



**UK COLLABORATIVE
CENTRE FOR
HOUSING EVIDENCE**

Housing and systems thinking

Working paper

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Summary

This working paper outlines the value of using systems thinking concepts to frame understanding of the housing sector. The UK Collaborative Centre for Housing Evidence (CaCHE) was funded in part on the basis that it would, where appropriate, integrate a focus on housing as a system into its evidencing, knowledge exchange and research strategies.

Systems thinking provides an array of useful concepts, mental models and modes of thinking that can inform and help structure housing policy and strategy development. To pursue this line of argument, the paper goes through the following stages. First, we set out core ideas associated with systems thinking, stressing a complexity-based perspective; to this we add other relevant systems thinking ideas such as system archetypes and other mental models. Second, we define a housing system and demonstrate how we can apply these ideas to thinking about the housing sector. Finally, the paper suggests ways in which this body of work can directly and indirectly contribute to housing policy and strategy development.

Key points

- Systems thinking focuses on the interrelationships between the elements of a system; clarity about where the boundaries of the system lie for the purposes of analysis; and the reality of different interests across the system, requiring a willingness to work with multiple perspectives. However, there is not one single “systems approach”. Systems analysis has evolved into multiple, different approaches and is applied in many different fields and areas of policy interest. It offers a useful set of tools with which to facilitate policy change, analytical thinking, and diverse interested stakeholders working together.
- Housing is a strong candidate to be considered as a system and to be analysed using systems thinking. There have been a few significant attempts to do this in the past, including in Scotland, but the case can be made that strategic and policy development in the housing sector would be enhanced if it were more fully infused with this way of thinking.
- One important generic way of conceptualising systems like housing is through the application of complexity thinking. This leads to an emphasis on the importance, for understanding the behaviour of social systems, of characteristics such as interdependence, feedback loops, emergence, initial conditions and path dependency, and evolutionary or adaptive learning.
- A longstanding feature of systems thinking is the development of mental models including causal loop diagrams and system archetypes. Systems archetypes are patterns of relationships that reappear frequently across society, economy and public policy. These methods can be used qualitatively to explore the structure and behaviour of systems or as the basis for quantitative system dynamics modelling. These approaches can be usefully applied in different ways to the housing system.
- Systems thinking can be applied fruitfully to housing strategy and policy development. As a first step we would recommend developing a checklist approach that keeps these ideas at the forefront of thinking when engaging with (policy) interventions that seek to leverage housing outcomes across a rich and complex system.

- We should not adopt systems thinking principles uncritically – mental models simplify and causal loop diagrams are only first approximations. Their value can be enhanced when they are backed up by the appropriate and consistent use of data, indicators and even simulation models¹. The complexity approach can also present challenges². It can be difficult to operationalise theoretical concepts when we move to empirical applications. Some approaches to complexity analysis may generate deterministic solutions that take insufficient account of policy making. In the end, the real value of complexity thinking is whether or not it can systematically impact on the effectiveness of our approaches to addressing real world problems.

Systems thinking

What is systems thinking?

At one level, systems thinking is a general demand for policy and analytical work to move beyond partial or narrow perspectives in favour of a more holistic and connected appreciation of the joined-up nature of society. It can also promote the recognition that there can be multiple perspectives upon reality: different stakeholders look at a real-world system from different angles, with different priorities and objectives, and consequently see different things. As a consequence, we need a more general or systemic foundation to our analysis.

Terms like “system”, “systems approach” or “systems analysis” can often be used in a common-sense or intuitive way or they can be a broad reference to the need to think about social structures. It does not necessarily imply that a writer is trying to invoke any specific systems thinking approach, of the type we are discussing here (a perfectly valid example of this would be the use of the term by Stephens³). In the sense to be developed here, systems thinking is more than simply identifying that policy or strategy for housing has to, in some way, account for or recognise it comprises many different elements or has to be appropriately located in its institutional context. It is to acknowledge that the different elements interact in complex ways: change in one has consequences for the system as a whole and for other components. It also suggests that understanding the perspectives, incentives and goals of the different parties involved is important to developing credible and sustainable system or policy change.

There are many definitions underscoring the myriad different approaches to systems. These approaches can differ conceptually, while similar approaches can take on somewhat different guises in different disciplines. At a general level, Williams and Hummelbrunner suggest three common threads across the theory and application of systems thinking⁴: an understanding of interrelationships; a commitment to *multiple perspectives* [or pluralism]; and, an awareness of *boundaries*. Interconnectedness has always been at the heart of systems thinking: complex patterns of interconnection and interdependency fundamentally shape the way a system behaves; these interconnections explain why simplistic models of cause and effect can be misleading and policy based on such models is ineffective or counterproductive. Multiple perspectives refers to a recognition of the importance of the different perspectives (and contexts) of the actors and institutions that constitute important elements or nodes of a system. Understanding this diversity and divergence of perspective can be a key part in the application of systems thinking to social change⁵. Indeed, Stroh argues that encouraging different stakeholders to think systemically can help overcome barriers to change and, at least, help each stakeholder to better understand other perspectives and appreciate collectively

¹ Roggio, A (2018) 'A systems thinking approach to the integration of food insecurity policy', *Journal of Public Affairs*, e1862 <https://doi.org/10.1002/pa.1862>

² Cairney, P (2012) 'Complexity theory in political science and public policy', *Policy Studies Review*, 10(3) 346-58.

³ Stephens, M (2011) 'Comparative Housing Research: A 'System-Embedded' Approach', *International Journal of Housing Policy*, 11(4) 337-355.

⁴ Williams, B and Hummelbrunner, R (2011) *Systems Concepts in Action: A Practitioner's Toolkit*. Stanford Business Books.

⁵ Canty-Waldron, J (2014) 'Using systems thinking to create more impactful social policy', *Journal of Futures Studies*, 19(2) 61-86; Stroh, D (2015) *Systems Thinking for Social Change*. Chelsea Green: Vermont.

what is required to make change happen⁶. Thirdly, it is essential – and unavoidable – that we draw boundaries and distinguish interactions within a system from external shocks and drivers from outside. But it is also important to recognise that where we draw the boundaries is an analytical decision – that can be, in an interconnected system, to some extent arbitrary – and that this decision fundamentally shapes the nature of the analysis.

Several reviews of the historical development of systems thinking, its branching into different strands and its recent re-emergence are available⁷. Systems thinking emerged from a harder science and engineering interest in cybernetics. Soft systems approaches that rely upon more heuristic arguments and the recognition of multiple perspectives were developed in the 1970s. More recently, complexity science concepts and applications have attracted considerable attention among policy scholars⁸. Systems thinking has long been associated with trying to better understand so-called “wicked problems”, an idea associated with Rittel and Weber⁹, who formally introduced the concept of wickedness to the public policy debate¹⁰.

Systems thinking is therefore not a well-defined homogenous approach but rather a set of ideas and practices that have evolved, split, and become entangled with other innovative approaches e.g. design thinking¹¹. It is both a broad orientation towards analysis – thinking holistically about interconnection – and a diverse range of specific tools and techniques for doing so. There are a number of key strands: cybernetics and hard modelling of system relationships focusing on dynamics and feedback loops, often building mathematical and statistical models and relying on computer simulations; softer heuristic approaches including mental models and system archetypes, as well as work within social policy domains (social care, education, homelessness, public health etc.); and, more recently, the infusion of complexity ideas into systems approaches, in the form of both ‘hard’ complexity modelling and ‘soft’ complexity thinking.¹²

In this working paper we start by reviewing complexity-infused approaches to systems thinking. We then focus on the mental models and systems archetypes ideas. Some would contend that system archetypes over-simplify, and that this may be at the cost of understanding problems in specific circumstances¹³. However, as thought experiments involving familiar situations, they often represent, as we shall see, very useful first approximations.

⁶ We do not explore this aspect of systems thinking – and related issues such as the potential power of ‘reframing’ – further in this paper, but we recognise it is a key characteristic of many soft systems approaches, in particular. It is an important discussion to have elsewhere about catalysing reform in, for instance, partnerships and other areas where multiple stakeholder interests may emerge and conflict.

⁷ See: Checkland, P and Scholes, J (1999) *Soft Systems Methodology in Action*. Wiley: Chichester; Meadows, D (2008) *Thinking in Systems: A Primer*. Chelsea Green: Vermont; Jackson, M (2009) ‘Fifty years of systems thinking for management’, *Journal of the Operational Research Society*, 60(1) 186-97; Mulgan, G and Leadbeater, C (2013) *Systems Innovation*. NESTA: London; Cook, J and Tonurist, P (2016) *From Transactional to Strategic: systems approaches to public service challenges*. OECD Observatory of Public Sector Innovation. https://www.oecd.org/media/oecdorg/satellitesites/opsi/contents/images/h2020_systemstinking-fin.pdf; Williams and Hummelbrunner (2017); Roggio (2018).

⁸ Room, G (2011) *Complexity, Institutions and Public Policy*. Edward Elgar: Cheltenham; Cairney (2012); Cairney, P (2019) ‘Evidence and policy-making’ in Boaz, A, Davies, H, Fraser, A and Nutley, S (eds) *What Works Next*. Policy Press: Bristol; Geyer, R and Cairney, P (eds) (2015) *Handbook of complexity and public policy*, Cheltenham: Edward Elgar.

⁹ Rittel, H and Weber, M (1973) ‘Dilemmas in a general theory of planning’, *Policy Sciences*, 4, 155-69.

¹⁰ Wicked problems and their taming are also ideas with their challenges. They help expose the different cultures of hard and soft systems thinking. The former, more confident that solutions can be derived; the latter, more sceptical. See Daviter, F (2017) ‘Coping, taming or solving: alternative approaches to the governance of wicked problems’, *Policy Studies*, 38(6) 571-588, for a recent overview of the issues.

¹¹ Cook and Tonurist (2016)

¹² Examples a broad range of hard and soft complexity approaches, applied to policy questions, can be found in Geyer and Cairney (2015).

¹³ Cook and Tonurist (2016)

Systems and complexity

Let's start with complexity-infused systems approaches¹⁴. The core ideas from this perspective include:

- **Interdependence/interconnectedness.** Systems might vary considerably, but they are all fundamentally about the interdependence of different elements or nodes, and that directs us to focus on their inter-relationships. Complexity starts from the proposition that you cannot explain the system by simply breaking it down into its component parts¹⁵ ¹⁶. In other words, not only should a policy problem be analysed in terms of its relevant components but the analysis should go further and take account of how those different components relate to each other and interact. This is also why multi or inter-disciplinary teams are often required to address the complex nature of the systems in question (and why systems thinking often embraces a wider *methodological pluralism*).
- **Emergence.** A typical feature of a complex system is that it displays system-level behaviour that cannot be derived from knowledge of its components – the behaviour is emergent. The interactions between the system's components/nodes imply that observed system outcomes are the product of complex causation. They may often suggest local initiation and self-organising behaviour. The rules by which local nodes and actors interact become much more important in shaping what happens in the system¹⁷. These processes may generate unpredictable periods of stability and rapid short run change. As a consequence, policymakers might not be able to predictably control system behaviour.
- **Dynamics** (including the impact of unfolding real time). System relationships change over time, sometimes sharply and at other times slowly and more predictably. This is not simply about the short and long run of change reverberating around systems, it also recognises that time is a real constraint or barrier to progress. Dynamic considerations change the way we analyse and evidence the systems we are concerned with, suggesting the inadequacy of more short-term static models. The focus on time is also suggestive of uncertainty and a difficulty in predicting or forecasting.
- **Initial conditions.** Systems are highly contextual and their behaviour depends significantly on what went before: for instance, the built environment or economic history of a region. Systems are thus *path dependent* and governed by the existing stock of resources, institutions and initial conditions: these constrain and shape how the system can develop and also place constraints on the ability to change the system. This may also suggest a degree of humility on the part of policy makers in terms of their capacity to change system outcomes (on top of the other complexity dimensions alluded to here that reinforce the difficulty of designing, implementing and monitoring the effects of policy or practice change in a given socio-economic system).

¹⁴ There are important critiques of the complex systems approach – see: Cairney (2012; 2019); Cook and Tonurist (2016); Freeman, R (1999) 'Recursive Politics: Prevention, Modernity and Social Systems', *Children and Society*, 13 232-41, among others (though note that, nonetheless, these writers are advocates of the insights that such thinking brings).

¹⁵ Cairney (2012)

¹⁶ This raises an interesting, but as yet unresolved, question. Would it be cored to claim that all social systems are complex? If that were the case then any apparent simplicity or observed predictable behaviour is best viewed as a temporary system status. The alternative perspective is that society includes a mix of different situations (simple, complicated, complex, chaotic) so complexity thinking only applies to a subset of social reality. That raises the further question of how you identify which situations are truly complex.

¹⁷ Cairney (2012)

- **Evolution, learning and adaptive behaviour.** The emphasis upon real time dynamics and path dependency leads systems thinking to a concern with the notion of evolution. Actors and institutions receive feedback from processes, outcomes and performance. Actors learn and adapt by changing their assumptions and behaviour. This will cause the interrelationships within the system to evolve and in turn change the structure and behaviour of the system. As a consequence, it is common to encounter the term *complex adaptive system* in the literature.
- **Amplifying/reinforcing feedback.** Positive feedback loops can amplify initial impacts, thereby creating non-linear change. Such feedback may of course be socially or economically negative, depending on the scenario (e.g. a negative shock is amplified, such as when a fall in GDP reduces employment which in turn further reduces spending and economic activity).
- **Balancing/equilibrating feedback.** Negative feedback loops reduce the impact of the initial stimulus. They can act to rebalance a system or return it to equilibrium. If this refers to a policy initiative then it may mean that the system responds to the policy shock by reacting against it. Statisticians talk about mean reversion and biologists refer to homeostasis where the system regulates its temperature in order to remain in balance. Negative feedback may help reduce the longer-term impact of shocks (like textbook fiscal 'automatic stabilisers'). But it might also make policy reform more difficult.

Key mental models and archetypes

Systems thinking has developed a large number of useful mental models and systems archetypes. System archetypes are underlying processes that repeatedly appear in different organisations, places, policies, or other systems contexts. Below, we introduce causal loop diagrams (CLDs) as a method for capturing system characteristics and then explain the intuitions behind well-known system archetypes¹⁸. We return to them again later to discuss them in the context of the housing system. First, however, we look briefly at three other important mental models.

Meadow's **bathtub** analogy relates to stocks and flows: processes whereby in- and outflows change the overall stock. If the flow of water into a bath is faster than the outflow then the bath will fill up; slower and the bath will empty. The analogy has broad application. The 'stock' and 'flows' in question could be carbon dioxide levels in the atmosphere and rate of polluting vehicle emissions relative to carbon capture; the relationship between local population and net migration; or the stock of houses net of new build, conversions and demolitions. This is one way of capturing both the importance of the overall stock (and the initial conditions or history of a system) and the balancing or reinforcing effects of in- and outflows combined.

The **iceberg model** is a way of thinking about the importance of systems as underlying processes that are easily missed because so much happens below the surface. Stroh¹⁹ distinguishes between visible short run events, crises or symptoms, on the one hand, and the associated underlying trends and patterns, on the other. The tendency is to focus on and firefight the events, whereas making sense of how the events relate to wider trends and patterns requires a more analytical approach to both diagnosis and subsequent policy or practice actions. However, there is a further and more fundamental level at the base of the iceberg – the system's structure: understanding this can help analysts and policy makers make sense of more fundamental causes, challenges and drivers shaping stability and change. This is as much about analysis of the interrelationships as seeing one's role from other perspectives: making a systemic contribution to improve outcomes may in part require taking a broader holistic view that recognises the unintended consequences of our own actions²⁰.

¹⁸ Stroh (2015); the concept of system archetypes was developed and popularised by P Senge (1990) *The fifth discipline: the art and practice of the learning organisation*, Random House Business.

¹⁹ Stroh (2015)

²⁰ Stroh (2015)

Third, and derived from hard systems work going back to the 1950s, is the idea of Ashby's requisite variety and the implied **complexity gap**²¹. Ashby's insight was that in confronting complex systems and problems, the response has to be equal in complexity and variety. Trying to break up the problem into more simple components will fail; instead, what is required is sufficient comprehension of the complexity in the system to be able to mount an equally structured response. The complexity gap arises where there is an imbalance between the system problem and the policy response.

We will return to all three of these mental models in relation to housing systems later in this paper.

Proponents argue that **system archetypes** are repeated or recurring system patterns that can be useful for understanding different types of situations. The task for the analyst is to understand the variables and their interrelationship in a particular setting and recognise that they can be mapped on to a system archetype. Stroh²² and many other systems texts cover the archetypes in considerable detail. They are usually presented as visualisations via what are called causal loop diagrams (CLDs). These diagrams seek to capture whether an initial stimulus leads to positive or negative impacts on other variables (ie whether they move in the same or in the opposite direction). CLDs take explicit account of positive (reinforcing) feedback or negative (balancing) feedback effects. We illustrate a systems archetype model below (the second one – *shifting the burden*) which works with the interaction between a positive (reinforcing, labelled 'R') feedback loop and negative (balancing, labelled 'B') loops. This is discussed in more detail under the case itself.

The archetypes are a relatively simple idea and capture comparatively simple systems, but they resonate with many different social situations. Some real-world systems will incorporate more than one archetype. The archetypes do not, however, exhaust the applicability of CLDs: many systems go well beyond them. In practice CLDs for real world systems can become extremely complex²³. Here, we identify the key idea associated with each archetype; later we consider their relevance to the housing system.

²¹ Cook and Tonurist (2016)

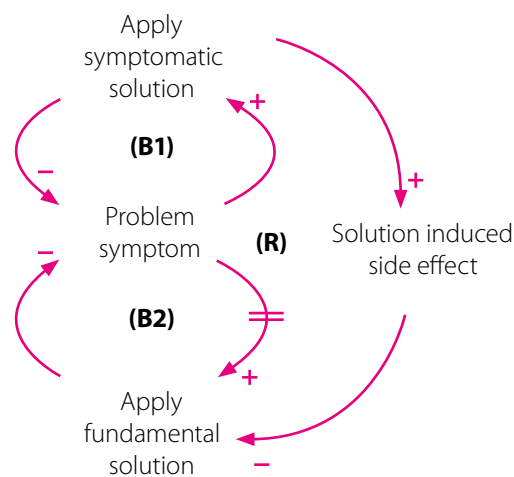
²² Stroh (2015)

²³ Cook and Tonurist (2016) illustrate this with the unfathomably complex causal loop diagram associated with the US forces analysis of the situation in Afghanistan towards the end of the last decade. A simpler – yet still complex - example can be found in the CLDs used by the Munro Review of social care in England: discussed in the social care chapter of Boaz, A, et al (eds) (2019), and more fully in Lane, D, Munro, E and Huseman, E (2016) Blending systems thinking approaches for organisational analysis: reviewing child protection in England, *European Journal of Operational Research*, 251, 613-623.

Below we introduce nine of the most well-known system archetypes:

- **Fixes that fail** – is about unintended consequences²⁴ where a quick fix is undertaken for well-intentioned reasons, but is aimed at symptoms rather than underlying causes. This works in the short run but makes things worse in the long term. Stroh uses the example of harsh prison sentences that reduce crime in the short run but, over time, a failure to rehabilitate and provide post-prison support leads to more offending. The short run effect might seem to balance the underlying problem but the reinforcing effect offsets and worsens the underlying problem over time. Another example might be the use of close performance monitoring to address a decline in organisational performance. While this might boost performance in the short-term, it has the effect of disempowering and demotivating workers so the underlying structural problem gets worse.

Figure 1: Causal Loop diagram of ‘Shifting the Burden’ Archetype



Source: [‘Making Connections’ website](#), 2010 (free to use resources)

- **Shifting the burden** – is a wider recognition of the tension between short run symptomatic problems and tackling long run causes (what Stroh, p.55, calls the *philanthropic challenge* or why for instance there is under-investment in public health relative to health care). Unlike the previous case, stakeholders generally know what both the fundamental problem and its solution are, but they lack the incentives and resources to make lasting change happen – so they go with the short run symptomatic response. In the causal loop diagram presented in Figure 1, the acknowledgement of a “problem symptom” could be to apply the “fundamental solution” that will reduce the problem symptom (bottom balancing loop B2). However, its reduction of the symptom occurs with a time lag (signified by the || crossing the line). This time lag incentivises the use of the “symptomatic solution” instead. This solution similarly has the effect of reducing the problem symptom (top balancing loop B1). However, the symptomatic solution also has a side effect that reduces the incentive to apply the fundamental solution (reinforcing loop R). The failure to apply the fundamental solution in turn increases the initial problem symptom.

²⁴ Stroh (2015)

- **Tragedy of the commons** – is a well-known market failure idea where a collective resource is allowed to decline because no individual affected party feels able to ensure that the necessary maintenance and management of the resource takes place. This might speak to the ongoing management of public spaces, natural resources like fisheries, or within organisations the protection and support of key central or corporate support services.
- **Accidental adversaries** – is a situation in which potential partners whose collaboration is of mutual benefit shift from a positive sum to a zero sum game (which may even become negative). This may arise because one player is doing less well than they want and their strategy to improve their own performance reduces the outcomes for the other player, who responds in kind and this reduces the performance outcome of the first player. As Stroh argues (p62), this process inadvertently reduces the performance of both and creates a vicious cycle. This sort of problem may arise in cases of trying to promote preventative spending across administrative silos i.e. promoting collaboration where the incentives to pursue one's own objectives and adhere to narrow rules inhibit achievement of the wider purpose²⁵.
- **Limits to growth** – represents Donella Meadow's original contribution to the environmental sustainability argument. Fundamentally, nothing grows forever at the same rate because external or internal factors eventually weaken the drivers for growth, which becomes self-limiting. This may be about internal management or operational performance limitations or the ceiling on external markets limiting a business or country's growth. Or it could be a question of the reduced availability of finite natural resources required to achieve continuing growth.
- **Growth and underinvestment** – previous or current growth of a business or policy is not sustained because of under-investment in the stock or the assets of the business or policy: growth or policy outcomes will falter because, to mix metaphors, the repairs to the roof were not done while the sun was shining (a form of short-termism).
- **Success to the successful** – initial conditions that advantage one group in a market or business setting (or perhaps life opportunities) are reinforced to the advantage of the already successful. This is an explanation for the growing concentration of wealth.
- **Drifting goals** – represents the unplanned weakening of performance over time and may arise because one inferior short run coping solution to long term problems may be to reduce the performance goals of the business or the system²⁶.
- **Escalation** - is about unintended proliferation when competing interests continually push back in a tit-for-tat wasteful (perhaps dangerously so, if it is an arms race) competition.

Meadows and others²⁷ focus on **leverage points** with which to address system challenges. These are places or modes of intervention in systems that range from weak to strong. Powerful leverage points may lie in non-obvious or relatively distant nodes in the system. The stronger leverage points tend to be those that are more difficult to act upon because they affect the system more profoundly. Increasing the rate of tax on plastic bags is straightforward to implement but has a relatively weak impact on overall environmental sustainability; whereas, changing away from GDP as the primary measure of economic growth could have a major impact upon sustainability, by reorienting the goals of the system, but it is extremely difficult to achieve.

²⁵ See also: Freeman (1999)

²⁶ Stroh (2015)

²⁷ E.g. Stroh (2015); Cook and Tonurist (2016)

Stroh conceives of leverage points as strategic focused interventions that maximise the impact of finite resources to effect systemic change – they encourage forensic targeting rather than broad scattergun approaches, using systems insights. Following Meadows, Stroh (p.148) focuses on four aspects that combine to make leverage effective:

- Stand back and increase awareness by studying the system and how it works²⁸
- Seek to change or rewire (e.g. through nudges and incentives) cause and effect behaviours that impact negatively on system outcomes
- Change actors’ mental models towards addressing long term fundamental causes rather than quick fixes
- Reinforce the purpose of system reform by aligning goals, policy instruments, measurement metrics and analysis, incentives and funding.

Systems thinking also makes one think differently about the use of evidence for policy and practice. Once one recognises the system structures around us and their importance, this changes the data and indicators we require to understand relevant processes, outcomes and policy performance. Moreover, this insight creates a consequent need to invest in data infrastructure and the capacity to fully exploit both the data and the insights from the systems approach. Just as systems thinking can enrich how we understand a problem and/or process, we need to align our data and evidencing strategies accordingly. The complexity of systems implies a further argument in favour of greater priority being attached to systems-aligned empirical evidence. This sort of evidence is also a necessary component of any serious attempt to apply harder forms of systems thinking involving model simulation and calibration.²⁹

There are, however, problems or questions over the use and application of systems thinking that we must acknowledge. We should not adopt systems thinking principles uncritically: the mental models discussed here simplify and causal loop diagrams are only first approximations. Their value can be enhanced if they are backed up by the appropriate and consistent use of data, indicators and even simulation models^{30 31}. The complexity science approach can also present challenges³². It can be difficult to operationalise theoretical concepts when we seek to move to empirical applications. Complexity science can be more deterministic than the more interpretative perspectives of *complexity thinking*.³³ Moreover, deterministic complexity science may take insufficient account of the ‘messy reality’ of policy making³⁴.

²⁸ Stroh favourably quotes Eisenhower’s call to think and not just jump in, p.148: ‘don’t just do something, stand there!’

²⁹ On this point see: Best, A and Holmes, B (2010) ‘Systems thinking, knowledge and action: towards better models and methods’, *Evidence and Policy* 6(2) 145-59; Holmes, B et al (2017) ‘Mobilising knowledge in complex health systems: a call to action’, *Evidence and Policy* 13(3) 539-60.

³⁰ Roggio (2018)

³¹ We would emphasize the importance of the word ‘appropriate’ here. Systems thinkers have been among the most outspoken critics of the inappropriate application of targets and indicators as part of systems of top-down performance management: see for example Seddon, 2008.

³² Cairney (2012)

³³ Extended discussions that seek to convey the qualitative insights offered by complexity thinking can be found in: Boulton, J, Allen, P and Bowman, C (2015) *Embracing complexity: strategic perspectives for an age of turbulence*, Oxford: Oxford University Press; and, Geyer, R. and Rihani, S. (2010) *Complexity and public policy: A new approach to 21st century politics, policy and society*, London: Routledge.

³⁴ Cairney (2012)

In the end, complexity offers a mode of thinking about social systems – it does not in itself impact upon real world problems. Instead, through changing the understanding of the nature of the system, it changes the understanding of the problem and therefore reshapes the understanding of the policy intervention that one might pursue. If we are thinking about the world from a complexity-inspired perspective how does that change our understanding of what policy is trying to do and how it does it? It might be that the actual policy substance stays the same, but looking at it through a complexity lens changes how we understand what it is trying to achieve and how it interacts with the system it is seeking to affect.³⁵

In contrast, Stroh,³⁶ and others who also take a stronger social change perspective, would argue that adopting systems approaches allows the development of a shared perspective that can indeed, in itself, facilitate social change via collaborative action infused with the insights of systems thinking, mental models and system archetypes.

Housing as a system

The term housing system is often used as a synonym for the housing sector and even the housing market. However, the concept of a housing system can – and should - be given a more specific set of meanings and applications, according to a variety of authors. A founding principle of CaCHE is that, in reviewing housing evidence, we should take a housing systems approach. The CaCHE proposal to ESRC (Case for Support, 2016, pp.1-3) stated:

“Housing is highly segmented, comprising numerous submarkets that vary by dwelling quality but also by country, region and locality. Different tenures have very specific roles and how the systems function, the homes that are available and where people live are all shaped by the practices of different professional and practice communities. Post-devolution, outcomes are also characterised by . . . fragmentation [which] means that there is no one-size fits all policy diagnosis or prognosis for our housing problems.”

“These problems arise because the housing sector is a complex system. . . . Such complexity creates wicked problems that are both difficult to characterise and respond to, complicating mobilization of knowledge and subsequent action. . . . Housing is also interdependent with other major systems such as transport, education, and social security.”

CaCHE seeks to develop a holistic, systematic, and rigorously evidence-based approach to understanding the workings of the system, emphasising the complex and dynamic connections and interdependencies between different parts of the system. Thinking about housing as a dynamic, complex, interdependent and relatively open system is therefore fundamental to the CaCHE approach. Policy interventions have to work with the grain of the housing system understood in this way.

However, not all of the Centre’s work will, or should, take a perspective explicitly rooted in systems thinking. In order to develop the depth and breadth of insight we are seeking it consciously encompasses different disciplinary and methodological perspectives that understand, delimit and interpret the system and its interactions in different ways. Nonetheless, the outcomes of the centre’s work taken together should be emergent in the sense that the whole is more than the sum of its parts. We need, therefore, to develop a set of approaches which allows us find commonality or added insight from looking at housing both systemically and from a variety of perspectives.

³⁵ This point is based on arguments developed by Room (2011) op. cit., fn8.

³⁶ Stroh (2015)

There have been some serious attempts to develop systems thinking in housing. Two of particular note are, first, John Seddon's Vanguard approach applied to public housing management and, second, the local housing systems analysis (LHSA) technique associated with Scottish Homes, Duncan MacLennan and Tony O'Sullivan³⁷. The latter was widely used in Scottish housing planning and continues to be recognizable in the current iterations of statutory housing needs and demand assessments.

Seddon's work is a complexity-based contribution to systems thinking which argues that the whole is more and different from the sum of the parts and hence solutions or analysis or diagnosis of organisations (the performance of service organisations) should take account of emergent properties rather than simply be built up from its components. While the original focus was on the private sector, later work also looked at the public sector and at public housing management in particular³⁸. In focusing at the systemic level, the approach seeks to improve performance through learning, feedback and organisational design based on customer requirements³⁹. The work done for ODPM suggested that there were significant cashable and non-cashable efficiency savings to be made in the three case studies examined. A key message from this work was that while performance indicators could complement systems thinking they should not drive the learning organisational design implied by the introduction of systems-based thinking. Indeed, an overriding focus upon crude performance indicators can drive very dysfunctional system behaviour.⁴⁰

Over a series of iterations going back to the early 1990s, Local Housing Systems Analysis (LHSA) was developed as a coherent operational housing planning tool. A stylised housing system along LHSA lines is represented in Figure 2. A systems approach was fundamental to LHSA and in 2004, O'Sullivan et al, argued (chapter 1) that the development of a local housing system for planning purposes should employ the following principles:

- Household behaviour through what economists term 'revealed preferences', in terms of the acts of choice, mobility and migration, delimit the spatial boundaries of functional housing systems, not administrative jurisdictions.
- Housing systems are characterised by diversity. Housing stock product groups (type, size, location, neighbourhood attributes) and consumer groups (household type, age, income, preferences & lifestyle, etc.) vary considerably and also interact with different institutions, intermediaries and other players.
- Housing systems are characterised by complex flows. The LHSA guide points to processes of construction, demolition, allocation and transactions, which generate signals that may also represent system imbalances or chronic problems – homelessness, high housing costs, shortages, etc.
- Housing is part of a wider social, economic and political environment. Drivers shape long term trends (e.g. demographic patterns of household formation); create medium term opportunities and threats (economic investment and disinvestment affecting jobs and thereby housing demand); and can generate short run shocks to the housing system (e.g. the credit crunch in 2007-08). Policy and planning drivers also impact, directly and indirectly, on housing systems.
- Housing is not static but rather is a dynamic system that changes over time. These changes emerge as a result of forces outside the system (i.e. the drivers described above) as well as the constrained choices made by consumers, suppliers and developers within the system. The LHSA authors stress that this is why scenario planning of different possible futures is an important element to thinking about the unfolding real time paths that housing systems might take (and reminds us of the importance of path dependence and history in real places).

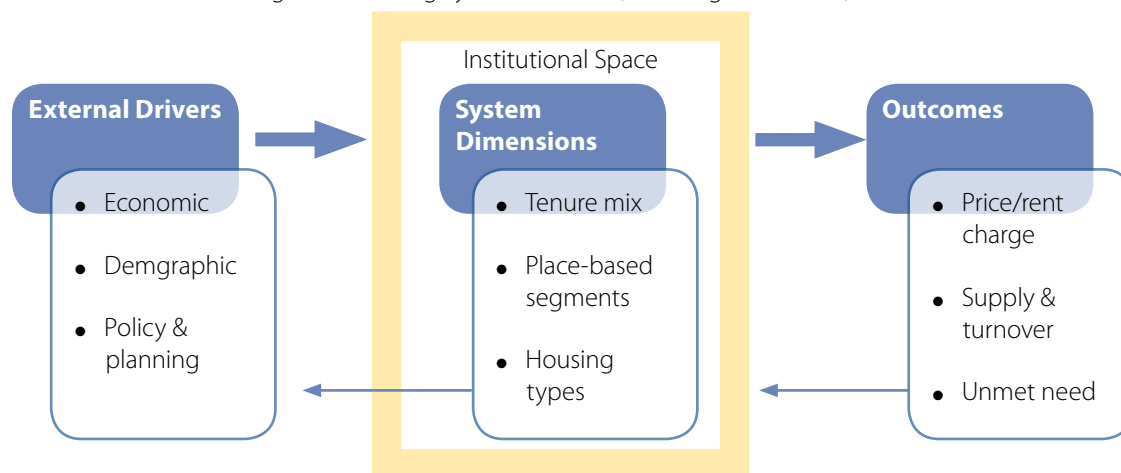
³⁷ O'Sullivan, A et al (2004) Local Housing Systems Analysis: A Good Practice Guide. Communities Scotland: Edinburgh.

³⁸ See: Seddon, J (2008) Systems thinking in the public sector. Axminster: Triarchy Press; ODPM (2005) A systematic approach to service improvement evaluating systems thinking in housing. ODPM: London; Jackson, M, Johnston, N and Seddon, J (2007) 'Evaluating systems thinking in housing', Journal of the Operational Research Society, 58(1) 1-12.

³⁹ O'Donovan, B (2012) 'Editorial for Special Issue of SPAR: The Vanguard Method in a Systems Thinking Context', Systematic Practice Action Research, 27 1-20.

⁴⁰ Seddon has also had some forthright things to say about the challenges of gaining acceptance within Whitehall of approaches rooted in systems thinking: see Seddon, J (2014) The Whitehall Effect, Axminster: Triarchy Press.

Figure 2: Housing System Schema (including institutions)



One of the current authors worked throughout in the LHSA team as far back as the early 1990s. It is not surprising, therefore, that we recommend its continued use both as a general approach and as a specific application subject to local contexts.⁴¹ However, it should be noted that there are other applications of different strands of systems thinking in housing research: comparative policy systems⁴², homelessness evidence⁴³, hard systems modelling of city-regional housing markets (examples online of working and conference papers covering Hong Kong and elsewhere⁴⁴) and more soft social change systems thinking applied in a blog looking at the Californian Bay Area housing affordability problems.⁴⁵

Figure 2 suggests a recursive relationship between external drivers, the internal dimensions of the system - including its institutional elements, and system outcomes. The framework is an open one, which encourages planners to collect data and indicators on the key nodes and the flows between them to help their funding decision makers make better informed decisions on where key pressure points and problems emerge from the analysis.

How does complexity thinking improve our understanding of housing processes? Returning to our list in the previous section, we can argue that each of the principal concepts is relevant:

- An interdependence or interconnectedness focus on flows and relations between system nodes. If we think of the relationships or elasticities between tenures (rising entry level prices increase demand for private renting); segments within tenures (e.g. PRS); or spatially across neighbourhoods or local government jurisdictions or filtering processes across housing value segments or more functional connected segments (land owners, local government, finance, trade bodies, consumers, providers, etc.) – we would expect to see linked decisions, perturbations and consequences of one acting on another.

⁴¹ For an application to Northern Ireland see: Gibb, K, O'Sullivan, A and Young, G (2012) 'Analysing the Belfast Housing Market: Learning Lessons from Extreme Volatility', *Town Planning Review*, 83(4) 407-30.

⁴² See: Van der Heijden, H (editor) (2013) *West European Housing Systems in a Comparative Perspective*. IOS Press: Amsterdam.

⁴³ <https://www.homelessnessimpact.org/> and see their work with Dartington Labs

⁴⁴ E.g. <https://www.systemdynamics.org/assets/conferences/2000/PDFs/hu159p.pdf>

⁴⁵ See: <http://www.systemsthinkingmarin.org/2018/06/27/wild-west-housing-a-systems-thinking-perspective-on-the-housing-crisis/>

- Emergence – the system effects of policies can be greater than anticipated because the system is more than the sum of its parts: local emergent properties produced by local interactions are hard to predict and set off changes and repercussions that are difficult to anticipate (e.g. tax changes on the Buy to Let sector increase the conversion supply of short terms lets concentrated in specific neighbourhoods, or properties purchased through the RTB converting into Buy to Let units in the PRS).
- Dynamics – policies operate in real time, with delays and implementation or effectiveness lags e.g. planning land release; market, building or development cycles interact with specific developments as they are constructed or irreversible investment decisions are made; tax changes to, for instance, LBTT operate with a lag.
- Initial conditions – the existing housing stock dominates the system; Meen and colleagues⁴⁶ argue that urban housing systems evolve slowly and exhibit mean reversion within local areas, making intended policy change harder to sustain. They conclude that micro housing and planning policies may be less effective than long term drivers like technological change, migration and war/natural disasters. More simply, the very low UK long-run elasticity of new housing supply means that considerable and sustained new supply over many years is required to have any meaningful effect to the general level of house prices.
- Evolution, learning and adaptive behaviour. Because the housing market operates in real time, learning from feedback, revising plans and adapting is central to the behaviour of individual sellers observed through time on the market studies of seller behaviour – where asking prices and selling conditions shift in response to perceived demand. It also reflects the importance of information in the system for consumers using online housing search facilities and providing useful data for models like choice-based lettings systems.⁴⁷
- Amplifying/reinforcing feedback. Housing market 'busts' accompanying broader economy recessions can worsen the downturn in a mutually reinforcing way as house price falls and job losses stoke arrears and repossessions which further reduce economic activity and generate further price falls and cycles of home losses.
- Balancing/equilibrating feedback. One well known idea in this regard is that of the counter-cyclical role of affordable or social housing investment when the market sector is experiencing weakened demand.

Returning to the previous section and its use of mental models and system archetypes, it is evident that the housing system and public policy for housing can be usefully captured in several of these ideas. This is a direct way in which one can see the potential utility of systems thinking when framing new directions in housing strategy and development:

- Shifting the burden. First, housing is path dependent and requires long term consistent policy change. However, this confronts short term parliamentary cycles, elections and political change. Can policy for slowly changing systems like housing be supported by building cross party consensus through big tent policy commissions that find common ground and then outline longer term policy strategies to which all parties commit to over more than electoral cycle? Second, if we return to the general case CLD diagram outlined above, we can provide a

⁴⁶ Meen, G, Gibb, K, Leishman, C and Nygaard, C (2016) *Housing Economics: A Historical Approach*. Macmillan: Basingstoke.

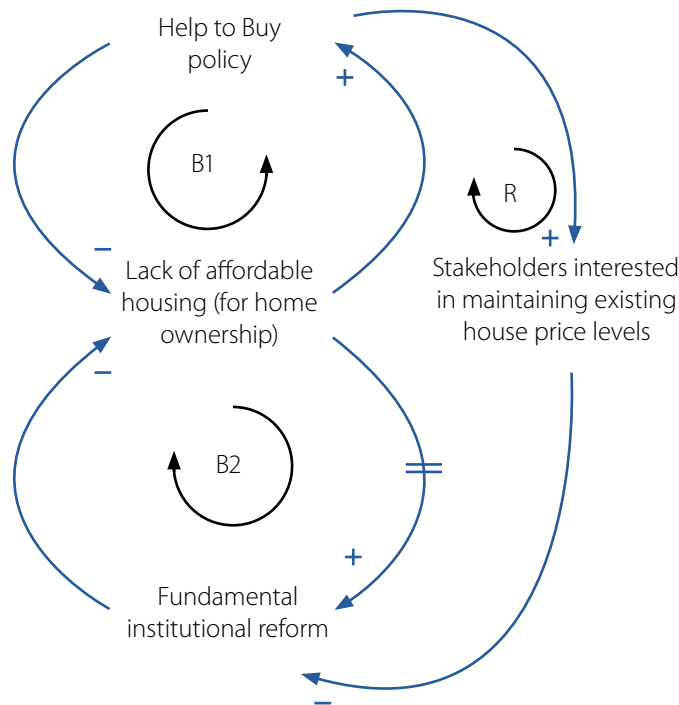
⁴⁷ Also, see Lux, M, Hájek, M and Kázmér, L. (2017) 'Application of agent-based modelling for estimation of norm-based dynamics of housing systems', *Housing, Theory and Society*, 34(4), 379-398. – who use agent-based modelling – a well-established simulation technique within complexity research – to examine the way in which social norms can constrain tenure choice decisions, as compared with the sorts of behaviours predicted by conventional rational choice economics.

more specific example relating to a badly functioning housing market. The problematic symptom is high house prices or low affordability. The symptomatic response is the Help to Buy policy (state equity shares and insurance guarantees) aimed at assisting households to afford prevailing prices. The unintended side effect of the symptom-based solution is to create a larger stakeholder group incentivised to promote high house prices (bankers, developers and existing owners). A more fundamental solution would seek to reform the land market, mortgage credit, the planning system, the house building industry and promote social/affordable supply (See Figure 2).

- Bathtub analogy. Scotland has a vacant and derelict land strategy that seeks over time to reduce and ultimately eliminate significant stocks of such sites. The bathtub analogy suggests that as well as focusing on bringing sites back into use (increasing the outflow from the stock of vacant and derelict land), that there would also be value in targeting marginal sites heading into dereliction before they get there. Evidence suggests that the overall stock of vacant and derelict land is similar to what it was twenty and more years ago, suggesting that creative thinking about the flows may be an important part of the solution.
- Complexity gap. Does the system of private renting regulatory enforcement have sufficient breadth of policy instruments and incentives to deliver across the needs of tackling non-compliance?
- Fixes that fail. In terms of homelessness policy, temporary accommodation solutions represent a symptomatic response that do not necessarily challenge the underlying causes and fundamental responses required to address effectively repeat and chronic homelessness – hence the focus in the recent rough sleeping working group to rethink temporary accommodation in Scotland.
- Tragedy of the commons. A classic market failure is the lack of co-ordination between private individual interests facing common repairs e.g. in a tenement block. The advent of the Buy to Let landlord, mixed tenure arrangements within blocks and ageing decaying property creates collective problems that require leveraged interventions.
- Accidental Adversaries. Where policy intervention requires multiple public/3rd sector agencies, silo problems emerge over objectives, resources, timescales that create rational strategies for individual components of the systems, but which fail to deliver the requisite partnership and alignment to make real change. We see these sorts of difficulties regularly hindering and constraining the capacity to do preventative work in areas like homelessness, area regeneration and the like.
- Success to the successful. Current work we are undertaking for the Scottish Poverty and Wealth Commission on housing wealth inequalities in Scotland reinforces the advantages conferred by parental wealth. This includes the housing outcomes for their children compared to those without such advantage, reinforcing and concentrating such inequalities with wider consequences such as in terms of social mobility and privileging certain forms of economic activity such as rentier investment rather than more entrepreneurial or innovative endeavours.

- Limits to growth. Recent research⁴⁸ suggests that the historical economic growth of leading cities and metropolitan regions in different countries, critical to future national economic growth, is increasingly hindered by a shortage of affordable housing: land becomes more scarce and rents and prices rise. This will undermine the productivity of such regions in time as it becomes more difficult to attract high value workers, let alone keep those who aim to earn just enough to be able to afford to live locally and who provide the basic services any city region requires to function. Without corrective systemwide housing policy reforms there will be hard limits to growth.
- Growth and underinvestment. The success of the community-based housing association movement in Glasgow was founded on both reimagining and renovating tenemental property. Those assets are now depreciating and concerns are increasing about how a new wave of investment work will be resourced and the wider implications of stock deterioration. Asset management strategies and the funding of long term repairs are, as a result, increasingly important priorities.

Figure 3: Shifting the burden: symptomatic and fundamental responses to affordability



⁴⁸ MacLennan, D, Pawson, H, Gibb, K, Hulchanski, D and Chisholm, S (2019) Shaping Futures: Changing the Housing Story – Full Report. University of Glasgow, Policy Scotland. <https://shapingfutures.gla.ac.uk/index.php/changing-the-housing-story>.

Final thoughts

Housing systems and systems thinking represent a cluster of approaches that can help to organise one's thinking. We see this when we consider the different characteristics or attributes of housing systems. From a methodological point of view systems approaches do not offer a one size fits all way forward. However, we think the utility or value of systems thinking comes from adopting a systems perspective more generally. If we take a systems perspective to our diagnosis of empirical, policy and practice questions, then we possess tools and modes of thinking that will encourage better analysis and might help avoid errors that arise from siloed thinking and too much focus on individual elements or nodes rather than the interconnectedness and emergent properties of the system. Roggio⁴⁹ is surely right, however, to demand more of systems thinking and stress the need to move beyond reliance on heuristic tools to the subsequent application of these principles in operational empirical models.

It is not easy to definitively apply spatial and conceptual boundaries to a system such as housing. As the last paragraph suggests, we would favour the pragmatic route which promotes thinking about housing problems and their analysis systemically and working perhaps with a mental checklist of system and sub-system questions or potentially important dimensions to help us operationalise systems thinking without being tied into particular disciplines, evaluative approaches or whatever.⁵⁰ Table 1 is a simplified checklist for housing strategy and policy development.

Table 1. Conceptual Checklist for Systems-thinking in Housing Research, Policy and Practice

1. External System Drivers (key factors operating on the system from outside)
 - Political, economic and planning context
 - Economic drivers
 - Demographic drivers
 - Policy drivers
2. Understanding the housing system's boundaries/archetype/mental model
 - What is the spatial scale (how open, loosely or well-defined is the system?)
 - How does household behaviour determine the functional boundaries and is there an administrative proxy?
 - Do the leading mental models or systems archetypes provide insights and can a causal loop diagram be constructed?
3. Role of Complexity
 - How does interdependency and relationships/interaction between elements operate in this system?
 - Are there important emergent properties?
 - Might we expect significant non-linear paths in key outcome variables?
 - Is learning and adaptive behaviour present? Is it important?

⁴⁹ Roggio (2018)

⁵⁰ See: Gawande, A (2010) *The Checklist Manifesto*. Metropolitan Books: New York. for the practical and life-changing adoption of checklists in different public spheres.

4. Role of Path Dependency

- What are the important initial conditions?
- Are there barriers and rigidities that limit the scope of lasting change? If so, then what are the significant dynamics e.g. lags and cumulative effects?
- Where are they and what form do they take?

5. Recognising Recursive Properties

- Is positive/amplifying feedback identifiable or anticipated?
- Are negative balancing (homeostatic or mean-reversion) properties identifiable or anticipated?

In looking at the general lessons from systems thinking and applying them to the housing system specifically, we have identified many potentially useful concepts and made brief suggestions about how they might be used. Local Housing Systems Analysis argues⁵¹ that complexity should imply a degree of humility on the part of the analyst. The appropriate response is not, however, to give up but rather to develop a more subtle understanding of the ways in which policy affects social systems and, using scenario planning techniques, to explore different possible future outcomes carefully and think through their consequences. This is an analytical process that allows us to evaluate the scenarios in terms of their possibly, plausibly and probability and work towards identifying normatively preferable futures. When faced with an unpredictable complex system the policy steps to move towards that future can only ever be tentative: effective learning is vital.⁵²

Lane⁵³ argues that researchers need to develop strategies to inculcate systems thinking into policy shaping. This includes forms of knowledge brokerage, network development with receptive policy makers, and wider dissemination, and support to develop the practice of systems thinking and systems research more generally. We see this paper as the start of a journey in that direction.

⁵¹ O'Sullivan, et al (2004)

⁵² Sanderson, I. (2009) 'Intelligent policy making for a complex world: pragmatism, evidence and learning', *Political Studies*, 57, 699-719.

⁵³ Lane, D (2016) "Till the muddle in my mind have cleared awa": can we help shape policy using systems modelling?', *Systems Research and Behavioral Science*, 33, 633-50.