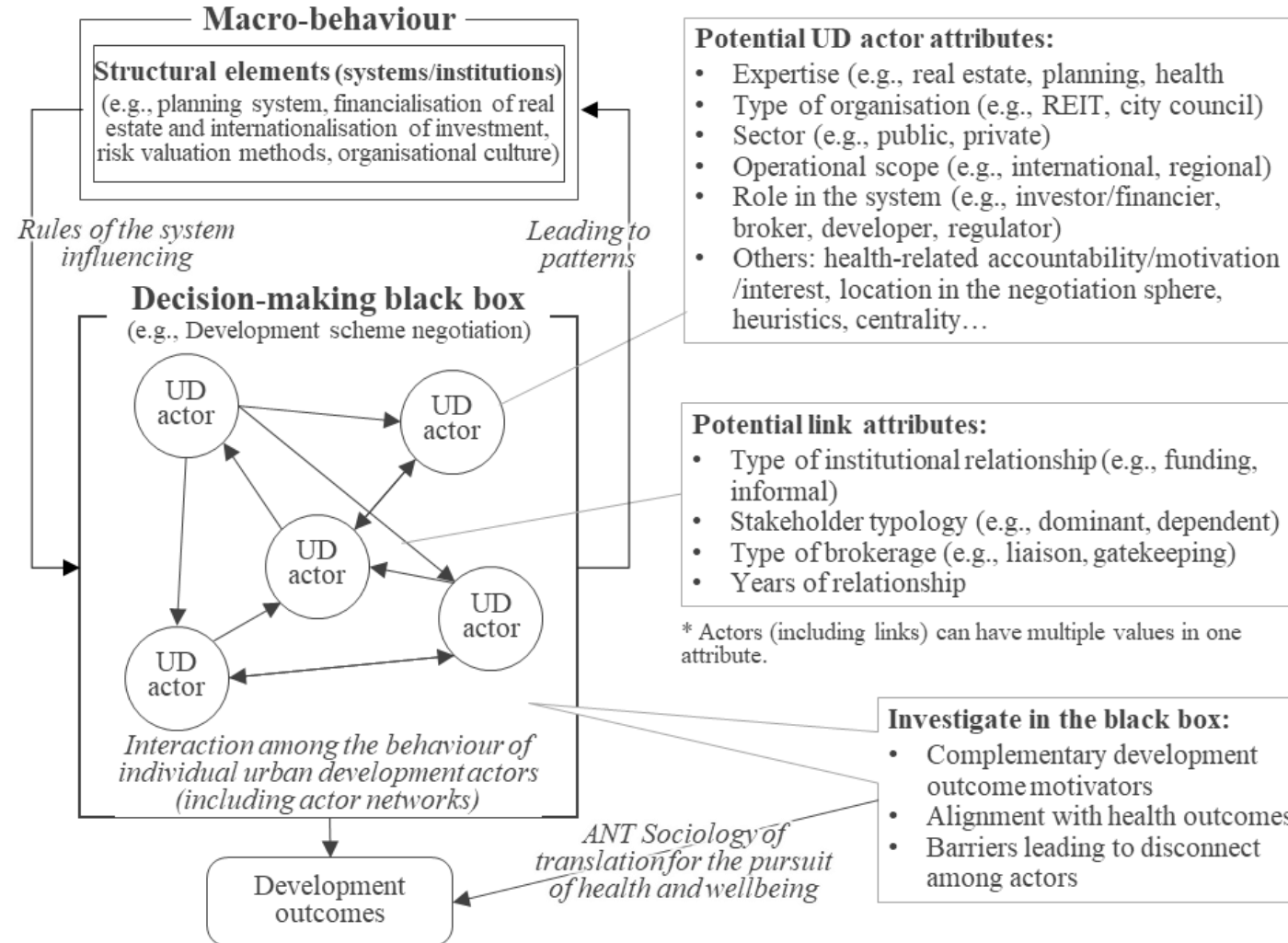


Source: Borgatti and Halgin (2011)

Source: Akakandelwa, 2018

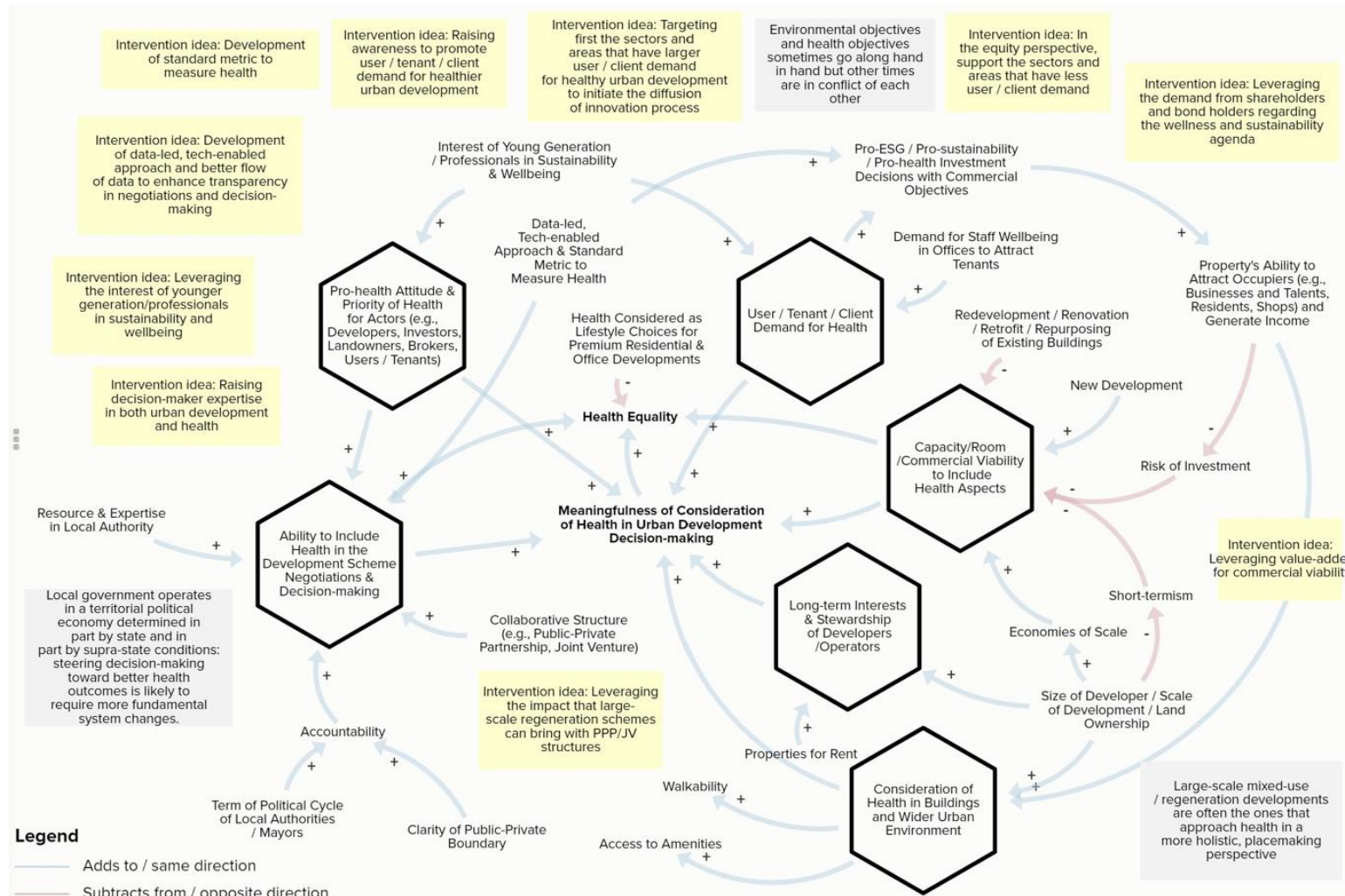
# Kwon and Pain (2023) Searching for Health and Wellbeing: Commercial Real Estate Actor Encounters with Planning in the Urban Development Decision-making 'Black Box'

Conceptualisation of the structure-agency model of urban development decision-making dynamics with a health focus



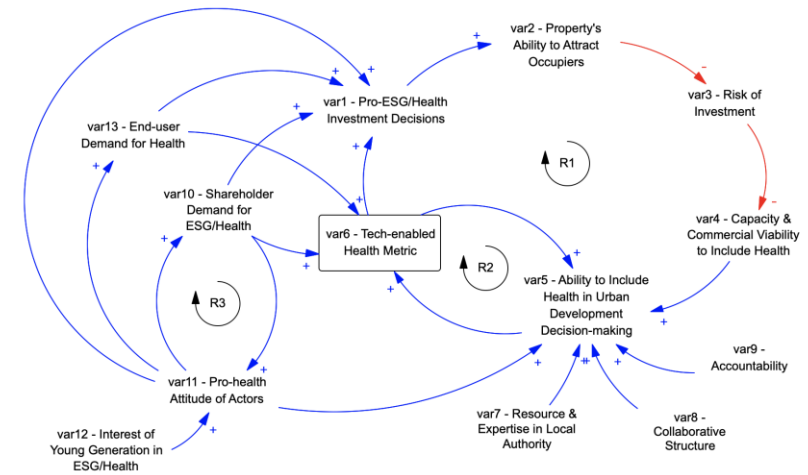


# Newberry, Kwon & Carhart (Forthcoming) Developing Causal Models to Investigate the Consideration of Health in Urban Development Decision-Making: An Example from a Real Estate Perspective



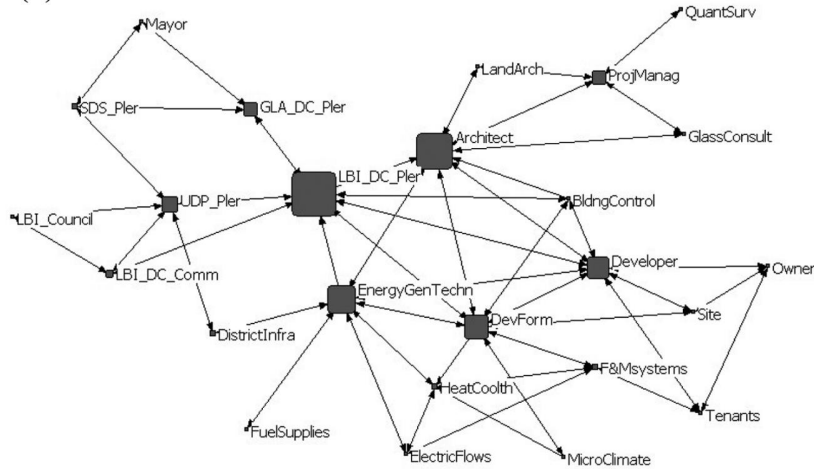
Causal loop diagrams of consideration of health in urban development decision-making described by 21 real estate actors

(including those in global RE services companies, global financial services companies, REITs)



## Further thoughts: Using actor-network theory (ANT) and ABM to model smart city as a socio-technical system?

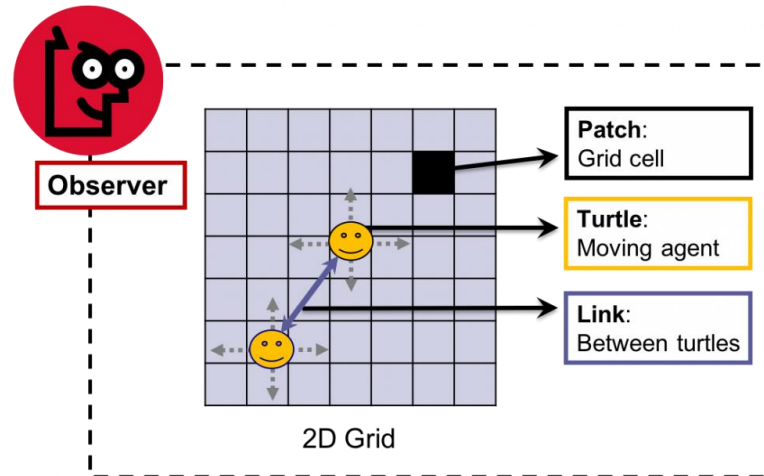
(b)



**Figure 2.** Network of all actants in commercial office development in Ropemaker Place.

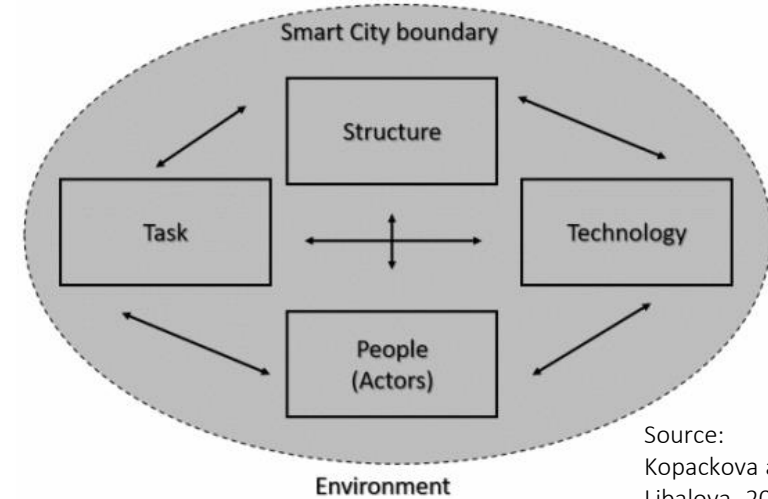
(a) Base network and (b) nodes weighted by betweenness score for actants.

Source: Rydin, 2013



Source: Izquierdo et al., 2019

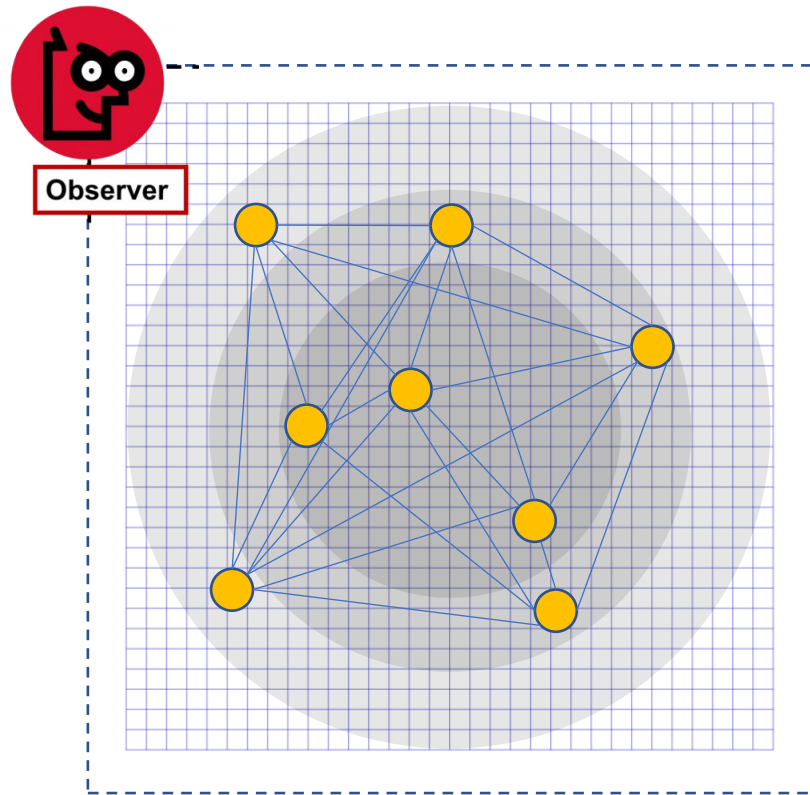
## Application of Leavitt's model for smart city



Source:  
Kopackova and  
Libalova, 2017



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Lecture 2:

Any questions?

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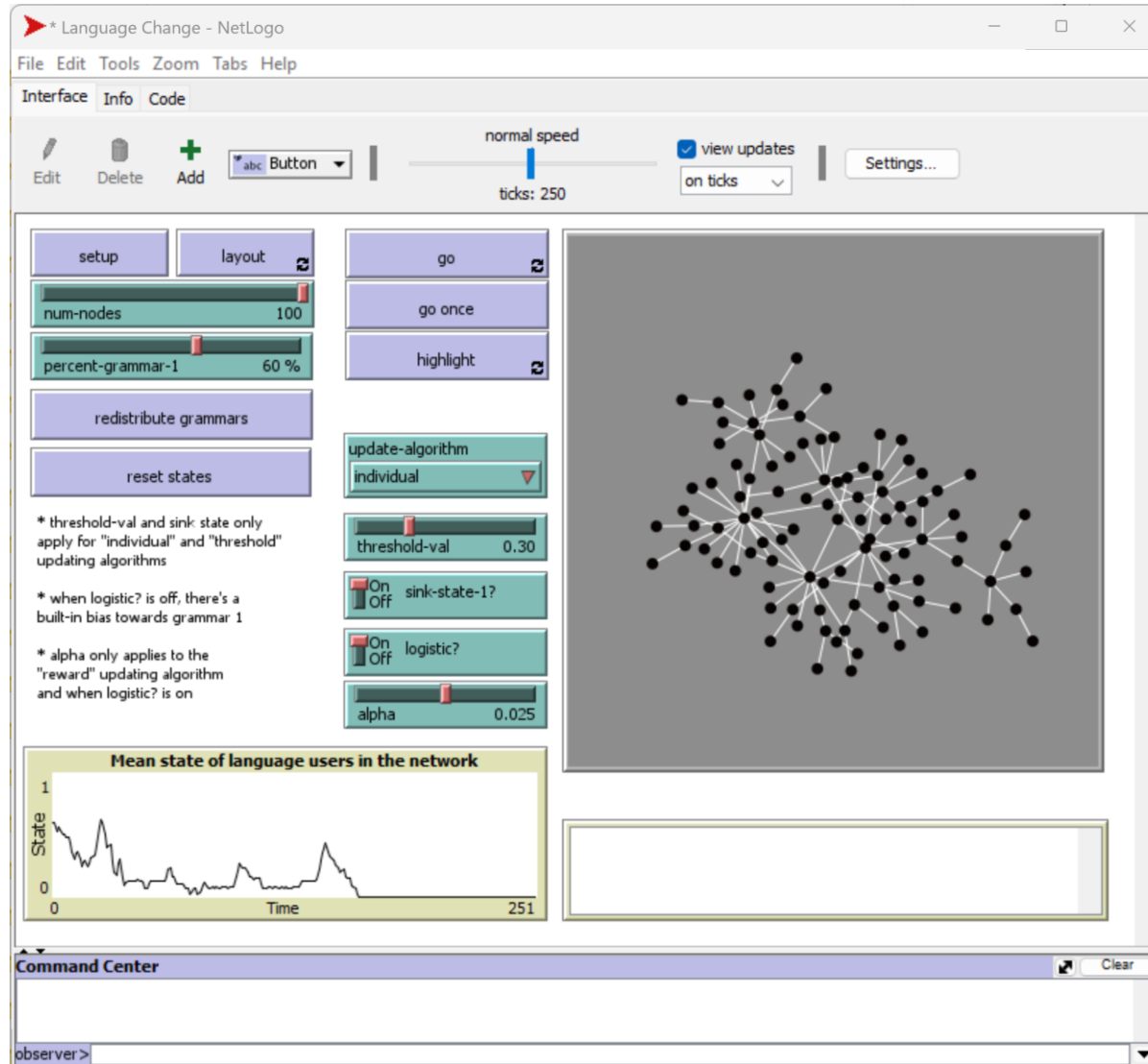
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For Software exercise 2,  
we will look at a network model!

[https://heeseorain.github.io/mini\\_module\\_abm/](https://heeseorain.github.io/mini_module_abm/)