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Complexity as a model for social innovation and social entrepreneurship: is there order in the chaos?

Abstract

The complexity sciences are subject to increasing policy interest from governments and international organisations as a means for fostering both social innovation and social entrepreneurship. However, there remains little conceptual clarity in how theories, concepts and ideas can be used consistently and productively. This article reviews the application of the complexity sciences in social innovation and social entrepreneurship scholarship overall and considers its implications for both fields. We outline how social innovation and social entrepreneurship can be conceptualised as complex processes, set within complex environments, tackling complex goals, and present a suitably revised model of the social innovation lifecycle. Based on this review - and the articles contributed to this special issue of *Social Enterprise Journal* – we argue that a complexity-informed perspective can contribute to scholarship and practice in three ways: as a rhetorical device, as an analytical framework for empirical analysis, and as a basis for developing new tools and methods for social innovation and social entrepreneurship. In this way academics can play a crucial role in helping policymakers and practitioners interested in the complexity sciences walk a line between fatalism and overstatement.

Introduction: social innovation, social entrepreneurship and complexity: exploring the linkages

Whether describing a looming social problem or a proposed innovative solution, it is increasingly commonplace to find the word “complex” affixed as a descriptor. Complexity is a particularly malleable term, denoting *inter alia* that something is poorly understood, politically contested, or difficult to accomplish. Complexity can be adopted in this sense as a framework for approaching issues constructively or, less helpfully, as a management gloss or an excuse for inaction. However, as the articles in this special issue demonstrate, the concepts, theories and methodologies of the complexity sciences can offer both constructive theoretical advancements and practical insights to help better address contemporary societal challenges.

As nation-states confront intractable social problems and adapt to system-changing shocks like financial crises, climate emergencies and the COVID-19 pandemic, social innovation and social entrepreneurship are often invoked as routes to needed systemic change (Ashoka, 2020; Avelino et al., 2019; Domanski et al., 2020; Westley and Antadze, 2010). Social innovation and social entrepreneurship charge practitioners with the development of novel ideas for increasingly unknown futures. For Goldstein et al. (2010, p,102), this brings forth a paradox: “if the novelty generation inherent in social innovation cannot be planned, how can social entrepreneurs bring about social innovation?”. In grappling with this question, the interrelated social innovation and social entrepreneurship literatures shifted focus from localised problems to ‘systemic and structural issues’ (Nicholls et al., 2015), from individual ‘heroic’ entrepreneurs to self-organising actors within ecosystems (Moore and Westley, 2011), and from a deterministic theory of change approach to a dynamic and non-linear

process of scaling, spreading and impact (Corner and Ho, 2010). By dint of the questions that now drive its inquiry, social innovation and social entrepreneurship might be considered innately complex concepts.

Complexity science - as a multidisciplinary and indeed multi-theoretical philosophical field (Castellani and Hafferty, 2009) - are as Mulgan (2012, p. 28) noted, “instinctively at home” with social innovation and social enterprises involving, “organic development, trial and error, [and] dispersed power.” Complexity theorists have explored “the unprecedented, the unpredictable, and the non-deductible” nature of both social innovation (Goldstein et al., 2010; Grimm et al., 2013; Matei and Antonie, 2015; Mulgan, 2012b; Taylor and Arundel, 2019; Westley and Antadze, 2010) and social entrepreneurship (Rhodes and Donnelly-Cox, 2008; Swanson and Zhang, 2011; Tapsell and Woods, 2010), and for developing novel means of promoting both processes (Geobey et al., 2012; Hervieux and Voltan, 2019; Zivkovic, 2018). This has involved complexity-derived concepts like emergence (Wheatley and Frieze, 2006), the adaptive cycle (Moore and Westley, 2011; Westley and Antadze, 2010), self-organisation (McCarthy, 2017; Tapsell and Woods, 2010), fitness landscapes (Rhodes and Dowling, 2018) and attractor states (Goldstein et al., 2010), while complexity-related concepts like disequilibrium, non-linearity, feedback and feed-forward and path dependency feature regularly, if more colloquially, in the literature.

Beyond academia, complexity theory and systems-informed approaches now feature much more strongly in the policy landscape and related grey literature. International organisations such as the OECD and the UN have explored systems theory as a development trajectory in recent years, while leading foundations like Ashoka, Schwab and Skoll have all explored elements of complexity in their research programmes. Yet, as more people look to systems

thinking and complexity theory to provide insights and practical guidance for the development, management and sponsorship of social innovation and entrepreneurship, there is a pressing need for complexity-informed scholarship to move beyond providing just a “menu of metaphors” (Mulgan 2012, p.29) and speak directly to a developing practice.

Complicating this drive for practical utility however is the reality that the complexity sciences are not a singular perspective, but rather an extended and quarrelsome family of theories. Research traditions which have developed from von Bertalanffy’s General Systems Theory, Forrester’s System Dynamics, Cybernetics and the Santa Fe Institute’s Complex Adaptive Systems approach focus primarily on modelling, predicting and ultimately influencing the behaviour of complex systems. Other traditions deriving from Cilliers’ postmodernism (Cilliers, 2002), Byrne and Callaghan's (2013) complex realism, and Critical Systems Thinking (Jackson, 2016) consider the challenges of complexity more fundamental and irreducible, demanding rapid adaptation rather than merely better-informed attempts at prediction. The breadth of inquiry and incommensurability of worldviews operant within the complexity sciences is often glossed over in the literature, and researchers (including those working within social innovation and social entrepreneurship) often adopt a ‘pick and mix’ approach, drawing from the complexity science’s vast conceptual library with little attention paid to philosophical consistency or practical complementarity.

In many academic disciplines, complexity is also often subsumed into an oppositional rhetoric, framing insight into problems more than solutions. For Mulgan (2015, p. *xiv*), this is “the constant challenge with systems thinking – how to see the interconnections between things without becoming intellectually overwhelmed, and trapped by them into a fatalism which presumes that change is impossible”. Conversely, while complexity’s constructive

potential is foregrounded in policy discourse by consultants and think tanks as a toolkit to unlock systems change, it can be positioned as a high-concept cure-all lacking analytical depth and criticality. It therefore seems particularly important now for academics to explore with consistency and scrutiny how the complexity sciences might inform a burgeoning policy interest while also offering constructive inroads to the disciplinary mainstream. Notable academic events like the International Conference on Social Entrepreneurship, Systems Thinking, and Complexity at Adelphi University, which led to a 2008 special issue of the *Journal Emergence: Complexity and Organization* contributed groundwork for this agenda. More recently, complexity thinking in social innovation has been carried forward through conference streams at the International Research Society for Public Management Conference and the International Social Innovation Research Conference, from which this special issue emerged. The articles in this special issue from (Abraham and Geobey, 2021; Lythberg et al., 2021; Rhodes et al. 2021; McGowan and Geobey, 2022) build on this body of work and further demonstrate the value of the complexity sciences as a theoretical tradition and empirical lens in social innovation and social entrepreneurship scholarship.

This review article opens this special issue. We survey the adoption and application of complexity science-related ideas in the social innovation and social entrepreneurship literatures to consider the former's contributions and implications for the latter's practice and theory, and we reflect on the contributions which this special issue makes to this area of research. In the following sections we focus our discussion on the fields of social innovation and entrepreneurship, while also acknowledging contributions from closely related fields like social finance. We also draw from pertinent literature from cognate disciplines of public administration, public policy, social-ecological systems and operations management where subject matter overlaps with social innovation and social entrepreneurship topics. Drawing

from the papers in this volume as well as wider literature review, we address two central questions: (1) how have the complexity sciences been applied to the fields of social innovation and social entrepreneurship, and (2) how can complexity contribute to improved theoretical understanding and practical insight in these two fields?

What is so complex about social innovation and entrepreneurship?

Authors writing in both social innovation and social entrepreneurship fields have characterised the nature and challenge of complexity differently. We describe and elaborate on three particular characterisations of complexity adopted in the literature: problem complexity, environmental complexity and process complexity. Understanding these characterisations shows how the challenges and opportunities afforded by complexity science have been understood and operationalised in the two fields, and to begin to explore what they imply in combination.

Complex problems

Firstly, many authors have noted the problems which motivate social innovators and entrepreneurs are often highly complex (e.g. Mulgan, 2012a; Nicholls and Murdock, 2011; Zivkovic, 2018). The social innovation field's focus, particularly in a policy-related context, has moved from narrower and more procedural goals towards deeply entrenched systemic problems from climate change to social inequity - typified by the innovation-driving UN Sustainable Development Goals (Sachs et al., 2019). Similarly, interest in social entrepreneurship has shifted from the promotion of individual agency toward addressing the institutional configurations which perpetuate wicked and intractable social problems

(Hervieux and Voltan, 2019). The focus of both fields have converged on the assumption that problems are wicked, not simple, requiring experimentation, adaptation and long-term collaborative engagement to address (Head, 2019).

However, complexity is not just encountered in facing higher-order wicked issues, but at multiple levels of a system. The focal points of many social innovation efforts - societal outcomes like obesity, educational attainment, or criminal recidivism - are created by a constellation of factors from personal decision making and individual psychology, to broader economic, technological or cultural institutions (Finegood et al., 2010). French et al. (2021) argue further that all social outcomes which may be targeted by social entrepreneurs are densely interconnected (compositional complexity), vary from individual to individual (experiential complexity) and change over time (dynamic complexity). In this context, authors have recognised the significance not merely for scaling proven social innovations but of fostering institutional capabilities of responsiveness and adaptability generally to address the need to constantly innovate in response to evolving challenges (Westley and Antadze, 2010). Other authors stress the significance of context to social entrepreneurship opportunities, noting the need to embrace the ad hoc and iterative nature of social innovation (Corner and Ho, 2010), and for social entrepreneurship to follow the opportunistic and responsive model of 'bricolage', rather than merely progressing innovations through the stages of a growth or maturity model (Bacq et al., 2015).

To make matters worse, social problems are often ambiguous as well as uncertain: they are difficult not merely to solve but to even address since their scale and definition is contested amongst stakeholders (Moore and Westley 2011). For Goldstein et al. (2010) a complexity-informed position cautions social entrepreneurs against a single-minded focus on growing and scaling social innovations and the authors instead advocate maintaining a criticality over

the interrelated arrays of positive and negative occurrences are generated through any social innovation process. Ambiguity implies that social innovations, rather than universal public goods, generate patterns of winners and losers and are therefore inherently politicised phenomena. The long-documented potential for unintended consequences of social interventions thrust within complex systems (Merton, 1936) is writ large in recent discussions of social finance and performance measurement (French 2021). With financial mechanisms like Impact Investing, Social Impact Bonds or Outcomes Funds designed to provide the necessary resources for social innovation or scaling social enterprise, the need for clear, static performance measures and unambiguous attribution is confounded by the innate complexity of the social problems they tackle (French and Mollinger-Sahba, 2021; Sinclair et al., 2021). A unidimensional view of success and linear conception of value creation in social entrepreneurship may then paradoxically ‘create conditions that result in the failure of the program, and most importantly, harm its constituents’ (Goldstein et al. 2008, p.17).

The need for critical and pluralistic perspectives within social innovation and social entrepreneurship processes is particularly prominent in the indigenous social innovation literature, where the explanatory potential of economic theories of creative destruction, entrepreneurialism and innovation diffusion hold less relevance. Berkes and Berkes (2009) observe that longstanding Indigenous holistic worldviews - in this case those of the Inuit - resembled ecological complexity. While Indigenous ways of knowing are incredibly diverse, especially in the field of Indigenous social innovation and social entrepreneurship, the need to rethink and reframe how we see the problems around us, and what is available for change (De Bruin and Mataira, 2018; Henry et al., 2017; Peredo et al., 2019), has deepened and broadened the interest in complexity as a key bridge between Indigenous and settler ways of knowing, being and doing (McGowan, 2018). Western-trained scholars are increasingly advised to grapple with cross-epistemological work, and to ‘decolonize’ their approaches in

the process (Goodchild, 2021). Tapsell and Woods' (2010) complexity-informed theoretical perspective permitted a more holistic analysis of Indigenous social entrepreneurship where competition-oriented Westernised logics common in social entrepreneurship and finance discourse lacked explanatory potential.

Complex environments

Others have positioned social innovation and social entrepreneurship amid a dynamic and volatile operating environment, with complexity enacted upon innovators and entrepreneurs by their external context. Both social innovation and social entrepreneurship take place amid a constant churn of policy interventions, new technologies and changing institutional dynamics, all providing an evolutionary dynamic to both processes. This is punctuated by large destabilizing shocks, in recent years the COVID-19 pandemic, financial crises and climate emergencies, which prompt large-scale reorganising in the face of an all-encompassing new reality. From a complexity-informed standpoint, social innovation and social entrepreneurship are open systems, innately connected and communicative with their external context and constrained and/or enabled by the opportunity context it offers.

Complexity theory cautions us to expect open systems to be dynamic, non-linear, interdependent and emergent, which imbues an intractable quality of uncertainty attached to the decision-making processes within any social intervention. Social innovation and entrepreneurship are charged in this context not just with enacting systemic change, but also with keeping up with it. This need for adaptation imparts an evolutionary quality to effectiveness and 'success' in a social innovation and entrepreneurship context, embodied in complexity science within the concept of 'fitness' amid changing performance landscapes (Rhodes and Donnelly-Cox, 2008). In what the authors argue is an increasingly unpredictable world, Westley and Antadze (2010) consider that social entrepreneurs must respond to the

opportunities and challenges afforded by their dynamic environment and therefore promote resilience as much as they spur change. Trivedi and Misra (2015) similarly argue that a necessary capacity for social enterprises to create and sustain social change is to consider the *ecology of the social problem*—the relationship and interaction between a social problem and its context. Similar trends

Environmental dynamism brings forward the need for collaboration amongst actors who possess divergent capacities, knowledges and resources necessary for effective action.

Operating in dynamic and multi-polar environments requires social entrepreneurs to effect change through networks, helping to cross scales and bridge the “seemingly insurmountable chasms that separate local solutions from broad system transformation” (Fleming and Waguespack, 2007). Network dynamics can also be understood as complex since they are coordinated through iterative and dynamic encounters amongst multiple self-organising stakeholders (Klijn 2008).

The need for social entrepreneurs to be system-changing is tempered by the limited power and knowledge of any actor operating in complex systems. Instead the ability to develop horizontal relationships, span boundaries and cooperate to achieve goals becomes critical in enabling social entrepreneurs and social ventures to create value. The need to operate through networks demands a distinctive set of skills, and in response the literature has advanced several overlapping roles in response, including inter alia, relationship building and network recharging (Moore and Westley 2011), boundary-spanning and knowledge brokering (Fleming and Waguespack, 2007), network weaving (Krebs and Holley, 2005) and systems convening (Wenger-Trayner and Wenger-Trayner, 2014).

Complex processes

Social innovation and social entrepreneurship can themselves also be understood as inherently complex processes. As Bill Drayton, the founder of Ashoka Foundation, conceptualized over 40 years ago, social entrepreneurs ‘combine the pragmatic and results oriented methods of a business entrepreneur with the goals of a social reformer’ (Sen, 2007, p. 536). In this understanding, sometimes called the ‘social innovation school’ of social entrepreneurship (Defourny and Nyssens, 2010), social entrepreneurs focus on innovative solutions to one or a few underpinning factors of complex social policy problems and develop a strong formal theory of change in their initiatives which makes explicit their assumptions about how social initiatives will lead to anticipated results.

Over time, academic literature has shifted focus from being defined as a ‘heroic’ model of social entrepreneurship, centred around motivated and capable individuals developing and implementing good ideas (Leadbeater, 1997), to a more decentralised and multi-actor model with its emphasis on systemic action. Edquist and Zabala-Iturriagoitia (2012, p. 1758) argue that social entrepreneurs “almost never innovate in isolation, but interact with other organizations to gain, develop, and exchange various kinds of knowledge, information and other resources”, a finding replicated in other analyses (Corner and Ho 2010). Innovations focussed on systemic problems link many interdependent actors in long-term goal-oriented collaboration (Mazzucato, 2021), and innovation generation and diffusion processes co-evolve as innovations cross boundaries to reach greater numbers of people (Westley and Antandze 2010). Beyond just funding high potential ideas or entrepreneurs, authors have argued for the development of nurturing ecosystems for social innovation, and the cultivation and maintenance of effective relationships amongst actors engaged in the process (e.g. Goldstein et al. 2008; Rhodes and Donnelly-Cox 2008; Swanson and Zhang 2011).

A cognate trend has been to recognise the recursive nature of social intervention where interventions in one area can result in unpredicted effects in others. In recognition of interdependency and the unforeseen consequences which individual entrepreneurial initiatives may precipitate, an ecosystem perspective seeks to establish higher-order conditions of a solution infrastructure which enable multiple stakeholders to learn and adapt, and to act collectively to maximise their effectiveness (Pel et al., 2020). Zivkovic (2018) notes an emerging complexity-informed literature that looks beyond individual innovations to marshal the contributions of a range of initiatives and organisations toward systems transitions. Complex social innovation processes are again particularly pronounced in an Indigenous context. Tapsell and Woods (2010) describe a Maori-based innovative process that arises through the interaction of the young opportunity seeking entrepreneur (potiki) and the elder statesperson (rangatira). They conceptualize this through Maori Maps; traditional-knowledge informed double spiral combining the twin flows of opportunity and heritage.

What does complexity imply for social innovation and social entrepreneurship scholarship?

The three domains discussed – problem complexity, environmental complexity and process complexity – show complexity as a multi-faceted feature of both social innovation and social entrepreneurship. These domains are not exclusive of one another, with their focus in the literature often a matter of author emphasis rather than different conceptual positions. From this perspective, social innovation and social entrepreneurship can be recast as complex processes, set within complex environments, tackling complex problems. In this interpretation, social entrepreneurs seeking to innovate solutions to social problems must overcome fundamental barriers to knowledge and operate in an environment over which they

have little direct control. A complexity-informed perspective on social innovation meanwhile recognises a deep-seated Knightian uncertainty wherein the challenges and opportunities encountered by many actors often cannot be anticipated, only negotiated as they are encountered.

As in other disciplines like organisation studies (Bourne et al., 2018) or public administration (Eppel and Rhodes, 2020), complexity can be drawn upon to oppose rationalistic and process-oriented tendencies within the literature. Rather than functioning simply as a critical theory however, the complexity sciences may also play a constructive role in advancing new theoretical directions and practical alternatives. In this section, we discuss three interrelated implications of complexity: that social innovation be understood as an evolutionary process rather than a discrete outcome; that the innovation diffusion process is dynamic and non-linear; and that social entrepreneurs may play a more critical and reflective role within this process, recombining elements in response to emergent threats and opportunities.

A processual understanding of social innovation

Our conceptualisation of complexity challenges static and materialistic conceptions of social innovation. Innovations are generally distinguished from ‘changes’, ‘inventions’ or ‘improvements’ by their disruptive and transformative impact (Osborne and Brown, 2011). These disruptive qualities are tied (implicitly or explicitly) to a conceptualisation of social innovation as finished products or material artefacts, whose tangible and irreversible qualities exert transformative change on their adopters.

But our discussion of complexity problematizes this understanding of innovation, since uncertain and ambiguous social problems, volatile and dynamic environments, and

unpredictable processes limit the potential for innovations to be universal, lasting, or easily scalable. A complexity-consistent understanding of social innovation fits more comfortably with the view of innovation as a process, enacted through changes in relationships and institutions, rather than a materialist view of innovation as techniques or products (Grimm et al., 2013; Neumeier, 2012). In this view, innovations are not achieved through reaching a fixed end point but are constantly challenged and updated as they react to changes in the systems they are embedded within. Social innovations within goal-directed ecosystems may also overlap and interact through configurations of ‘systemic’ innovations (Davies et al., 2012) The quality of ‘discontinuous change’ usually summoned to delineate innovation from invention or recombination, is therefore better understood as a description of its innate processual dynamics.

Non-linear pathways to scale and impact

In the face of mounting systemic crises and societal challenges, a constant concern is how best to scale and spread social innovations. Theories of the social innovation journey or lifecycle often take as given a linear process of growth and diffusion driven by supply and demand, with innovations moving from idea generation, to prototyping and testing, and finally to scaling up or spreading out (see e.g, Mulgan et al., 2007; Murray et al., 2010. This procedural model has faced critique (see Rayner and Bonnici (2021) for a recent summary), however it remains a powerful concept in the development and provision of supportive infrastructure by government, investors and philanthropic organisations. Financial investment is often staged along these distinctions, with for instance innovation competitions to generate ideas, seed funding for prototyping theories of change, and finally, social investment attracted to those ‘proven’ innovations which reach a recognised standard of evidence.

Complexity cautions however that social innovations will often take a more dynamic and non-linear approach to scale and impact. Reconceptualised as a complex process, spreading and scaling has as much to do with re-invention and adaptation as they do with processes of diffusion, persuasion and implementation. A dynamic environment means that innovations, without readjustment, will sooner or later stop working. The partnerships which embody systemic approaches to social entrepreneurship are also fractious, since as Westley and Antadze (2010, p. 13) warn, “unforeseen shocks or discontinuities can derail the relationship, changing the rules at any point.” Over time, institutional change and mission drift may mean that innovations may also stop qualifying as ‘social’.

From a complexity-informed theoretical position, social innovation involves the constant renegotiation of strategy and values, far beyond a rationalistic process of identification and diffusion of ‘what works’. The innovation ‘life cycle’ can therefore be expected to be dynamic and non-linear as assumptions are revisited and the situational context changes.

Figure 1 offers a visual representation of this conceptualisation, adapting the traditional social innovation lifecycle from a complexity-informed perspective. This representation recognises that prototyping and experimentation is a continuous process rather than a preliminary stage, and that the diffusion process is recursive, consisting of adaptation and recombination rather than adoption, imitation and dissemination.

[FIGURE 1 about here]

A complex role for social entrepreneurs

From this perspective, the traditional role which social entrepreneurship plays in the initiation and progression of social innovations appears is one role amongst many. Indeed, our discussion of complexity limits the applicability of a traditional perspective in which the system-shaping efforts of social entrepreneurs through social enterprise or new venture creation transition systems from one state to another through the accomplishment of social innovation. Social entrepreneurs need to develop a thorough understanding of the system that they are intervening in when developing innovations and to operate in partnership to achieve systemic impact. Rather than waiting for ideas and innovations to be ‘discovered’ by suitably motivated social entrepreneurs, funders and convenors of social innovation ecosystems should invest in the supportive systemic infrastructure – e.g. networks, flexible funding, relevant training and development opportunities - which enables their emergence. Funders may sponsor multiple social entrepreneurs operating within solution ecosystems to create new institutional norms (Kennedy and Parsons, 2012) and energise system transitions (Zivkovic 2018).

The role of social entrepreneurs in the social innovation process has often been likened to advocates and champions for ideas. There remains an important and valid approach to undertaking social innovation through a more linear approach when conditions are suitably stable and innovations well enough defined. However, from a complexity-informed perspective, the basis of innovation lies not only with the theory of the firm, but with the system. A complexity-informed perspective illuminates the value of social entrepreneurs as critical friends and learning partners to system-changing partnerships (Hesselgreaves et al., 2021), challenging and reformulating ideas and innovations in response to emerging opportunities and gathering threats. Prototyping and experimentation, while a preliminary

feature of scale in a linear conception of the social innovation lifecycle, are therefore a constant process with social entrepreneurs managing an ever evolving and emerging relationship (Westley and Antadze, 2010). Durability and resilience, rather than scalability and portability, may offer more relevant ambitions for social entrepreneurs seeking to enhance their impact.

The role of social entrepreneurs as bricoleurs, charged with recombining elements and responding opportunistically to emerging opportunities (Fuglsang, 2010), seems appropriate in this context. While often relegated in the literature to lesser forms of systemic impact (Zahra et al., 2009), bricoleurs take on a renewed emphasis in helping “create structures by means of events” (Fuglsang, 2010, p. 73). This requires social entrepreneurs developing a set of specific skills including as Moore and Westley (2011, p. 1) note, those which, “enable pattern generation, relationship building and brokering, knowledge and resource brokering, and network recharging.”. Rather than solely operating as initiators (e.g. through venture creation) or champions (e.g. through policy advocacy or idea brokerage) of social innovation, social entrepreneurs may play an additional role as part of what Cajaiba-Santana (2014, p.49) calls the “collective creation of new legitimated social practices”.

Advancing the study and practice of social innovation and social entrepreneurship: a constructive role for complexity theory

We have explored the implementation of complexity theory in social innovation and social entrepreneurship across three key dimensions (problem complexity, environmental

complexity, and process complexity), and from this derived an alternative conceptualisation of social entrepreneurship and social innovation as complex processes, set within complex environments, tackling complex goals. We make three interrelated arguments: - that social innovation is a continuous process rather than a product, that the diffusion process is non-linear, and that social entrepreneurs can play a more critical and reflective role, responding to emergent opportunities, working in partnership, and recombining elements of the social innovation process rather than merely leading it to scale. So, what does this mean, and how should this guide the advancement of social innovation and social entrepreneurship, in theory and practice? We consider three particular means of deploying complexity as a theoretical basis in social innovation and social entrepreneurship are salient: complexity as rhetoric, as an analytical approach, and as a basis for developing new tools and methods. The papers contributed to this special issue from Lythberg et al. (2021); McGowan and Geobey (2022), Rhodes et al. (2021) and Abraham and Geobey (2021) cover a wide range of pertinent topics and approaches, contribute to each of trajectories.

Complexity as a rhetorical device

At the most basic level, a complexity-informed understanding of social innovation and social entrepreneurship is a rhetorical position, seeking to reframe how social innovation and social entrepreneurship are understood in a manner which better fits their dynamics in the real world. The rhetorical power of complexity was invoked by Goldstein et al. (2008) to counter the ‘heroic’ model of social entrepreneurship, which the authors took as the dominant theoretical perspective at the time. All papers in this special issue adopt a similar rhetorical position, seeking to move discourse and practice beyond static and agentic procedures of picking winners and scaling ‘what works’ toward a live, opportunistic and adaptive process.

Complexity-informed research can prove influential in this manner - the UK Government's (2007) Foresight Obesity Diagram mapped subjective linkages between dozens of factors driving societal obesity – but did not yield any real analytical value (e.g. in helping frame a coherent policy response). It did however function as a powerful rhetorical mechanism to invoke humility through its overwhelming visual complexity. The revised social innovation lifecycle presented in this article could provide a similar rhetorical function, visually confounding linear conceptions of innovation development and scale, while promoting a critical and systemic approach to the development and diffusion of innovation.

Complexity as an analytical lens

Complexity can also provide a distinctive analytical basis to explore the conceptual and empirical dimensions of social innovation and social entrepreneurship. Complexity informs a range of methodological approaches from innovations in case-based research (Byrne et al., 2020) to simulation methods like agent-based modelling (Gilbert, 2020). In addition, complexity science's conceptual library is well-placed to deepen understanding of a complexity-informed understanding of social innovation and social entrepreneurship. [In this special issue, concepts like self-organisation (Lythberg et al., 2021), boundary-spanning, emergence, attractor states (Lythberg et al., 2021; Abraham and Geobey, 2021), and the adaptive cycle (McGowan and Geobey, 2022), are drawn upon across a range of empirical contexts.

The contributions in this issue use complexity-informed analysis to surface different and contrasting accounts of the antecedents and outcomes of social innovation and social

entrepreneurship processes, challenging existing assumptions in the field rather than filling research gaps. (Abraham and Geobey, 2021) adopt complexity as a framing to derive insight from a failed social innovation, addressing the gap between well-researched success stories and often neglected failures. Using the adaptive cycle and basins of attraction as their analytical framing, (McGowan and Geobey, 2022) position the Luddite movement as a multi-level conflict about development pathways in Industrial-era Britain. In a contemporary context, the authors argue this analysis can help to analyse cross-scale dynamics and fit in moments of systems change.

Complexity theory may be particularly consequential in analysing non-traditional and particularly non-Western social innovation and entrepreneurship processes which diverge from economics-influenced understandings focussed on marketisation and competitive dynamics. Lythberg et al. (2021) analyse the Aotearoa's Treaty of Waitangi/Te Tiriti o Waitangi as a structural attractor that, over time, has helped frame Indigenous social innovation in a drive towards decolonization in an imperfect but improving partnership. The authors derive a 'double spiral' combining the dual flows of opportunity and heritage which provides an alternative explanatory account for Indigenous social entrepreneurship.

Complexity as a constructive theory

Finally, complexity can be a productive body of theory from which to theorise and advance new tools, methods and approaches. Complexity has been used to inform the development of new approaches to social innovation, from financing (Geobey et al., 2012) to evaluation (Hervieux and Voltan, 2019). Continuing this line of enquiry, (Rhodes et al., 2021) apply a 'temporary social innovation system' framework to examine social innovation across 10

cases involving social entrepreneurs as one of many actors involved in developing ‘Nature-based Solutions’ in Europe and identify patterns of both success and failure. The authors provide practitioners and sponsors of social innovation and entrepreneurship with practical framings and insights through which to organise their efforts.

Concluding thoughts

The complexity sciences are a long-established theoretical perspective in the social innovation and social entrepreneurship literatures (Goldstein et al., 2008; Mulgan, 2012b). As the articles within the special issue demonstrate, complexity also can play a significant part of its future, functioning as rhetoric, as an analytical device in empirical analysis and as a source of ideas for developing new tools and methods for improving practice.

This editorial review article has explored the implications which complexity holds for social innovation and social entrepreneurship, and has considered the implications of an alternative conceptualisation of social innovation and an expanded understanding of social entrepreneurship – as complex processes, set within complex environments tackling complex problems. We argue that a complexity-informed perspective brings to the field both a productive theoretical perspective and a distinctive research agenda. The opportunity space has shifted slightly. The ‘heroic’ model of social entrepreneurship which authors like Goldstein et al. (2008) took as the dominant theoretical perspective at the time no longer holds nearly so much sway in the field. Instead, as complexity theory has moved into solution-focussed policy, consultancy, and philanthropic arenas, we should also be careful not to resurrect the ‘heroic’ social entrepreneur - emboldened this time by systems thinking and complexity-informed tools. While complexity-informed strategies are often conflated with large-scale system *changing* impacts (see e.g. Ashoka 2020), our analysis also clarifies an

important role for system *influencing* social innovations which may be limited to particular geographical or temporal contexts, whose impact may be more intangible, and which may diffuse more dynamically.

There has been a significant increase in interest and acceptance within academia and practice for taking a complexity-informed approach, even during the writing of this article. Social entrepreneurship has been recognised in the Map of the Complexity Sciences (Castellani, 2021), Australia's Social Enterprise National Strategy is taking a 'missions or systems-led approach' (Hannant, et al., 2021, p. 86), the Government of Victoria's (2021) new social enterprise strategy is encouraging the formation of 'collaborative social enterprise networks that seek to address critical challenges, such as food security and unemployment' (Victorian State Government, 2021, p. 33). The consultation process for the 2022 Social Enterprise World Forum identified 'systems and complexity-based approaches' as one of four areas the sector wants to progress (Allen et al., 2021), and 'Complexity and Systems Change Approaches to Social Enterprise' will be a stream at its upcoming Academic Symposium. While these and many other recent developments are not fully explored in this article, they provide fertile ground for further investigation.

To revisit Goldstein et al. (2008), does complexity science and social innovation and entrepreneurship have a fortuitous future? The challenge will be helping practitioners walk a line between complexity's two 'roads to nowhere': fatalism (complexity as a rejection of the possibility of intentional social change) and overstatement (systems thinking as the only solution to humanity's most wicked problems). There is therefore a critical role for academics to play a role at the forefront of this research agenda, undertaking careful and critical engagement with the complexity sciences as an analytical resource, and comparing its novel predictions with the lived reality of social innovation and social entrepreneurship in practice.

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