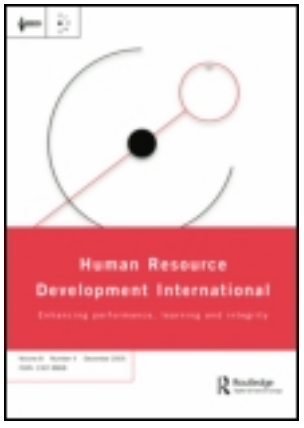

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Model of complexity leadership development

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Leadership development has traditionally encapsulated an individualistic focus in organizations more properly construed as leader rather than leadership development. Over more recent years, advances in leadership theory have moved towards seeing leadership from more relational and systemic perspectives that have implications for leadership development practice. This article builds on this literature in putting forward a model of leadership development drawing upon ideas and concepts from complexity science. Complexity leadership development is suggested to incorporate a focus on four key dimensions that recognize the interrelatedness and systemicity of leadership in organizations. Here the behaviours of individuals interact with wider organizational processes and contexts that together are considered to produce overall leadership effects. Four dimensions are put forward in the complexity leadership development model comprising (1) network conditions, (2) shared leadership, (3) organizational learning and (4) leader skills and knowledge. The implications of the model for future research in HRD and challenges for practice in the field are discussed.

Keywords: leadership development; leader; complexity; networks

Introduction

Much of the writing in leadership until relatively recently has been dominated by solo-heroic leadership models typified by style theories of leadership. These models are increasingly becoming of limited value given the complexity that organizations are now contending with (Clarke 2012a; Higgs 2003). The term complexity captures the greater levels of uncertainty, ambiguity, interdependencies and interrelatedness that now characterize the environments in which organizations operate. Rapid social, economic and technological shifts that are taking place as we enter the next decade are producing greater complexity, resulting in the increasing dynamics of instability (Uhl-Bien, Marion, and McKelvey 2007). These conditions now place major constraints on conventional constructs of leadership. These are typically focused on how an individual leader exercises interpersonal influence to gain the commitment and motivation of followers towards the pursuit of organizational goals.

A leader-centric perspective of leadership has similarly formed the basis of most *leadership development* models that have appeared in the literature (e.g. Conger 1992; Gardner et al. 2005; Orvis and Ratwani 2010). Although there have been recent advances in delineating differences between viewpoints of how leader and leadership development might be construed (Day 2001; Drath et al. 2008), there have been few attempts to extend the concept of leadership development from a complexity leadership perspective (cf. Turnbull James 2011). This article is an initial attempt at doing so through presenting

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a conceptual model to guide both theory and practice in complexity leadership development. The article is structured as follows. First, a brief review of leader and leadership development is presented identifying how these represent differing notions of development, moving from individual to systemic levels. Next, the key elements of a complexity leadership perspective are discussed. This highlights a significant departure from the way in which the construct of leadership has typically been perceived in the past. A conceptual model for undertaking complexity leadership development is then put forward, incorporating interventions that target both human and social capital in organizations. Finally, considerations of how the model can be used to inform future research are discussed alongside the challenges this approach to leadership development poses for HRD practice.

Leader and leadership development: contrasting targets for development

Over recent years writers have increasingly sought to differentiate between the concepts of leader and leadership development, very much mirroring theoretical developments in our understanding of leadership. McCauley and van Velsor (2004, 2) define leader development as being about 'the expansion of a person's capacity to be effective in leadership roles and processes'. As such it is concerned with the development of an individual's skills, knowledge and competencies associated with formal leader roles. From a HRD perspective, the focus is one of human capital development in organizations. Day (2001) suggested that this individual-level focus targets intra-personal competencies and highlights skills such as self-awareness, self-regulation and self-motivation as being central to the development process. More recently, the developmental process by which leader proficiency in these skills evolves, has been recognized as involving a deeper-level personal transformation associated with leader identity formation as leaders increasingly become aware of themselves (Day, Harrison, and Halpin 2009; Day and Sin 2011). Research in leader development has therefore concentrated on gaining a better understanding of the formal and informal learning processes that contribute to the development of formal leaders and how organizations might effectively intervene in the process (Day, Gronn, and Salas 2004; Dragoni et al. 2009; Orvis and Ratwani 2010; Reichard and Johnson 2011).

Underpinning this approach, however, remains the assumption that leadership is essentially a process of interpersonal influence, whereby leaders exert influence over followers to achieve desired goals. As such, leader development has very much been shaped by leader-centric theories of leadership, ranging from trait to behavioural category and style perspectives (Northouse 2004). The key critiques of this approach concern the failure to consider how leadership is as much dependent on followers as it is on formal leaders (Yukl 2002; Higgs 2003), how differing contexts shape leadership effectiveness and its enactment (Osborn, Hunt, and Jauch 2002) and a failure to study the process of leadership in a more systemic manner (Yukl 2002; O'Toole, Galbraith, and Lawler 2002). More recently, perspectives on leadership as a relational process (involving both leaders and followers) as exemplified through leader–member exchange (Uhl-Bien 2006) as well as the theory of shared leadership (Hillier, Day, and Vance 2006), have shifted our understanding of leadership away from its traditional individualistic focus to a more collective, social concept. Leadership is the property of relationships, no longer residing in one individual. Instead of human capital, the focus in leadership development shifts towards the development of social capital. From this perspective, many writers have identified the importance of interpersonal skill development for both leaders and followers, as being a key focus for leadership development creating the bases for trust and respect (Day 2001; McCallum and O'Connell 2009).

Through building social capital, the organization's capacity for enacting leadership tasks needed for collective work comes to be realized (McCauley and van Velsor 2004). Hillier, Day, and Vance (2006) argue that increasingly complex organizational environments require effective team-work, and this provides the underpinning for a shared model of leadership associated with the concerted actions of multiple players rather than the behaviour of one individual (Gronn 2002, 2009). Leadership development is thus influenced by notions of leadership as a more distributed, fluid construct (Yukl 2002; Hillier, Day, and Vance 2006). Here then, leadership is perceived as a function of social resources embedded in relationships. This has resulted in typical definitions of leadership development as being about 'expanding the collective capacity of organizational members to engage effectively in leadership roles and processes' (McCauley, Moxley, and Van Velsor 1998).

Although important, such definitions of leadership development have yet to expand sufficiently to accommodate a much wider systemic perspective on the nature of leadership. This recognizes leadership as an emergent possibility within the social system where the interaction of individuals within the wider system becomes the central focus. The increasing complexity facing organizations requires us to consider leadership as embedded not merely in sets of interpersonal relationships, but more widely as constituting an array of interacting organizational processes that facilitate intelligent and innovative organizational adaptation.

A complexity leadership perspective

Although a complexity perspective of leadership recognizes a role for human relations or personal influence models, this is only as part of a much broader set of leadership processes associated with managing dynamic systems and the interconnectivity within networks (Marion and Uhl-Bien 2001). Complexity leadership draws upon a number of insights from complexity science in order to frame leadership as a property of a social system. In this sense, it considers the concept of leadership from a relational perspective (Uhl-Bien 2006), but importantly extends it further in connecting leadership processes specifically with a system capacity for adapting to change, dealing with ambiguities and responding more effectively to complex problems. Complexity leadership thus enables an organization to deal more successfully with dynamic environments. Processes and capabilities that result in innovation and adaptability are thus the primary focus for understanding leadership. Leadership is therefore defined in its broadest sense as those structures, processes and practices that 'makes things happen' (Huxham and Vangen 2005) in order to cope with greater uncertainty.

Complexity leadership begins with a number of important assumptions about the nature of reality within complex situations or environments. The first of these recognizes open systems such as work organizations as inherently too dynamic and unpredictable to be defined by simple models. It therefore challenges the value of reductionist approaches that believe leadership and its impact within complex systems can be captured by simple and linear, cause–effect relationships (Prigogine 1997). The focus is therefore on how leadership might bring about conditions that enable or facilitate organizational effectiveness, in contrast to *determining* it. The second assumption is that organizations are seen as complex adaptive systems (CAS) that cannot be understood by simply breaking down its constituent components, since the interactions between the system and its environment give rise to unforeseen and unpredictable outcomes and behaviours. However, a key feature of CAS is that order emerges naturally through many iterations or cycles of random interactions between agents operating within the system, who both act on and

are acted on by the structures in which they are embedded (Cilliers 2001). The many interdependent agents present within the system who interact with one another and influence one another, are able to generate novel behaviour for the system. It is important to recognize that agents in the system also include aspects such as ideas and perspectives that themselves can be thought to have meaning and identities. In terms of complexity leadership, the focus is on trying to capitalize on these interactive dynamics and fostering the interactive conditions through which productive outcomes become more, rather than less, likely.

A basic unit within complex adaptive systems is the notion of ensembles, which refers to sets of individuals and workgroups possessing shared interrelationships and interests. A further unit is that of aggregates, which refers to the emergent structures that arise when ensembles interact within the social system connected to innovation. When ensembles interact, they are able to engage in behaviours and activities that can lead to reaching common understandings from which self-generative behaviours arise, based around problem-solving and creativity (Marion and Uhl-Bien 2001). The role of leadership here then, is to facilitate and capitalize on these random interactions of aggregates, and create the conditions that promote bottom-up behaviours from which human and social capital give rise to distributed intelligent activity, a process called autocatalysis (Luke 1998). Leadership then is an emergent, interactive dynamic that emerges from the interactions in complex adaptive systems, and of which new learning and problem-solving is the outcome (Lichtenstein and Plowman 2009). A key focus in complexity leadership development is therefore seeking to influence the contexts and processes that give rise to these network dynamics. Uhl-Bien, Marion, and McKelvey (2007) describe these characteristics of contexts as being the networks of interactions and interdependent relationships, as well as the conflicting constraints and tensions in the network that are able to generate adaptive behaviours and problem solving.

Complexity leadership development: system- and individual-level development

Clarke (2012b) has recently argued the need for a levels-of-analysis perspective when examining leadership training and development. In considering complexity leadership development, the model here posits two levels of analysis that together comprise the targets for development. These are (1) system level and (2) individual level (see Figure 1). Each of these levels describes targets for leadership development that are explained as bringing about the conditions for tension and autocatalysis within the social system. These in turn give rise to the possibility of the system's positive adaptation.

System-level development

The first level is that of the social system, or system level. Here the targets for leadership development are the structure, culture and processes that together characterize the social system. These are argued here to support the development of distributed intelligence and enhance social capital. Three key criteria for development are identified at the system level: (1) network conditions, (2) shared leadership and (3) organizational learning.

(1) *Network conditions:* Enhancing the adaptive capacity of an organizational system to respond to complexity, requires a focus on the network conditions in which an organization is situated. A major condition in order for collaboration to occur between agents in a CAS for the possibility of generating novel behaviours and

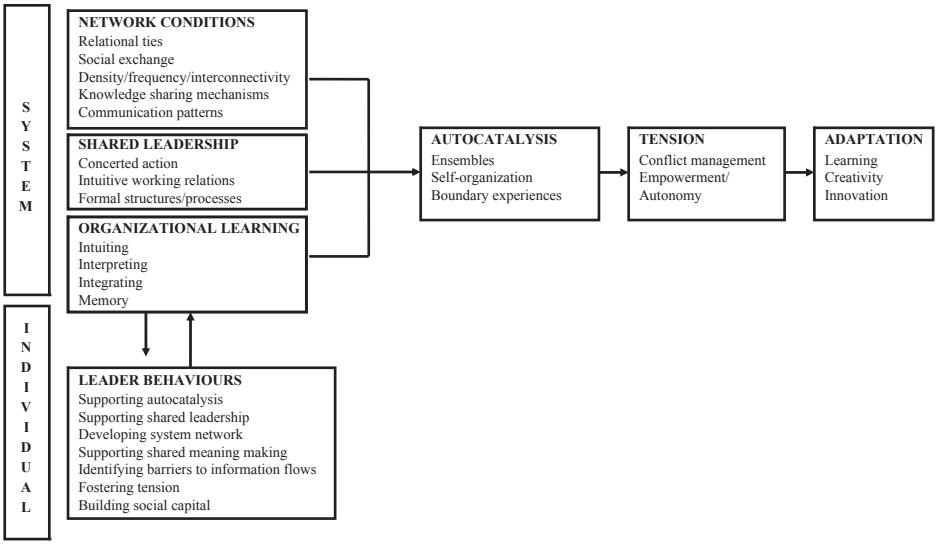

Figure 1. A model of complexity leadership development.

responses is that they must be able to interact both with the environment and with each other with great frequency and at very high levels (Brown and Eisenhardt 1997). The formal and informal structural connections between organizational members and partners, combined with formal and informal processes within the organization associated with communication patterns and mechanisms for knowledge sharing, represent leadership catalysts that enable emergent innovation (Balkundi and Harrison 2005; Brown and Eisenhardt 1997; Uhl-Bien, Marion, and McKelvey 2007). Supporting this are studies suggesting that the characteristics of boundary spanners or brokers in terms of structural density (type and number of connections with others) are able to generate more diverse and alternative ways of thinking and problem solving and have greater skill in translating information across groups (Burt 2004). The extent to which the agents' connections to one another in a network occur, referred to as structural closure, has also been found to be associated with the adoption of change (Battilana and Casciaro 2012). Organizational members possess differing expertise, and it is essential that information could be effectively and quickly distributed and exchanged among members, in order for synergies from the interactions between information and expertise to be achieved (Ensley, Hmieleski, and Pearce 2006).

(2) *Shared leadership:* Complexity leadership development requires fostering close patterns of interdependence between organizational actors in order to understand better complex problems and coordinate responsive actions within the social system (Uhl-Bien, Marion, and McKelvey 2007). Shared leadership dispenses with the idea of followers, maximizing the contributions many more individuals can make to solving difficult problems (Gronn 2002; Spillane, Halverson, and Diamond 2000). In this sense, leadership needs to be distributed throughout the system or organizational network in order to capitalize on the intelligence that is available. Through the effective use of this intelligence, shared knowledge can be created (Agranoff 2007). This recognizes that individuals can pass in and out of

leadership roles depending upon tasks and challenges. It is the concerted action, arising when an individual adopts such a role, that makes leadership in this sense shared (Feyerherm 1994). Gronn (2002) has suggested that distributed leadership is realized through 'conjoint agency'. This refers to those involved synchronizing their actions in order to achieve synergy, which is brought to bear on problem resolution. This occurs when individuals engage in concerted action that comes about through (1) spontaneous collaboration, (2) intuitive working relationships, or (3) formal structures (or institutional practices, e.g. project teams, working parties). Each of these contributes towards enabling 'boundary experiences', which are the loci for creating shared meaning and exploring different perspectives and important conditions for collaboration (Feldman et al. 2006; Schneider 2009). From a complexity perspective, shared leadership is seen as central to differing organizational units spontaneously coming together, interacting and generating new knowledge and mutual learning (Kauffman 1995; Luke 1998).

(3) *Organizational learning:* It is recognizing the importance of knowledge co-creation within the CAS that highlights the significance of organizational learning as capturing key system processes associated with adaptation and innovation. Although differing perspectives characterizing organizational learning can be found (Wang and Ahmed 2003) alongside their critics (Huysman 2004; Ortenblad 2002), a number of key concepts are relevant in relation to complexity leadership development. Drawing on an information processing perspective (Huber 1991), Crossan, Lane, and White (1999) representation of organizational learning as consisting of 4I processes capturing learning at different levels is of value. Learning is suggested to occur through intuiting and interpreting (individual), interpreting and integrating (group) and integrating and institutionalizing (organizational). Learning is thus seen as experiential, which then becomes stored and available in explicit and tacit routines, rules and procedures (memory) (Walsh and Ungson 1991; Zhou 1993). From a complexity perspective, new knowledge and learning arises through the interaction between system members who, by coming together, become empowered to identify problems and resolve tensions in the system (Kauffman 1993). Creating knowledge is therefore a social process that requires people to make sense of information, generate new meaning and co-create new understanding (Chiva, Grandio, and Alegre 2010; Hannah and Lester 2009).

Individual-level development

At the individual level of analysis, complexity leadership development moves away from a focus on the structures and processes that are the targets for development at the system level, to the individual behaviours required of formal and informal individual leaders within the social system. Based on structuration theory (Giddens 1984), individuals are both acted on by the wider system and act on it, and are thus able to shape system-level criteria identified above. A focus on the role of individuals acting as formal and informal leaders is also consistent with Gronn's (2009) notion of hybrid leadership and alignment. This recognizes that individual leadership can co-exist and mutually interact with dispersed leadership configurations within an organization. Importantly, the more differing patterns and sources of leadership are planned and aligned, the greater likelihood of positive leadership ensues. Both types of leaders (formal and informal) are seen as critical

to harnessing the creative effects of distributive intelligence. Rather than simply being about interpersonal influence, the formal leader's role, however, is instead one of facilitating the conditions for spontaneous and emergent leadership. Developing knowledge and skills to support leader behaviours in seven major areas are considered important here.

(1) *Supporting autocatalysis:* This involves leaders organizing the work environment to facilitate interactions among ensembles. Formal leaders can focus on job design features such as enhancing delegation, empowerment and offering greater autonomy to team members, as well as providing resources that maximize network building (such as facilitating inter-organizational reviews). Another key aspect here is providing team members with knowledge and skills to manage and resolve conflict, thus maximizing the success for interacting aggregates to reach common understandings and accommodations. The structuring and maintenance actions and behaviours the leader undertakes that will influence team dynamics and processes to support interdependence and interaction are therefore significant (Friedrich et al. 2009).
(2) *Supporting shared leadership:* The formal leader role needs to be one of coordinating and coaching rather than controlling. It is through these functions that spontaneous, self-organizing communities are then likely to emerge. Leaders need to focus on building social capital and enhancing social exchange between members in order to maximize adaptive behaviours and innovation (Graen and Uhl-Bien 1995). Here relational leader behaviours are seen as important; however, their role is less concerned with motivating team members as opposed to facilitating interaction between system members and cultivating a climate conducive to the formation of aggregates.
(3) *Developing the system's network:* Complexity leadership requires leaders to develop their skills in effectively managing and developing networks (Gnyawali and Madhavan 2001). This involves enriching established connections, and developing new connections within the network(s) in which they are embedded (Regine and Lewin 2000). A leader therefore needs to encourage increased contact and interactions between team members and help to develop shared expectations for collaboration (Taggar and Ellis 2007).
(4) *Supporting shared meaning-making:* Although complexity leadership recognizes that social systems are self-organizing and that creative problem solving potentially can emerge in favourable network conditions, the need to keep the system developing on the right track is important. A key element here is the leader engaging in sense-giving with team members in order to promote shared understandings and serve as a basis for resolving tension within the network (Foldy, Goldman, and Ospina 2008). Leaders need to work with stakeholders to develop a shared vision that helps to frame the context for network ensembles engaging in generating creative solutions to problems. Here, there is a need for leaders to think in terms of systems and importantly how subsystems interconnect within their wider environments (Senge et al. 2008).
(5) *Identifying barriers to information flows:* Leaders also need to examine impediments to information entry and distribution within the social system, and look to counteracting barriers to knowledge exchange. Individuals with access to greater amounts of information within a network are likely to possess greater network centrality, which has been found to be associated with leader emergence (Mehra et al. 2006). The distribution and exchange of information in a network, combined

with the knowledge of where expertise lies, is integral to the emergence of shared leadership (Friedrich et al. 2009).

(6) *Fostering the positive value of tension:* Uhl-Bien, Marion, and McKelvey (2007) suggest complex leaders should foster adaptive tension within the system to facilitate interactive dynamics that are the basis for the emergence of ensembles. This requires leaders to provide structures and processes that offer opportunities for the surfacing of conflicting perspectives, needs and goals among team members. It necessitates creating a team climate that values divergent views, and supports ensembles through providing them with the skills to resolve conflicts and differences.

(7) *Building social capital:* The importance of social capital in promoting knowledge transfer (Levin and Cross 2004) places a primacy on leader skills in building and developing social capital within the network. Cognitive social capital is developed through developing shared systems of meaning and can be supported through leaders engaging in behaviours that support shared meaning-making (Tsai 2000). Relational social capital, by contrast, is built through reciprocal obligations and social exchanges that bring about trust (Morse 2010) and respect (Clarke 2011). This emphasizes the leader's relational skills and behaviours that enhance social ties rather than being about motivating network members.

Proximal and distal outcomes of complexity leadership development

The targets for complexity leadership development at both the system and individual levels are posited here to help support *autocatalysis* and *tension* (proximal outcomes) within the social system. Autocatalysis occurs as a result of self-organization and the emergence of ensembles. Tension promotes adaptive problem solving through motivating interactional dynamics (Uhl-Bien, Marion, and McKelvey 2007). It reflects the notion that organizational members and stakeholders will possess differing perceptions of a problem, needs and at times incongruent outcomes that together create a force for action. It is seen as a creative impetus that facilitates information exchange and adaptation. Both tension and autocatalysis are supported through targeting the system- and individual-level criteria identified within the model. Based upon complexity thinking, autocatalysis and tension are intermediary mechanisms through which system adaptation occurs and the distal outcomes of creativity and innovation become more possible (Lichtenstein 2000; Lichtenstein and Plowman 2009).

Discussion

Leadership development has primarily focused on leaders, whilst neglecting the dynamic systems comprising leadership in its wider sense (Osborn, Hunt, and Jauch 2002; Uhl-Bien, Marion, and McKelvey 2007). This has resulted in a limited perspective of what might be thought of as leadership development. It is argued here that complexity leadership offers an alternative systemic perspective on the nature of leadership that can help social systems organize themselves more effectively to promote adaptation and change. Although empirical research on complexity leadership development remains in its infancy, there are a number of studies that have demonstrated the benefits of adopting a complexity perspective, primarily in the healthcare, public sector collaboration arenas (Attwood et al. 2003; Bovaird 2008; Ovretveit 2005; Umble et al. 2005). Here, leadership is seen to be

important as far as it acts as a catalyst for building networks, which are the structural components of complex adaptive systems able to generate novel behaviour. There is also evidence that the space agency NASA is now adopting a complexity perspective on leadership in identifying new sets of competences and leadership behaviours for its technical experts working on projects (Morris and Williams 2012). In their leadership development model, knowledge and skills in systems thinking, political expertise, communication and strategic alignment are brought together to form an overall framework in order for managers to manage increasing complexity.

The model of complexity leadership development posited here can help organizations to determine what the goals of HRD activities should be, and the processes they need to develop in order to support complexity leadership in action. The model focuses on both system- and individual-level criteria in order to optimize an organization's capacity for autocatalysis, or its adaptive capability arising through distributed intelligence. A number of specific interventions can be drawn upon to target development at these levels. HRD processes that promote the positive airing of differences and opposing perspectives as well as support the positive resolution of conflict, are key to enabling self-organization and problem-solving among the network's agents. Shared leadership necessitates creating the conditions under which network agents can 'lead' problem-solving. Friedrich et al. (2009) identified a number of collective leadership constructs, using which they map the critical processes through which shared leadership is thought to emerge. The key processes they have identified are the formal leader's skills, leader/team exchange (such as delegation), team performance parameters (such as collaborative problem-solving and conflict management), communication patterns, team affective climate and the characteristics of the team and leader networks.

This suggests that leadership development activities could draw upon a range of specific organization development (OD) and learning interventions. For example, facilitated conflict resolution sessions and training staff in assertiveness and conflict management could help bring about more productive team climates for airing differences of opinion and opposing perspectives. OD diagnostic techniques could be utilized to identify the nature of communication patterns within the organization and levels of empowerment experienced by staff. Job and work redesign interventions could open up information flows and provide for greater autonomy. OD techniques for building social capital and increasing opportunities for social connectivity could include search conferences, interdepartmental information briefing sessions as well as educational and training initiatives for developing relational skills (Clarke 2005, 2010a, 2010b).

In terms of organizational learning, HRD interventions could be directed towards breaking down silo-working mentalities between departments and promoting a systems perspective to organizational problem solving (Dixon 1997). Audits of knowledge management policies and practices could help to identify how knowledge is acquired and transferred through the organization. Here, the goals for HRD should be focused on bringing about more effective, self-sustaining learning networks and examining how organizational learning processes can be integrated with a strategic approach to HRD (Tseng and McLean 2008).

Future research and challenges

The notion of complexity leadership suggests a radical shift in the focus of research on leadership development, based on the four key areas suggested here as supporting tension and autocatalysis. In relation to network conditions, we need to identify how particular

acts of organization can foster adaptive capacities within the system. Leadership arises through a pattern of interactions between team members in organizations and the structural conditions in which they act. Studies that focus on the nature of interrelationships within the organization, how these are influenced and constrained by team organization and processes, and whether these lead to adaptive problem-solving will provide insights into the interactive dynamics by which complexity leadership emerges. Studies of organizational networks can focus on various indices of interconnectivity, such as the level of collaboration and coordination between team members, the level of trust within the team and the patterns of formal and informal communication through which ensembles can emerge in response to changing circumstances. How particular structural arrangements such as frequency and patterns of communication, the use and design of agreements, as well as how knowledge management procedures interact in such a way as to influence the emergence of ensembles, will help us to identify how patterns of alignment between structural conditions support emergent leadership.

As well as a focus on structural conditions, the network will also be influenced by cultural factors that influence knowledge sharing. This includes factors such as norms for dealing with conflict that are likely to affect the positive effects of creative tension, that is, the motivational force for adaptive behaviours. Research that attempts to capture the temporal changes that occur in the adaptive dynamics within a team, and how these are then influenced in response to changing organizational network conditions, will reveal data about the type of organizational contexts that support complexity leadership development.

Shared or distributed leadership is seen as a key condition within a complexity perspective and future research needs to examine the internal and external factors through which this may be supported in organizations. As yet, we know little about the dynamics of role performance relating to team members adopting leadership roles. Questions relating to how leadership is shared, and how the alignment of leadership distribution and its balance produces effects in differing circumstances, are therefore of paramount importance (Harris 2007; Harris and Spillane 2008). These multiple meanings of leadership are likely to act as cultural influences that may either impede or support conjoint agency, the self-generative behaviours that are needed to respond to ambiguity and complexity. Research should capture these social constructions of leadership held by team members and examine how these interact with team structural conditions, to identify when shared leadership may be more likely to develop.

The formal leader's role in enabling an organization to respond more effectively as a complex adaptive system requires new research that adopts a different focus on leader skills and behaviours compared to that which has dominated leader development in the past. Some of these behaviours, such as relational skills, remain the same. However, the focus of studies needs to be on how these are associated with building social capital and fostering social exchanges within a network, rather than their role in motivating followers. Similarly, participative and empowering behaviours need to be studied in terms of their influence on supporting team cohesion and the emergence of shared leadership. Other research should focus on how a leader undertakes network building and enhances connectivity within networks, and to identify how this may support the emergence of ensembles capable of innovation.

Finally, although this article is an initial attempt at developing a model for complexity leadership development, the model does represent significant challenges for the field of HRD. In terms of research, there are three major issues with which to contend. The first one concerns criticisms of the appropriateness of applying complexity science ideas

drawn from the physical and biological sciences to human social systems (Cilliers 2001; Goldstein, Hazy, and Lichtenstein 2010). Many argue that complexity ideas may not offer organizational science much beyond that of a metaphor for generating potential insights into learning and adaptation (Burnes 2005; Palmberg 2009). In particular, ignoring how politics and emotions are instrumental in driving and interpreting human behaviour. Some of the key assumptions of CAS are that the system moves to a state of optimization and that the outcomes are wholly adaptive. Houchin and MacLean (2005) undertook a 4-year ethnographic study examining strategic change in the public sector from a complexity perspective. Their findings challenged the notion that novel forms of order emerge naturally in a social system following destabilization. In their study, the system returned to a similar state of order that had occurred prior to destabilizing change interventions. They suggested that this was due to human motivations driven by the desire to reduce anxiety. Based on this work, social systems may not reflect true CAS in that they neither always give rise to novel outcomes nor have an inherent tendency to reach order.

A further problem concerns the lack of concrete organizational case studies of how complexity theory has been successfully applied within HRD contexts. Although there have been a few studies that have helped one to explain and better understand organizational change, these have offered only partial insights (Brown and Eisenhardt 1997; Houchin and MacLean 2005; Pascale 1999; Shaw 1997). Nevertheless, there are a few studies that illustrate the use of complexity concepts as interventions in change programmes designed to improve connectivity and feedback, which do suggest positive results (Stacey 1996; Shaw 1997; Griffin, Shaw, and Stacey 1998; Seel 2000). Further challenges may lie in that the data generated from research is so highly contextualized that it may have far more limited generalizability than typically generated within HRD research. This may be judged to be of limited value for HRD practitioners who, through organizational constraints, increasingly look to best practice or formulaic solutions to meet immediate leadership development needs.

A second major problem is very much linked to this. Complexity leadership development relies heavily on the notion of a non-linear, sudden coming together of interdependent agents in the system to solve problems in a creative way. This occurs through appropriately structured networks rather than by centrally coordinated groups or teams (Uh-Bien et al. 2007). As yet, our understanding of what constitutes an appropriately structured network is very much in its infancy. Arguably, although some degree of order is eventually expected to arise from random iterations of agents coming together, the inability to specify when this might occur or might be expected poses challenges within organizations that are heavily influenced by short-term goal horizons. Similarly, much of the posited benefits for innovation and problem-solving arising through emergent aggregates are arguably derived from the transfer of tacit knowledge (Polanyi 1966). Although extensive contact and close interpersonal relationships are thought to promote tacit knowledge transfer (Goffin and Koners 2011), much of our understanding of the processes by which this occurs remains highly theoretical (Nonaka and Takeuchi 1995).

There are also as yet unknown feasibility implications for HRD practice. Although tension is seen as a facilitative process within the dynamics of a complex adaptive system, it may require levels of empowerment and individual competences in conflict resolution and negotiation that exceed the limits of many members of the workforce, or at least will pose an immense burden on the HR development function to support. Beeson and Davis (2000) argue that this will require a fundamental shift in the role of leaders rejecting command and control style of management. HRD practitioners will need to encourage experimentation and divergent views, and rethink the nature of hierarchy and control

(Morgan 1997). This level of freedom and autonomy may prove too destabilizing for organizations. The notion of rationalizing control through detailed attention to planning and organization also runs deep within the management psyche, such that offering deterministic development solutions is hard, for leaders and HRD professionals alike, to resist. At the same time, we might find that the bottom-up emergence of problem solving and creative behaviour through autocatalysis derives from such a high degree of informality within the system that the use of ordered leadership development interventions may well constrain or suppress adaptive capacity such that the effects create a negative feedback.

All these questions represent significant challenges for both HRD research and practice. In terms of research, we may need to adopt an approach that recognizes the strength of the complexity leadership development theory in terms of its explanatory rather than predictive power. What seems clear is that research will need to elevate long-term case study qualitative research methods above quantitative research approaches, to begin to get answers to some of these questions. This itself may also prove difficult and introduce new tensions within the field, where a vigorous debate already exists over the actual purpose and boundaries of HRD.

Conclusions

Organizations are dealing with environments of increasing uncertainty and complexity that place significant constraints on the effectiveness of traditional solo-heroic models of leadership. Relational and systemic perspectives of leadership are better placed to enable organizations to draw upon leadership capacity, but require us to develop new models of leadership development. An initial model of complexity leadership development that better supports organizational adaptation and innovation is posited here to facilitate distributed intelligence. The model captures the systemic nature of leadership by focusing on key domains comprising network conditions, organizational learning, shared leadership and leader skills and knowledge. Whilst individual leaders are seen as important and requiring a particular set of skills, leadership development also involves shaping the context, particularly structures and cultures. Together, these support the process of autocatalysis, argued here to be central in order for organizations to deal with increasing complexity. However, a shift towards complexity leadership development represents a number of significant challenges for both research and practice in HRD. These are likely to play a role in shaping the field over the coming decades.

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