Leadership for Complex System Governance

David Walters

Abstract Recognizing complexity and uncertainty as norms for the environments in which organizations exist, complexity theory, complex systems, and complex adaptive systems have been suggested as appropriate to address these challenges. Further, merging aspects of complex systems and governance to develop a systems-based framework for design, evolution, and implementation of the metasystem which governs a complex system has been proposed. In this chapter, we explore leadership issues associated with governance of complex systems. Topics include the relationship between systems leadership and the Complex System Governance (CSG) reference model; a review of leadership including leadership styles, functions, ethics, complex system leadership, and Complex System Governance leadership; system leadership practice including responsibilities, effects and impacts of leadership, the role of leadership in metasystem design, implementation and operation; and the applicability and integration of systems leadership into the CSG reference model. Exercises will then be addressed.

Keywords Leadership · Complexity theory · Complex systems · Complex system governance

1 Introduction

The extensive body of scholarly literature regarding leadership addresses the subject across a number of domains including nursing, education, academia, economics, politics, military, and business, to name but a few. Much of this literature, developed over a significant period of time, addresses leadership from the perspectives of required personal skills, organizational impact, developmental issues, behavioral characteristics, or ethical issues. Over these many years of study, researchers have developed more than 60 classification systems to help characterize leadership. Despite these efforts, there is no single accepted definition for leadership. However, for the

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purposes of this chapter, a definition for leadership, based on concepts from the literature, will be identified and will be used as a basis for further discussions. Leadership functions, responsibilities, effects, and impacts as well as leadership ethics will be also explored.

It is clear from reviewing the literature that the study of leadership from a systems theoretic perspective is a relatively recent endeavor with an emerging emphasis on complexity theory. The primary goal in this chapter is to explore the role of leadership in the governance of complex systems from a systems theory and management cybernetics perspective. The systems theory axioms and propositions which underpin this study were covered in detail in the "Complexity" chapter.

2 The Context for Complex System Governance Leadership

Complex systems exist in environments characterized by uncertainty and complexity. Governance of these systems requires execution of metasystem functions necessary to ensure system viability, or more specifically, control, communication, coordination, and integration of the complex system [1]. CSG is an emerging field based in systems theory, management cybernetics, as well as governance, and has been defined as the '*design, execution, and evolution of the metasystem functions necessary to provide control, communication, coordination and integration of a complex system*' [2] (p. 5). The CSG reference model, previously addressed in "Complex System Governance Reference Model", is a systems-based construct that identifies essential Complex System Governance functions. As a reminder, the functions identified in the CSG reference model include policy and identity (Metasystem 5), system context (Metasystem 5*), strategic system monitoring (Metasystem 5′), system development (Metasystem 4), learning and transformation (Metasystem 4*), environmental scanning (Metasystem 4′), system operations (Metasystem 3), operational performance (Metasystem 3*), and information and communications (Metasystem 2). Figure 1 is a graphical representation of the CSG reference model. Design, implementation, and operation of the system, including the metasystem which provides for these functions, are the responsibility of leadership; therefore, system leadership has a role in each of the aspects of the Complex System Governance reference model. A more detailed discussion of the roles and responsibilities of leadership in ensuring the functions identified in the reference model are executed is provided later in this chapter.

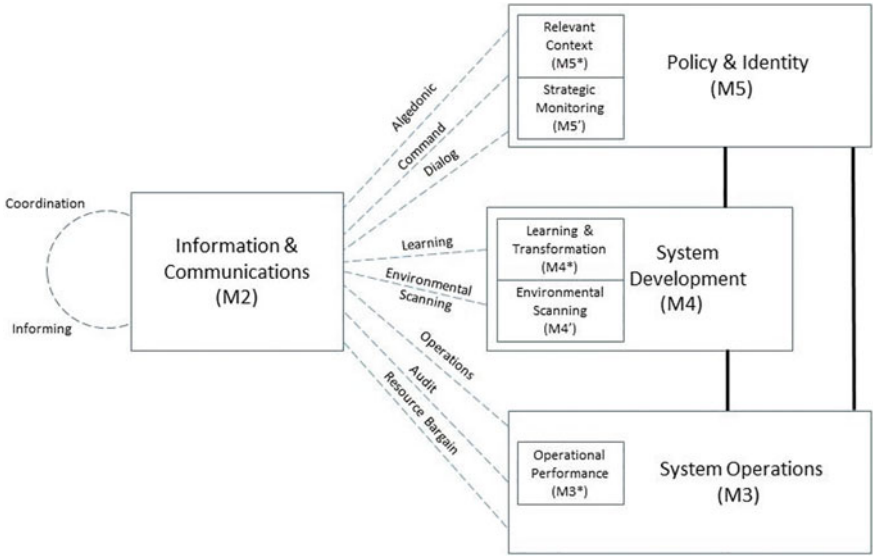

Fig. 1 Complex System Governance reference model

3 Leadership—A Review

3.1 Overview

History is replete with examples of leaders throughout the ages so it is no revelation that leadership has been practiced for many years. Serious study of leadership has also been conducted for quite some time from many points of view. There exists extensive literature regarding leadership addressing the subject across a number of domains including economics, politics, military, education, nursing, academia, and business, to name but a few. Perspectives explored in this literature include required personal skills, organizational impact, developmental issues, traits (behavioral characteristics), or ethical issues associated with leadership. More than 60 classification systems to help characterize leadership [3] have been developed over the years. Eight dominant 'different schools' of contemporary leadership are apparent from the literature. There is also an emerging school. Among the contemporary schools of leadership are those subscribing to *Trait Theory, Skills Theory, Situational Theory, Contingency Theory, Path-Goal Theory, Transformational Theory, Transactional Theory,* and *Servant Theory.* The emerging school of leadership subscribes to *Complexity Leadership Theory.* Table 1 provides a discussion on each of these leadership theories. In spite of this history, no single, universally agreed upon definition of leadership exists [4, 5]. Some generally (but not universally) accepted characteristics of leadership include leadership is a *process*, involving *influence* resulting from *dynamic interaction*, occurring in a *group*, and working toward a *common goal* [4, 6, 7].

Table 1 Dominant schools of leadership

School	Perspective	Discussion
Trait Theory	Traits	This theory suggests that people either are or are not born with the *qualities* that predispose them to success in leadership roles. Intelligence, sociability, and determination are consistently cited as central qualities Proponent: Crowley [11]
Skills Theory	Skills	This theory suggests that learned knowledge and acquired skills and abilities are significant factors in effective leadership Proponent: Katz [12]
Situational Theory	Multiple	This theory suggests that different styles of leadership are warranted for different situations. The ability to adapt or adjust to the circumstances of the situation is required. The primary factors that determine how to adapt are an assessment of the competence and commitment of followers. The assessment of these factors determines if a leader should use a more directive or supportive style Proponent: Hersey and Blanchard [13]
Contingency Theory	Multiple	This theory suggests that effectiveness of a leader is contingent on how well the leader's style matches a specific setting or situation Proponent: Fiedler [14]
Path-Goal Theory	Multiple	This theory suggests that effective leaders can improve the motivation of followers by clarifying the requirements and removing obstacles to high performance and desired objectives. There is an expectation that people will be more focused and motivated if they believe they are capable of high performance, believe their work is worthwhile, and their effort will result in desired outcomes Proponent: Evans [15]
Transformational Theory	Multiple	This theory suggests that leadership is a process of engagement in which a leader is able to create a connection with followers that results in increased motivation and morality in both followers and leaders. The leader must be attentive to the needs and motives of followers in order to help them reach their maximum potential. Transformational leadership may also describe how leaders can initiate, develop, and implement important changes in an organization Proponent: Downton [16]

(continued)

Table 1 (continued)

School	Perspective	Discussion
Transactional Theory	Multiple	This theory focuses on the exchanges that take place between leaders and followers. It suggests that a leader's job is to create structures that make clear what is expected and also the consequences for meeting or not meeting these expectations. Often likened to management Proponent: Weber [17]
Servant Theory	Multiple	This leadership theory suggests that leaders should be servants first, that is, in order to be effective, leaders must place the needs of their followers, customers, and the community ahead of their own interests Proponent: Greenleaf [18]
Complexity Theory	Process	This leadership theory focuses on enabling learning, creativity, and adaptability of complex adaptive systems (CAS) within a context of knowledge-producing organizations Proponentes: Uhl-Bien, Marion, McKelvey [19]

Implied by these characteristics is that leadership involves a relationship between a leader and those led [8, 9]. Marion [10] reminds us the goal to which a group aspires may be temporal or not well understood due to complexity, thus requiring conditions to be created by leadership that enable productive pursuit of the goal. For the purpose of this chapter, leadership will be defined as follows: *a process whereby the conditions that enable a group to productively pursue a common goal is created or fostered*. Creating the conditions to enable pursuit of the goal includes influencing the group through dynamic interactions. A leadership role is not necessarily the sole province of official position, nor is it static. Any individual in a group may take on a leadership role. It is also the case that positional authority does not necessarily result in leadership. For example, a person in a position of authority who might be expected to provide leadership might delegate that role to another person or persons within the team in a particular instance.

3.2 Leadership Styles

Leadership has also been analyzed from the perspective of style. Among the styles often identified are *Autocratic*, *Democratic, Laissez-Faire, Charismatic, Transactional, Transformational* and *Situational.* Table 2 provides information regarding each of these leadership styles.

Table 2 Leadership styles

STYLE	DESCRIPTION	APPLICATION	EFFECT	SOURCE
Autocratic	Leader makes decisions unilaterally even if input from other team members would be useful	Appropriate for situations in which a decision is needed quickly	This leadership style can have a detrimental effect on team morale, dynamics, and productivity	[20, 21]
Democratic	Leader makes the final decisions but includes members of the team in the decision-making process	Appropriate for leaders to foster an environment in which the team is significantly engaged in projects, participate in decision making, and are encouraged to be creative	This style of leadership may not always be effective, especially when a quick decision is required	[20, 21]
Laissez-Faire	Leader gives their team a good deal of autonomy in determining how work will be accomplished and how deadlines are set	Advice and resources are provided, if required, but otherwise the leader does not get involved. Inappropriate for teams not able to self-manage	May result in high job satisfaction	[21]
Charismatic	Leader inspires and motivates team members	Leaders who employ this style of leadership often focus on themselves and their own ambitions	Depending on the leader's motivations, this may affect the team positively or negatively	[10, 21]
Transactional	Leaders and those led operate under the premise that assigned team members agree to obey the leader when they accept a job as they are being paid for their effort and compliance on a short-term task	This type of leader–follower relationship makes clear everyone's roles and responsibilities	Does not encourage creative tension within the team. Rewards (positive or negative) are contingent upon performance	[21, 22]

(continued)

Table 2 (continued)

STYLE	DESCRIPTION	APPLICATION	EFFECT	SOURCE
Transformational	Leader motivates teammates with a shared vision of the future which is communicated well, and clear goals for the achievement of that future are set	For environments where change in individuals or the system is desirable	This style of leadership typically results in high productivity and engagement on the part of the team members	[21, 22]
Situational	A leadership style in which the leader uses different leadership styles depending on the maturity of assigned team members	Differing approaches used depending on maturity of teammates. Directing for immature, participative, or delegating for mature teammates	Works if the leader is attuned to the needs of the people led, otherwise can demotivate or not provide sufficient support	[21, 22]

3.3 Leadership Functions

A definition for leadership has been provided, a number of common leadership styles have been addressed, and we now turn our attention to the functions of leadership which should be performed regardless of the style employed. Although by no means a categorical list, functions associated with leadership may include *create a vision* [5, 10, 23]; *build trust* [9, 24, 25]; *enable* [10, 23]; *adapt* [9, 10, 26]; *communicate* [23, 25, 27]; *protect* [10, 25]; and *influence* [5, 6, 9]. Figure 2 illustrates these leadership functions and some of the actions which support those functions.

Creating a vision entails envisioning a future desired or possible state or condition. When developing a vision, beginning with a broad perspective helps avoid exclusion of potentially desirable opportunities or alternatives. Developing a vision is a necessary part of building a plan or roadmap to channel a team's effort toward a shared goal [23] making it easier for teammates to appreciate their fit in the organization and guiding behavior [4]. It is also an opportunity to question accepted assumptions [27] as part of an effort to reframe the future. Once a vision has been created, it must be communicated if pursuit of that vision is expected. Communication will be addressed in more detail later in this chapter.

Building trust within a team is an important function of a leader. For the purposes of this chapter, we will use the definition of trust provided by the Merriam-Webster online dictionary—*trust* is defined as *the belief that the person is reliable, good, honest, and effective* [28]. Trust in a leader is, therefore, the belief that the leader is reliable, good, honest, and effective. Reliability suggests the leader's actions are consistent and the team is not having to be wary of the leader's mood or guess their next move. Good suggests the leader's actions, and behaviors are sufficiently

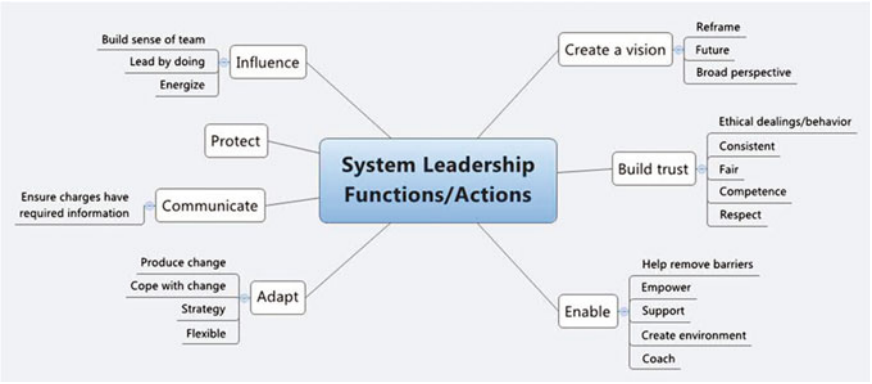

Fig. 2 System leadership functions/actions

transparent and ethical. Fair means the leader treats teammates as well as others justly and respectfully. Honest suggests the leader does not engage in purposeful deception. Effective suggests the leader is competent and can lead the team to accomplish goals. Maccoby suggests '*People follow a leader either out of fear or for a mix of positive reasons such as hope for success, trust in the leader, excitement about a project or mission, or the opportunity to stretch oneself to the limit*' [29] (p. 57). Fear does not lead to trust. It is far better for long-term success for teammates to follow a leader for positive reasons rather than fear. Given a leader can build trust within the team, that leader will likely enjoy the respect of those teammates.

Another function of leadership is *enabling* the team to pursue accomplishment of goals. Included in this function may be creating conditions for team success, barrier removal, empowering team members, supporting them, and coaching them. The path from current conditions to the goals envisioned can be challenging and circuitous. Marion [10] suggests it is up to a leader to create conditions for a creative environment within which the team can succeed. Empowering team members encourages the exercise of initiative and self-sufficiency [4] which can enable quicker response to issues and lessen the leader's burdens. There are times, however, when situations require the engagement of a leader with positional authority. In these cases, the team members do not have the capability to overcome the barriers that have been encountered. It is incumbent upon the leader to recognize these situations and to take appropriate and timely action. Inadequacy of team members' capabilities (knowledge, skills, or abilities) may also be a barrier to success for the team. In these cases, the leader must recognize the issues, develop remediation options, and help the team overcome those shortcomings.

Toor [5] suggests leadership is about *adapting* to as well as producing change. Developing strategies to attain the goals of the vision which in turn allow plans for execution to be developed are the responsibility of leadership. The environments within which systems operate are not static; therefore, it should be expected that execution plans will be constantly reviewed and adapted, as necessary, to extant

conditions. Leaders, therefore, must be flexible in order to cope with the inevitable changes in conditions that will most likely occur. Leadership is responsible for ensuring the system is capable of meeting current expectations and is on a trajectory for continuing to meet future goals.

Communicating is an essential function of leadership which involves presence as well as listening [23]. Leadership communication is the essential information to the right audience in a timely manner [30]. Ensuring lines of communications exists across all levels of an organization and is important to ensure requisite information is available when and where needed [10]. Effective communications can catalyze individual and group participation while enabling leaders to 'exert their influence through the stories they tell and the ways they embody those stories' [31] (p. 155).

The welfare of the team is the responsibility of the leader. There may be times when the team or team members need protection from spurious threats or conditions from within or outside the organization (system). This does not mean protecting poor performers as this would be counter to the welfare of the team. Endeavors associated with change have some level of risk. Failure, when prudent risks were assumed, is not unreasonable; however, in some organizations, no failure is acceptable. It is in these cases that it is important that the leader provides protection for team members involved.

Kaiser [6] suggests leaders have an effect (either a positive or negative) on the performance of an organization by *influencing* individuals to contribute to the attainment of the organization's goals. Good leadership takes strength of character and a firm commitment to doing the right thing, at the right time, for the right reason including following through on commitments [21, 30].

Figure 2 is an illustration of leadership functions and actions.

3.4 Leadership Ethics

In spite of ethical behavior being important to effective leadership [32], a significant body of research literature has yet to be published regarding the theoretical foundations of ethical leadership [4].

Ethics is concerned with the character of individuals or groups (institutions, societies) which includes the values and morals which are recognized to be desirable [4, 33]; essentially: what is right or wrong, good or bad. Leadership, from the perspective of ethics, is about what a leader does and who they are as a person.

Northouse [4] suggested a set of principles for ethical leadership which include *respect, service, justice, honesty, and community*. How a leader addresses these principles is indicative of their character.

Respect for the individual is often identified as an issue that is important to ethical leadership [4, 34, 35]. Ethical leaders treat individuals with dignity and as valuable team assets by empowering them to be creative [35], not simply as means to an end [4]. In the context of leadership, respect is having consideration for a person's perspective, conviction, or position regarding an issue under consideration. Respect

also includes listening attentively to members of the team and being tolerant of varying points of view [4].

Service is about attending to others, which might include mentoring, empowering, coaching, or team building [4, 35]. Service is about putting the other's welfare foremost in a leader's effort while foregoing personal gain for the sake of team members or the organization.

Northouse [4] suggests j*ustice* is about treating people fairly. Transparency in actions can be important since the perception of fair treatment is a subjective judgment made by affected or observing individuals [34]. Transparency can help the affected person(s) or observers be more confident in the motives of the leader. Justice is not necessarily about treating everyone the same, it is more about giving everyone an equal opportunity. For example, there may be situations in which the team leader might need to allow individual team members more latitude during specific periods of time to help them succeed.

Honesty is about not purposely deceiving others by not telling the truth or by not representing reality as fully as possible [4]. A leader can find themselves in a difficult position when they cannot share information fully with team members. In this case, a delicate balance is required between guarding privileged information that has been shared with the leader and openness. Trustworthiness, an important issue in the relationship between leaders and their team, is influenced by the perception of their honesty.

Northouse [4] (p. 437) observes that '*an ethical leader takes into account the purpose of everyone involved in the group and is attentive to the interests of the community and the culture.*' Ethical leadership seeks a common goal for the team, one that each of the team members can embrace as their own. The goal will be one that is beneficial to each of the team members.

In summary, good leaders show respect to the individuals, they put the welfare and interests of the group ahead of their own self-interests, treat people fairly and justly, are honest with their team, and consider the greater good for the community [4].

A definition of leadership, leadership styles, a number of important functions of leadership, and leadership ethics have been discussed. It is now time to address complex systems leadership.

3.5 Complexity Theory Perspective of Leadership

It has been recognized that complexity and uncertainty are the norms for the environments in which organizations exist [36]. As a result, complexity theory, complex systems, and complex adaptive systems are being suggested as appropriate to address these conditions [7, 36–38]. *Complexity theory* is the 'study of complex and chaotic systems and how order, pattern and structure can arise from them' [39]. Johnson [40] (p. 17) observed that '*complexity looks at the complicated and surprising things which can emerge from the interaction of a collection of objects which themselves*

may be rather simple.' Complex systems were introduced earlier in this work. Among the characteristics of complex systems discussed were the large number of elements, loosely organized, with many interactions between those elements. In addition, these systems evolve over time and are open to their environment [41]. Hazy [37] observes that complex adaptive systems (CAS) have a capacity to adapt to changes in the environment within which they exist. Uhl-Bien, et al. [19] (p. 302) credit Dooley [42] with describing CAS as '*an aggregate of interacting agents that behave according to three principles: order is emergent as opposed to predetermined, the system's history is irreversible, and the system's future is often unpredictable*.' Marion and Uhl-Bien [10] suggest that organizations are complex adaptive systems composed of agents who interact with one another, mutually affecting each other, which generates new behavior for the system as a whole. Systems theory is being used to help in the understanding of complex and complex adaptive systems leadership (implicitly if not explicitly) with a limited set of propositions considered and is tending away from strictly considering hierarchical, positional, or character/characteristic-based perspectives to also include viewing leadership as an emerging event resulting from interactions between people [7] where leaders enable conditions appropriate to success of the endeavor. Implicit in this perspective is leadership can emerge from any part of an organization for a specific instance. In summary, *leadership* in complex systems is an emergent, interactive dynamic that produces outcomes while *leaders*, who may emerge from any part of the organization or team, are individuals who influence these interactions and outcomes [19].

3.6 Complex System Governance Leadership

Turning now to *Complex System Governance leadership*, a review of the roles and responsibilities of leadership with respect to the requisite functions identified in the complex systems governance reference model will be explored. Complex System Governance has been defined as '*the performance of (metasystem) functions necessary to provide direction, communication, control, and change necessary to ensure continuing viability of a system*' [43] (p. 156). The complex system reference model discussed in "Complex System Governance Reference Model" identifies nine functions that must be performed by the metasystem to ensure system viability. Recall those functions included policy and identity (M5); system context (M5′); strategic system monitoring (M5*); system development (M4); environmental scanning (M4′); learning and transformation (M4*); system operations (M3); operational performance monitoring (M3*); and information and communications (M2). The metasystem roles and responsibilities of leadership from a high-level perspective are shown in Table 3. A more detailed discussion of these roles and responsibilities is provided later in the practice section of this chapter.

The next section of this chapter will discuss systems leadership issues with implications for practice.

Table 3 Complex System Governance reference model leadership roles and responsibilities

Metasystem	Function	Leadership Role	Leadership Responsibility
M5	Provide direction, oversight, accountability, and evolution of the System	Enable provision of direction, oversight, accountability, and evolution of the system	Ensure direction, oversight, accountability, and evolution of the system are provided and occur
M5′	Monitor the system context (the circumstances, factors, conditions, or patterns that enable or constrain the system)	Enable the system context to be monitored	Ensure the system context is monitored
M5*	Maintain system context and monitor measures for strategic system performance	Enable maintenance of system context and monitoring of strategic system performance measures	Ensure maintenance of system context and monitoring of strategic system performance measures
M4	Analyze and interpret implications and potential impacts of trends, patterns, and precipitating events in the environment in order to develop future scenarios, design alternatives, and future focused planning to position the system for future viability	Enable analysis and interpretation of trends, patterns, and events in the environment to enable planning for future system viability	Ensure environmental analysis and interpretation in support of planning for future system viability
M4′	Provide the design and execution of scanning of the environment with focus on patterns, trends, threats, events, and opportunities for the system	Enable the design and execution of environmental scanning	Ensure environmental scanning occurs
M4*	Provide for identification and analysis of metasystem design errors (second-order learning) and suggest design modifications and transformation planning for the system	Enable identification of metasystem design errors	Ensure identification of metasystem design errors

(continued)

Table 3 (continued)

Metasystem	Function	Leadership Role	Leadership Responsibility
M3	Maintain operational performance control through the implementation of policy, resource allocation, and design for accountability	Enable operational performance control	Ensure operational performance control
M3*	Monitor measures for operational performance and identity variance in system performance requiring system-level response	Enable operational performance measures to be monitored and identify variance in system performance requiring system-level response	Ensure operational performance measures are monitored and system performance variances requiring system-level responses are identified
M2	Design and implement the architecture for information flow, coordination, transduction and communications within the metasystem and between the metasystem, the environment, and the governed system	Enable design and implementation for information flow, coordination, transduction and communications within the metasystem and between the metasystem, the environment and the governed system	Ensure design and implementation for information flow, coordination, transduction and communications within the metasystem and between the metasystem, the environment and the governed system

4 Applicability of Leadership to Complex System Governance

'Leadership is a highly sought-after and highly valued commodity' [4] (p. 1). Whether positional or emergent, teams coalesce around good leadership which affects team members' satisfaction, attitude, performance, and system (organization) success in a positive manner [44]. Leadership also affects the culture of an organization—by talk or action, the corporate culture is communicated to team members, either good or bad, ethical or unethical. In this next section, the responsibilities, effects, and impacts of leadership will be explored.

4.1 Leadership Responsibilities, Effects, and Impacts

Earlier in this chapter, the growing recognition that complexity and uncertainty prevail in the environments in which organizations exist [36] was discussed as was the appropriateness of complexity theory, complex systems, and complex adaptive systems to address these conditions [7, 36–38]. Also discussed was that *leadership* in complex systems is an emergent, interactive dynamic that produces outcomes while *leaders*, who may emerge from any part of the organization or team, are individuals

who influence these interactions and outcomes [19]. Regardless of the source of leadership, positional or emergent, the leadership functions discussed earlier in this chapter need to be performed. The reader will recall the functions identified include creating a vision, building trust, enabling, adapting, communicating, protecting, and influencing. It is the responsibility of the leader to contribute to creating a vision, which entails envisioning a desired or possible state or condition in the future. This may be accomplished by the leader alone or by bringing together appropriate team members and leading an effort to define the vision, or by creating the environment in which the vision can be developed by team members. Engaging team members in the development of a vision, although possibly taking more effort and time consuming, has advantages including exploring multiple perspectives (complementarity), beginning the process of disseminating the information related to the vision (communications), and jump-starting buy-in by those participating. Regardless, the vision must be communicated to the whole team in a way in which each member can embrace the vision. Along with creating a vision, an appropriate organizational design to pursue the vision must be identified and implemented which is also a leadership responsibility. Care should be taken to ensure the resulting organization enables team success, supports emergent networks, and does not make it more difficult for the team to succeed. As the environment within which the organization (system) exists is not static, organizational (system) design is not a 'one and done' effort, it must be flexible and requires continual review to ensure requisite functions are being performed. This does not imply continuous organizational change which can be disruptive (relaxation time). The effects on the organization of having established goals to which the team can aspire, a construct within which to operate, and a course to follow include diminished uncertainty and a sense of purpose. As a result, the impact on the team members may include diminished stress and a sense of purpose.

As previously discussed, building trust within a team is an important function of leadership. For a leader to build trust, team members need to believe the leader is reliable, good, honest, and effective. 'Actions speak louder than words' may be trite but without a doubt true in this area. Trust is earned over a period of time but can be lost in an instant. It is important, therefore, that the leader be consistent, ethical, forthright, and effective. The effects may include establishing an environment within the organization in which the leader can inspire team members to embrace the vision as their own [23]. Impacts include a team working toward a goal with more enthusiasm and being more willing to sacrifice to achieve the goal.

Enabling is about creating conditions for team success, helping to remove barriers, empowering team members, supporting them, or coaching. There are situations that arise that only a leader with positional authority can resolve. In these situations, it is the responsibility of that leader to act in a timely manner to resolve the issue thus allowing the team to devote their efforts to attaining the goal. Impact includes improved team morale and a sense of being able to accomplish tasking.

As previously discussed, leadership is about *adapting* to as well as producing change [5]. Leaders are charged with developing strategies to attain the goals of

the vision which in turn allow plans for execution to be developed. The environments within which systems operate are complex, therefore not completely understood (system darkness), and are not static. It should be, therefore, no surprise that execution plans must be constantly reviewed and adapted to extant conditions as currently understood. This requires leaders to be flexible in order to cope with the inevitable changes in conditions that will occur. Ensuring the system is capable of meeting current expectations and is on a trajectory for continuing to meet future goals (homeorhesis) is a responsibility of leadership. The effect is relevant planning and organizational constructs for team operations. Impact is a relevant team effort toward achieving goals.

Visions, goals, directives, or plans are worth little if the information contained therein is not shared with appropriate agents. Communicating the right information, at the right time, to the right people is important to the success of any endeavor. Leadership's role is to ensure means are available to facilitate communications as well as using those means to ensure team members have the opportunity to be properly informed. Communicating, that is transmitting information accurately and reliably from a source to a recipient, is not an easy task. What the source thought they said and what the recipient interpreted from what they heard may be significantly different even if there was minimum noise in the transmission channel. For example, in the 2013 Federal Viewpoint Survey, nearly 53 percent of the survey respondents indicated dissatisfaction with 'the information you receive from management on what's going on in your organization' [45]. Similar concerns can be found in other domains as well. The point is good communication, that truly informs, is a difficult but necessary undertaking that starts with leadership. Communications can affect the climate of an organization with good communications having a positive effect while poor communications can encourage a negative organizational climate. The impact can be seen in efficiency and morale.

A leader has a responsibility to help ensure the welfare of the team. Sometimes this requires the leader to protect the team or its members. Team members need to know that their leader 'has their back' when they perform their duties in good faith. In the end, the leader is responsible for the performance of the team. This concept is no more evident than in the sign that was displayed on President Harry Truman's (1945–1953) desk in the White House that read 'The Buck Stops Here' [46]. This does not, however, mean protecting poor performers or illegal activity. A team that has confidence in the leader backing their efforts and deflecting spurious threats may be more willing to take (prudent) risks.

As previously discussed, leaders can have either a positive or negative effect on the performance of an organization by *influencing* individuals to contribute to the attainment of the organization's goals [6]. Influence can be for good or bad and is not always overt and obvious. On occasion, results of influence can be immediate and obvious as in the case where a leader, by word or actions, inspires current team performance. There are other instances where influence is more subtle and takes longer to manifest the results. For example, a leader can impact the perceptions and character of a team and its members by consistent performance of their duties in an ethical and effective manner. This can lead to an understanding that there is an

expectation that team members will act in a similar manner. The converse is also true. If the leader's actions are continually unethical, it should be of no surprise that team members follow the leader's lead. Leadership, at least good leadership, takes strength of character and a firm commitment to doing the right thing, at the right time, for the right reason including following through on commitments [21, 30]. This is the essence of leading by example. The effect is an established environment of expected behavior. The team members' conduct is among the impacts of leadership influence.

4.2 Role of leadership in Metasystem design, Implementation, and Operation

In "Complex System Governance", the concept of *metasystem* was introduced. Beer defined metasystem as *"…a system over and beyond a system of lower logical order, and therefore capable of deciding propositions, discussing criteria, or exercising regulation for systems that are themselves logically incapable of such decisions and discussions or self-regulation…'* [47] (p. 402). The purpose of the metasystem is to provide the functions necessary for organizational (system) viability. This means the functions are necessary for the organization (system) to continue to exit. The metasystem is the means by which Complex System Governance is exercised. Although these functions could emerge from a self-organization effort, an explicitly designed metasystem (purposeful design) is preferable. As previously discussed, the organizational construct within which the organization operates is the responsibility of leadership; therefore, leadership is responsible for design, implementation, and operation of the metasystem which is part of that construct. Exercising purposeful design over the metasystem affords leadership the opportunity to influence how the necessary functions are performed and by whom as well as influencing the efficiency with which they are performed.

The next section will explore the relationships between systems leadership and the Complex Systems Governance reference model discussed in "Complex System Governance Reference Model".

4.3 Applicability and Integration into the Complex System Governance Reference Model

"Complex System Governance Reference Model" introduced the Complex System Governance reference model which is an organizing systems-based construct for facilitating development of essential Complex System Governance functions. In this section, the relationship between leadership and each of the aspects of the Complex System Governance reference model will be explored. Table 2 provided an introduction to the roles and responsibilities of leadership in relation to the governance

functions identified in the Complex System Governance reference model. Table 4 discusses each of the roles and responsibilities of leadership in regard to the identified governance functions including potential leadership actions and mechanisms that might be used.

5 Summary

The purpose of this chapter was to explore leadership for Complex Systems Governance. In the process, a definition of leadership was provided, the relationship between systems leadership and the Complex System Governance reference model was explored; a review of leadership including leadership styles, functions, ethics, complex system leadership, and Complex System Governance leadership was completed; system leadership practice including responsibilities, effects and impacts of leadership, the role of leadership in metasystem design, implementation, and operation was addressed; and the applicability and integration of systems leadership into the CSG reference model were explored.

In the end, CSG leadership adds to the mosaic of understanding of leadership that has been developed over years of research that resulted in the various perspectives of leadership previously discussed.

The next section will address exercises.

6 Exercises

1. An organization has recognized a trend in their customer base to which a response is required. A team is established to analyze the conditions and determine organizational changes, in function or configuration, required to meet this challenge. Discuss the role of leadership in this effort specifically identifying systems propositions that may be in play.
2. Creating a vision for an organization (system) has been identified as a responsibility of leadership. Discuss the role of leadership in creating a vision from your perspective. Identify the system propositions that might influence the design of the vision and explain what the influence of each is.
3. Discuss the advantages and disadvantages of a purposefully designed metasystem as contrasted with an emergent design resulting from self-organization. Include in the discussion the systems propositions that may influence these efforts.
4. In the framing vantage of the Complex Systems Governance development reference model, one of the issues addressed is the bounding of the system of interest. Discuss what this entails, the importance of bounding the system, the role of leadership, and identify supporting system propositions.

Table 4 Leadership roles and responsibilities

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
System: M5—Policy and identity Function provides direction, oversight, accountability, and evolution of the system. Focus includes policy, mission, vision, strategic direction, performance, and accountability of the system such that (1) the system maintains viability, (2) identity is preserved, and (3) the system is effectively projected both internally and externally					
Enable system identity to be established and maintained in the face of changing environment and context	Provide guidance, communications channels, and resources to establish and maintain system identity in the face of changing environment and context	- guidance documents - internal communications - meetings - resource allocations	Ensure system identity is established and maintained in the face of changing environment and context	Monitor how well the system identity reflects the desired characteristics and culture of the system as well as how well it is distributed throughout the system. Increase engagement as necessary to achieve desired results and be prepared to reallocate resources if required	- direct personal interactions - meetings - internal correspondence - resource reallocation
Enable the system vision, strategic direction, purpose, mission, and interpretation to be defined, clarified, and propagated	Provide guidance and resources required to define, clarify, and propagate the system vision, strategic direction, purpose, mission, and interpretation	- guidance documents - internal communications - meetings - resource allocations	Ensure the system vision, strategic direction, purpose, mission, and interpretation are defined, clarified, and propagated	Monitor how well the system vision, strategic direction, purpose, mission, and interpretation are defined, clarified, and propagated throughout the system. Increase engagement as necessary to achieve desired results and be prepared to reallocate resources if required	- direct personal interactions - meetings - internal correspondence - resource reallocation

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable the system focus to be determined and balanced between present and future on an active basis	Provide guidance and requisite resources to actively determine and balance the system focus between the present and the future	- guidance documents - internal communications - meetings - resource allocations	Ensure the system focus is determined and balanced between present and future on an active basis	Monitor how well the system focus is determined and balanced between present and future on an active basis. Increase engagement as necessary to achieve desired results and be prepared to reallocate resources if required	- direct personal interactions - meetings - internal correspondence - resource reallocation
Enable strategic plan dissemination	Provide guidance, venue, and resources required to disseminate the strategic plan	- guidance documents - internal communications - meetings - resource allocations	Ensure the strategic plan is disseminated	Monitor how well the strategic plan is being disseminated. Increase engagement as necessary to achieve desired results and be prepared to reallocate resources if required	- direct personal interactions - meetings - internal correspondence - resource reallocation
Enable oversight of strategic plan execution	Provide guidance and resources to oversee execution of the strategic plan	- guidance documents - internal communications - meetings - resource allocations	Ensure strategic plan execution is afforded oversight	Oversee execution of the strategic plan	- meetings - internal correspondence - resource reallocation
Enable provision of capital resources necessary to support the system	Provide requisite resources to support the system	- resource allocations	Ensure capital resources necessary to support the systems are provided	Monitor availability of requisite capital for system support. Be prepared to reallocate resources as required	- meetings - internal correspondence - resource reallocations

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable setting of present and future problem space for focus of product, service, and content development and deployment	Provide guidance and resources necessary to define focus for present and future products, services, and content development and deployment	- guidance documents - internal communications - meetings - resource allocations	Ensure setting of present and future problem space for focus of product, service, and content development and deployment	Monitor focus of present and future products, services, and content development and deployment. Be prepared to provide additional guidance and reallocate resources if required	- meetings - internal correspondence - resource reallocations
Enable establishment of strategic dialog forums	Provide guidance, venues, and resources for the establishment of strategic dialog forums	- guidance documents - internal communications - meetings - resource allocations	Ensure establishment of strategic dialog forums	Monitor the establishment of and engage in strategic dialog forums	- direct personal interactions - meetings - internal correspondence
Enable autonomy-integration balance to be preserved in the system	Provide expectations and guidance to preserve the autonomy-integration balance in the system	- guidance documents - internal communications - meetings	Ensure autonomy-integration balance in the system is preserved	Monitor autonomy-integration balance in the system. Be prepared to provide additional guidance as required to attain and maintain desired results	- direct personal interactions - meetings - internal correspondence
Enable system products, services, content, and value to be marketed	Provide expectations, guidance, and resources for marketing of system products, services, content, and value	- guidance documents - internal communications - meetings - resource allocations	Ensure system products, services, content, and value are marketed	Monitor marketing of system products, services, content, and value. Be prepared to provide additional guidance and to reallocate resources as required to attain and maintain desired results	- meetings - internal correspondence - resource reallocations

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable planning and execution of public relations	Provide expectations, guidance, and resources for planning and execution of public relations	- guidance documents - internal communications - meetings - resource allocations	Ensure planning and execution of public relations are accomplished	Monitor public relations planning and execution. Be prepared to provide additional guidance or engage as necessary as well as to reallocate resources to attain and maintain desired results	- meetings - internal correspondence - resource reallocations
Enable external mentorship to be developed	Provide guidance, expectations, and resources for mentorship development	- guidance documents - internal communications - meetings - resource allocations	Ensure external mentorship is developed	Monitor mentorship development. Engage as necessary. Be prepared to provide additional guidance and to reallocate resources as required to attain and maintain desired results	- meetings - internal correspondence - resource reallocations
Enable system policy direction to be established	Provide guidance and resources necessary for establishment of system policy direction	- policy documents - internal communications - meetings - resource allocations	Ensure system policy direction is established	Monitor system policy direction. Be prepared to engage, provide additional guidance, and/or reallocate resources as necessary to attain and maintain desired results	- meetings - internal correspondence - resource reallocations
Enable system identity to be maintained	Provide guidance and resources necessary to maintain system identity	- guidance documents - internal communications - meetings - resource allocations	Ensure system identity is maintained	Determine system elements' perspectives of system identity. Be prepared to engage, provide additional guidance, and/or reallocate resources as required to maintain system identity	- direct personal interactions - meetings - internal correspondence - resource reallocation

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable system interests to be represented to external constituents	Provide guidance and resources for system interests to be represented to external constituents	- guidance documents - internal communications - meetings - resource allocations	Ensure system interests are represented to external constituents	Monitor representation of system interests to external constituents. Be prepared to engage, provide additional guidance and/or reallocated resources as required to attain and maintain desired results	- external correspondence - internal correspondence - meetings - resource reallocations
Enable the expanded network for the system (strategic partners) to be defined and integrated	Provide guidance and resources to define and integrate the expanded system network	- guidance documents - internal communications - meetings - resource allocations	Ensure the expanded network for the system (strategic partners) is defined and integrated	Monitor the defining and integrating of the expanded network for the system. Be prepared to engage, provide additional guidance, and/or reallocate resources to attain and maintain or desired results	- external correspondence - internal correspondence - meetings - resource reallocations
Enable scenarios for system transformation to evolve	Provide guidance and resources for system transformation evolution	- guidance documents - internal communications - meetings - resource allocations	Ensure scenarios for system transformation to evolve are developed	Monitor development of scenarios for system transformation. Be prepared to engage, provide additional guidance, and/or reallocate resources as required to attain or maintain desired results	- meetings - internal correspondence - resource reallocations
Enable strategic transformation direction to be implemented	Provide expectation, guidance, and resources for implementation of strategic transformation direction	- guidance documents - internal communications - meetings - resource allocations	Ensure strategic transformation direction is implemented	Monitor implementation of strategic transformation direction. Be prepared to engage, provide additional guidance, and /or reallocate resources required to attain or maintain desired results	- direct personal interactions - meetings - internal correspondence - resource reallocation

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
System M5′—System context Function: Monitor the system context (the circumstances, factors, conditions, or patterns that enable or constrain the system)					
Enable system context to be identified	Provide guidance and resources to identify system context. Participate in effort to identify system context	- guidance documents - internal communications - meetings - resource allocations	Ensure system context is identified	Monitor identification of system context. Be prepared to increase engagement and/or reallocate resources if necessary to attain or maintain desired results	- meetings - internal correspondence - resource reallocations
Enable contextual impacts on system performance (constraining and enabling) to be assessed	Provide guidance, expectations, and resources for assessment of contextual impacts on system performance	- guidance documents - internal communications - meetings - resource allocations	Ensure contextual impacts on system performance (constraining and enabling) are assessed	Monitor assessment of contextual impacts on system performance. Be prepared to provide additional guidance and/or reallocate resources to attain or maintain desired results	- meetings - internal correspondence - resource reallocations
Enable context to be actively managed	Provide guidance and resources to actively manage context	- guidance documents - internal communications - meetings - resource allocations	Ensure context is actively managed	Monitor context management. Be prepared to engage, provide additional guidance, and/or reallocate resources to attain or maintain desired results	- meetings - internal correspondence - resource reallocations
Enable boundary spanning to determine the boundary conditions, values, and judgments for the system to be conducted	Provide guidance and resources to conduct boundary spanning to determine the boundary conditions, values, and judgments for the system	- guidance documents - internal communications - meetings - resource allocations	Ensure boundary spanning to determine the boundary conditions, values, and judgments for the system is conducted	Monitor effort to determine the system's boundary conditions, values, and judgements. Be prepared to engage, provide additional guidance, and/or reallocate resources if necessary	- direct personal interactions - meetings - internal correspondence - resource reallocation

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable inquiry into contextual barriers to system execution or development to be conducted	Provide guidance and resources to conduct inquiry into the contextual barrier to system execution or development	- guidance documents - internal communications - meetings - resource allocations	Ensure inquiry into contextual barriers to system execution or development is conducted	Monitor progress in determining contextual barriers to system execution or development. Be prepared to provide additional guidance, engage, and/or reallocate resources as necessary	- direct personal interactions - meetings - internal correspondence - resource reallocation
Enable the influence of contextual aspects for the system to be monitored and assessed	Provide guidance and resources to monitor and assess the influence of contextual aspects for the system	- guidance documents - internal communications - meetings - resource allocations	Ensure the influence of contextual aspects for the system is monitored and assessed	Review effort to monitor and assess the influence of contextual aspects for the system. Be prepared to engage, provide additional guidance, and/or reallocated resources if necessary	- direct personal interactions - meetings - internal correspondence - resource reallocation
System M5*—Strategic system monitoring Function: Maintain system context and monitor measures for strategic system performance and identify variance requiring metasystem-level response with emphasis on variability that may impact future system viability					
Enable tracking of ongoing system performance based on dashboard measure of performance for operations	Provide guidance and resources to develop/maintain dashboard for system performance measures as well as tracking of ongoing system performance based on dashboard information	- guidance documents - internal communications - meetings - resource allocations	Ensure tracking of ongoing system performance based on dashboard measure of performance for operations is accomplished	Monitor dashboard information. Be prepared to provide additional guidance and/or reallocate resources if necessary	- meetings - internal correspondence - resource reallocations

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable system performance to be disseminated throughout the system	Provide guidance, communications channels, and resources to disseminate system performance throughout the system	- guidance documents - internal communications - meetings - resource allocations	Ensure system performance is disseminated throughout the system	Monitor system performance dissemination throughout the system. Be prepared to provide additional guidance, communication channels, and/or reallocate resources if necessary	- direct personal interactions - meetings - internal correspondence - resource reallocation
Enable inquiry into performance aberrations to be conducted	Provide expectations, guidance, and resources to conduct inquiry into system performance aberrations	- guidance documents - internal communications - meetings - resource allocations	Ensure inquiry into performance aberrations is conducted	Monitor inquiries into system performance aberrations. Be prepared to engage, provide additional guidance, and/or reallocate resources to attain/maintain desired results	- direct personal interactions - meetings - internal correspondence - resource reallocation
Enable operational performance measures to be monitored and assessed for continuing adequacy	Provide guidance and resources to monitor and assess continuing adequacy of operational performance measures	- guidance documents - internal communications - meetings - resource allocations	Ensure operational performance measures are monitored and assessed for continuing adequacy	Review effort to monitor and assess operational performance measures for continuing adequacy. Be prepared to engage, provide additional guidance, and/or reallocate resources if necessary	- direct personal interactions - meetings - internal correspondence - resource reallocation

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
System M4—System development Function: Analyze and interpret implications and potential impacts of trends, patterns, and precipitating events in the environment in order to develop future scenarios, design alternatives, and future focused planning to position the system for future viability					
Enable the analysis and interpretation of environmental scanning results for shifts, their implications, and potential impacts on system evolution	Provide resources necessary to analyze and interpret environmental scanning results as well as means to communicate the results to appropriate parts of the system	- resource allocations - internal correspondence	Ensure environmental scanning results are analyzed and interpreted for shifts, their implications, and potential impacts on system evolution	Monitor the results of environmental scanning. Be prepared to make requisite changes to existing operations and development plans based on information resulting from the analysis and interpretation of the environmental scan	- internal correspondence - meetings - resource reallocations
Guide the development of the system strategic plan and system development map	Provide clear expectations regarding the development of the strategic plan and system development map. Provide resources to develop the strategic plan and system development map	- guidance documentation - meetings - resource allocations	Ensure the system strategic plan and system development map are developed	Monitor the development of the system strategic plan and system development map. Be prepared to provide additional guidance and/or reallocate resources as necessary	- direct personal interactions - internal correspondence - meetings - resource reallocations
Enable the use of information and knowledge resident in M4 to inform strategic planning	Make system development information available to inform strategic planning. Devote resources necessary	- meetings - internal correspondence - resource allocations	Ensure information and knowledge resident in M4 are used to inform the strategic plan	Monitor the use of system development information to inform the development of the strategic plan. Be prepared to provide guidance and/or resources as required	- direct personal interactions - internal correspondence - meetings - resource reallocations

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable future product, service, and content development to be guided by information and knowledge resident in M4	Share the expectation that future product, service, and content development will be guided by information and knowledge resident in M4. Provide necessary resources to allow M4 to participate in development as appropriate	- guidance documentation - meetings - resource allocations	Ensure information and knowledge resident in M4 are used to guide future product, service, and content development	Monitor the use of information and knowledge resident in M4 in development plans for future products, service, and content development. Be prepared to provide guidance if not the case	- meetings - internal correspondence - resource reallocation
Enable investment priorities to be guided by information and knowledge resident in M4	Provide clear expectations that investment priorities are to be guided by information and knowledge resident in M4. Provide resources and communications channels necessary to inform the system	- guidance documentation - meetings - resource allocations	Ensure information and knowledge resident in M4 are used to guide investment priorities	Monitor the use of information and knowledge resident in M4 in determining investment priorities. Be prepared to provide guidance if not the case	- meetings - internal correspondence
Enable future relationships critical to system development to be identified	Provide criteria for critical future relationships. Provide resources for development of candidates. Provide a venue for review	- guidance documentation - meetings - resource allocations	Ensure future relationships critical to system development are identified	Monitor identification and review of critical future relationships. Engage as necessary and be prepared to reallocate resources as required	- meetings - internal correspondence - resource reallocation
Enable future development opportunities and targets that can be pursued in support of mission and vision of the system to be identified	Provide resources to identify future development opportunities and targets aligned with mission and vision for the system. Provide a venue for review	- resource allocations - meetings	Ensure future development opportunities and targets that can be pursued in support of the mission and vision of the system are identified	Monitor identification and review of future development opportunities and targets. Engage as necessary. Be prepared to reallocate resources as required	- meetings - internal correspondence - resource reallocation

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
System M4′—Environmental scanning Function: Provide the design and execution of scanning of the environment with focus on patterns, trends, threats, events, and opportunities for the system					
Enable environmental scanning for the entire system to be designed	Provide expectations and resources for design of environmental scanning	- guidance documents - internal correspondence - meetings - resource allocations	Ensure environmental scanning for the entire system is designed	Monitor design of environmental scanning. Engage as necessary. Be prepared to reallocate resources as required	- meetings - internal correspondence - resource reallocation
Enable the environmental scanning designs to be executed	Provide guidance and resources necessary for execution of environmental scanning designs	- guidance documents - internal correspondence - meetings - resource allocations	Ensure the environmental scanning designs are executed	Monitor execution of designs of environmental scanning. Engage as necessary. Be prepared to reallocate resources as required	- meetings - internal correspondence - resource reallocation
Enable a model of the metasystem environment to be maintained	Provide expectations and resources for maintenance of a model of the metasystem environment	- guidance documents - internal correspondence - meetings - resource allocations	Ensure a model of the metasystem environment is maintained	Monitor execution of the maintenance of a model of the metasystem environment. Engage as necessary. Be prepared to reallocate resources as required	- meetings - internal correspondence - resource reallocation
Enable emergent environmental conditions and events to be captured	Provide expectations and resources for capturing emergent environmental conditions and events	- guidance documents - internal correspondence - meetings - resource allocations	Ensure emergent environmental conditions and events are captured	Monitor efforts to capture emergent environmental and events. Engage as necessary. Be prepared to reallocate resources as required	- meetings - internal correspondence - resource reallocation

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable results from environmental scanning to be consolidated and synthesized	Provide resources to consolidate and synthesize the results from environmental scanning	- resource allocations - internal correspondence - meetings	Ensure results from environmental scanning are consolidated and synthesized	Monitor efforts to consolidate and synthesize the results from environmental scanning. Engage as necessary. Be prepared to reallocate resources as required	- meetings - internal correspondence - resource reallocation
Enable essential environmental information and shifts to be disseminated throughout the system	Make essential environmental information and shifts available throughout the system. Devote resources necessary	- guidance documents - meetings - resource allocations	Ensure essential environmental information and shifts are disseminated throughout the system	Monitor efforts to disseminate essential environmental information and shifts throughout the system. Engage as necessary. Be prepared to reallocate resources as required	- meetings - internal correspondence - resource reallocation
System M4*—Learning and transformation Function: Provide for identification and analysis of metasystem design errors (second-order learning) and suggest design modifications and transformation planning for the system					
Enable processing of inputs for system wide implications	Provide resources required to process metasystem design errors for system wide implications	- resource allocations	Ensure inputs for system wide implications are processed	Monitor processing of inputs of metasystem design errors. Engage as necessary and be prepared to reallocate resources as required	- meetings - internal correspondence - resource reallocation
Enable identification of mechanisms for double-loop learning	Foster a culture of learning and provide resources required to identify mechanisms for double-loop learning	- guidance documents - internal communications - meetings - resource allocations	*Ensure mechanisms for double-loop learning are identified*	Monitor progress in identifying mechanisms for double-loop learning. Engage as necessary and be prepared to reallocate resources as required	- meetings - internal correspondence - resource reallocation

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable designing of objectives, measures, and accountability for second-order learning in the system	Provide clear expectations and resources for designing objectives, measures, and accountability for second-order learning in the system	- guidance documents - internal communications - meetings - resource allocations	Ensure objectives, measures, and accountability for second-order learning in the system are designed	Monitor design of objectives, measures, and accountability for second-order learning in the system. Engage as necessary and be prepared to reallocate resources as required	- meetings - internal correspondence - resource reallocation
Enable future transformation analysis	Provide resources for future transformation analysis. Articulate expectations for outputs and outcomes	- guidance documents - internal communications - meetings - resource allocations	Ensure future transformation analysis is accomplished	- engage as required and reallocate resources if needed	- meetings - internal correspondence - resource reallocation
Enable provision of future focused input to strategy development	Provide a venue for inclusion of future focused input to strategy development as well as required resources	- guidance documents - internal communications - meetings - resource allocations	Ensure future focused input to strategy development is provided	Monitor strategy development, engage if necessary, and be prepared to reallocate resources if required	- meetings - internal correspondence - resource reallocation

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
System M3—Systems operations Function: Maintain operational performance control through the implementation of policy, resource allocation, and design for accountability					
Enable oversight of products, services, value, and content delivery	Develop and communicate expectations. Establish clear authority and responsibility for operational performance oversight and provide requisite resources for accomplishment. Foster culture that encourages recognizing and addressing emergent issues by the system at the location closest to the issue (self-organization)	- policy documents - operational plans - meetings - resource allocations	Ensure oversight of products, services, value, and content delivery is provided	Maintain visibility of operational performance. Use performance aberrations to vector additional scrutiny to specific areas. Be prepared to clarify guidance, reassign authority and responsibility, or reallocate resources in response to aberrations or emergent conditions	- meetings - direct personal interactions
Enable system planning and control for ongoing day-to-day operational effectiveness	Develop and communicate expectations (minimal critical specifications). Recognize time constraints for decisions associated with day-to-day operations (emergence). Delegate planning and control authority to the lowest level (closest to the issue) as appropriate (autonomy). Provide resources for accomplishment	- policy documents - meetings - resource allocations	Ensure system planning and control for ongoing day-to-day operational effectiveness are provided	Maintain visibility of planning and control for ongoing day-to-day operational effectiveness. Use performance aberrations to determine which areas might need additional scrutiny. Be prepared to clarify guidance, reassign authority and responsibility, or reallocate resources in response to aberrations or emergent conditions	- meetings - direct personal interactions

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable development of near-term system design response to evolving operational issues	Recognize that parts of the system closest to the evolving operational issues may have best perspectives on required system design responses to those issues. Empower these parts of the system to address near-term system design responses to evolving operational issues. Provide requisite resources for accomplishment	- policy documents - meetings - resource allocations	Ensure near-term system design response to operational issues is developed	Maintain visibility of evolving operational issues and responses there to. Be prepared to provide guidance or reallocate resources in response to emergent conditions	- direct personal interactions - internal correspondence - meetings - resource reallocation
Enable monitoring of operational performance measures	Provide resources to monitor operational performance impacted by evolving operational issues	- resource allocations	Ensure operational performance measures are monitored	Maintain visibility of performance. Be prepared to provide guidance or reallocate resources in response to emergent conditions	- direct personal interactions - internal correspondence - meetings - resource reallocation
Enable interpretation and implementation of system policies and direction from an operational perspective	Provide operational policies and direction that are clearly communicated. Provide clear expectations regarding implementation as well as resources required for monitoring	- meetings - internal correspondence - resource allocations	Ensure system policies and direction are (correctly) interpreted and implemented from an operational perspective	Maintain visibility of performance. Be prepared to provide guidance or reallocate resources in response to emergent conditions	- direct personal interactions - internal correspondence - meetings - resource reallocation

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable determination of resources, expectations, and performance measurement for operational performance	Provide clear guidance regarding expectations for operational performance. Provide resources necessary to determine how to meet those expectations as well as to measure that performance	- policy documents - meetings - resource allocations	Ensure resources, expectations, and performance measurement for operational performance have been determined	Monitor effort to determine resources, expectations, and performance measures for operational performance. Be prepared to provide additional guidance or reallocate resources	- meetings - internal correspondence - resource reallocation
Enable design for accountability and performance reporting for operations	Provide clear expectations regarding accountability and performance reporting for operations. Provide resources required to design and execute the reporting process (or system?)	- policy documents - meetings - resource allocations	Ensure accountability and performance reporting for operations	Monitor accountability and performance reporting. Be prepared to provide additional guidance or reallocate resources if reporting is inadequate	- internal correspondence - meetings - resource reallocation
System M3*—Operational performance monitoring Function: Monitor measures for operational performance and identity variance in system performance requiring system-level response. Emphasis is on variability and performance trends that may impact system viability					
Enable tracking of ongoing performance of the system based on dashboard measures of performance for operations	Provide guidance for dashboard development and measures of performance for operations to be monitored. Provide resources to develop, operate, and maintain a dashboard	- guidance documents - meetings - resource allocations	Ensure ongoing performance of the system is tracked based on measures of performance for operations	Monitor ongoing system performance and use of dashboard. Be prepared to provide additional guidance or reallocate resources if the dashboard is not providing requisite information for tracking of ongoing operations, or if the dashboard is not being used	- direct personal interactions - meetings - internal correspondence - resource reallocation

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable dissemination of system performance information throughout the system	Provide clear expectations regarding dissemination of system performance information throughout the system. Provide resources required to enable information dissemination	- policy documents - meetings - resource allocations	Ensure system performance information is disseminated throughout the system	Monitor availability of system performance information throughout the system. Be prepared to provide additional guidance or reallocate resources if necessary	- direct personal interactions - meetings - internal correspondence - resource reallocation
Enable the conduct of inquiry into performance aberrations	Allocate resources necessary to conduct inquiry into performance aberrations	- resource allocations	Ensure inquiries into performance aberrations are conducted	Monitor and/or engage in efforts to address performance aberrations as appropriate. Be prepared to allocate resources as required to support this effort	- direct personal interactions - meetings - internal correspondence - resource reallocation
Enable the monitoring and assessment of the continuing adequacy of operational performance measures	Allocate resources necessary to monitor and assess the continuing adequacy of operational performance measures	- resource allocations	Ensure the continuing adequacy of operational performance measures are monitored and assessed	Maintain visibility of and/or engage in efforts to monitor and assess the continuing adequacy of operational performance measures	- direct personal interactions - meetings - internal correspondence - resource reallocation

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
System M2—Information and communications Functions: Design and implement the architecture for information flow, coordination, transduction and communications within the metasystem and between the metasystem, the environment, and the governed system					
Enable the design and maintenance of the architecture for information flows and communications between the metasystem and environment, and between the metasystem and the governed system	Provide vision/guidance regarding expected outputs/outcomes as well as requisite resources to design and maintain the information and communication architecture. Recognize that the initial vision/guidance will be incomplete and that emergence will influence the results thus requiring this to be a continuous effort	- meetings - internal correspondence - guidance documents - resource allocations	Ensure the architecture for information flows and communications between the metasystem and environment, and between the metasystem and the governed system is designed and maintained	Stay abreast of the status of the architectural products. Provide oversight by meeting with the architecture team as required to review products and processes resulting from this effort. Continue providing requisite resources	- meetings - product/project reviews - resource reallocation
Enable accessibility of coordinating information within the system	Insist that requisite communication channels be available to support access to coordinating information and foster a culture of information sharing. Expect emergent requirements. Provide requisite resources to support communication channels	- meetings - internal correspondence - resource allocations	Ensure coordinating information within the system is accessible	Query personnel to determine success of gaining access to coordinating information. Be prepared to 'encourage' removal of roadblocks and bottlenecks	- meetings

(continued)

Table 4 (continued)

Leadership Role	Actions	Mechanisms	Leadership Responsibility	Actions	Mechanisms
Enable identification of standard processes and procedures necessary to facilitate transduction and provide effective integration and coordination of the system	Provide vision/guidance regarding expected outputs/outcomes of effort to identify standard processes and procedures as well as requisite resources. Be mindful of minimal critical specification and emergence	- guidance documents - internal correspondence - meetings - resource allocations	Ensure standard processes and procedures necessary to facilitate transduction and provide effective integration and coordination of the system are identified	Maintain visibility into system operations from the perspective of availability of guidance provided by standard processes and procedures. Be prepared to add, delete, or modify processes or procedures when required to improve integration and coordination	- direct personal interactions - meetings - guidance document revisions - resource reallocations
Enable forums to identify and resolve emergent conflict and coordination issues within the system	Encourage a culture of cooperation and open-minded, straight forward discussion regarding conflict and coordination issues (complementarity). Set expectations that conflict and coordination issues will be resolved at the lowest level possible (closest to the issue)	- personal example - meetings - guidance documents	Ensure forums to identify and resolve emergent conflict and coordination issues within the system are created as needed	Observe the system's ability to engage in open, straight forward discussion regarding conflict and coordination issues. Query personnel regarding conflict resolution	- direct personal interactions - meetings

5. Discuss how an appropriate leadership style for an organization might be determined.
6. From your perspective, is there a need for leadership style within an organization to change over time? If so, under what circumstances?
7. What are some of the consequences of changing leadership style? What consequences might result if the leadership style within an organization is not congruent with the needs of the organization?

References

1. Keating C, Katina P, Bradley J (2014) Complex system governance: concept, challenges, and emerging research. Int J Syst Syst Eng 5(3):263–288
2. Keating C, Katina P (2015) Editorial: foundational perspectives for the emerging complex system governance field. Int J Syst Syst Eng 6(1/2):1–14
3. Fleishman E, Mumford M, Zaccaro S, Levin K, Hein M (1991) Taxonomic effort in the description of leader behavior: a synthesis and functional interpretation. Leadersh Quart 2(4):245–287
4. Northouse PG (2013) Leadership theory and practice, 6th edn. SAGE Publications Ltd., Thousand Oaks, CA
5. Toor S (2011) Differentiating leadership from management: an empirical investigation of leaders and managers. Leadersh Manag Eng 11:310–320
6. Kaiser R, Hogan R, Craig SB (2008) Leadership and the fate of organizations. Am Psychol 63(2):96–110. https://doi.org/10.1037/0003.0066X63.2.96
7. Lichtenstein B, Uhl-Bien M, Marion R, Seers A, Douglas J (2006) Complexity leadership theory: an interactive perspective on leading in complex adaptive systems. Emerg Complex Orga 8(4):2–12
8. Kupers W, Weibler J (2008) Inter-leadership: why and how should we think of leadership and fellowship integrally? Leadership 4:443–475. https://doi.org/10.1177/1742715008095190
9. Maccoby M, Scudder T (2011) Strategic intelligence: a conceptual system of leadership for change. Perform Improv 50(3):32–40. https://doi.org/10.1002/pfi.20205
10. Marion R, Uhl-Bien M (2001) Leadership in complex organizations. Leadersh Quart 12:389–418
11. Crowley W (1931) The traits of face-to-face leaders. Psychol Sci Public Interest 26(3):304–313
12. Katz R (1955) Skills of an effective administrator. Harv Bus Rev 33(1):33–42
13. Hersey P, Blanchard K (1969) Management of organizational behaviour—utilization of human resources. Prentice Hall, New Jersey
14. Fiedler F (1964) A Contingency model of leadership effectiveness. In: Berkowitz L (ed) Advances in experimental social psychology, vol 1. Academic Press, New York
15. Evans M (1970) The effects of supervisory behavior on the path-goal relationship. Organ Behav Hum Perform 5(3):277–298
16. Downton JV (1973) Rebel leadership, New York
17. Weber M (1947) The theory of social and economic organization. The Free Press, New York
18. Greenleaf R (1977) servant leadership a journey into the nature of legitimate power and greatness. Paulist Press, New Jersey
19. Uhl-Bien M, Marion R, McKelvey B (2007) Complexity leadership theory: shifting leadership from the industrial age to the knowledge era. Leadersh Q 18(4):298–318
20. Gonos J, Gallo P (2013) Model for leadership style evaluation. Management 18(2):157–168
21. MindTools (2014) Core leadership theories learning the foundations of leadership. www.mindtools.com

22. Giltinane C (2013) Leadership styles and theories. Nurs Stand 27(41):35–39
23. Prieto B (2013) Establishing and building leadership skills. Leadersh Manag Eng 13:209–211
24. Katzenbaugh J, Santamaria J. (1999) Firing up the front line. Harv Bus Rev 107–117
25. Kotter J (1990) What leaders really do. Harv Bus Rev 68(3):103–111
26. Osborn R, Hunt J, Jauch L (2002) Toward a contextual theory of leadership. Leadersh Q 13:797–837
27. Vera D, Crossan M (2004) Strategic leadership and organizational learning. Acad Manag Rev 29(2):222–240
28. Merriam-Webster (ed) (2014) Merriam-Webster on-line dictionary. Merriam-Webster, Inc., Springfield, MA
29. Maccoby M (2000) Understanding the difference between management and leadership. Res Technol Manag 43(1):57–59
30. Lowder R (2009) The most important attributes of leadership—a personal skills improvement guide. Outskirts Press, Inc., Denver
31. Gardner H, Laskin E (1995) Leading minds an anatomy of leadership. BasicBooks, New York, NY
32. Thompson K, Thach E, Morelli M (2010) Implementing ethical leadership: current challenges and solutions. Insights Chang World J 2010(4):107–130
33. Gabriele E (2011) Ethics leadership in research, healthcare and organizational systems: commentary and critical reflections. J Res Adm 42(1):88–102
34. Caldwell C, Hayes L, Karri R, Bernal P (2008) Ethical stewardship—implications for leadership and trust. J Bus Ethics 78:153–164
35. Sankar Y (2003) Character not charisma is the critical measure of leadership excellence. J Leadersh Organ Stud 9(45–55)
36. Coffey G (2010) A systems approach to leadership how to create sustained high performance in a complex and uncertain environment. Springer, London
37. Hazy J, Goldstein J, Lichtenstein B (eds) (2007) Complex systems leadership theory: new perspectives from complexity science on social and organizational effectiveness, vol 1. ISCE Publishing, Mansfield, MA
38. Onyx J, Leonard R (2010) Complex systems leadership in emergent community projects. Community Dev J 46(4):493–510
39. Dictionary.com (2014) http://dictionary.reference.com/
40. Johnson N (2009) Simply complexity. Oneworld Publications, London, UK
41. Skyttner L (2001) General systems theory: ideas and applications, 1st edn. World Scientific Publishing Co., Pte. Ltd., River Edge, NJ
42. Dooley K (1996) Complex adaptive systems: a nominal definition. www.researchgate.net
43. Keating C (2014) Governance implications for meeting challenges in the system of systems engineering field
44. Bass B (1990) Bass and Stogdill's handbook of leadership—theory, research, and managerial applications, 3rd edn. The Free Press, New York, NY
45. OPM (2013) 2013 Federal employee viewpoint survey. OPM, Washington, DC. http://www.fedview.opm.gov/2013/Reports
46. Truman_Library (2014) 'The Buck Stops Here' Desk Sign. http://www.trumanlibrary.org/buckstop.htm
47. Beer S (1994) Brain of the Firm. John Wiley & Sons, New York, NY