

PART 2, CHAPTER 4.

STAKEHOLDERS, ISSUES, AND THE SHAPING OF LARGE ENGINEERING PROJECTSⁱ

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1. INTRODUCTION: STAKEHOLDERS, ISSUES, AND THE SHAPING OF LEPS

Large engineering projects (LEPs hereafter) are significantly shaped by the multi-type and networked relationships between LEPs and their stakeholders in both market and nonmarket environments. As explained in **Chapter XX**, PPP projects are large, complex engineering projects that involve long-term relationships between a dynamic group of powerful stakeholders across their lifecycles from the public, private and civic sectors, and so are especially challenging to manage. This chapter advances a multidisciplinary network approach, namely Stakeholder Value Network (SVN), as a lens to examine, understand, model, and manage stakeholder relationships in LEPs like PPP infrastructure projects. The SVN approach brings together knowledge from three domains: engineering systems, organizational sociology, and strategic management. Specifically, the focus of this chapter is on exploring the underlying connections between stakeholders and issues; extending the methodological framework of “Stakeholder-based SVN” to “Issue-based SVN”; as well as discussing the strategic implications of Issue-based SVN and demonstrating the benefits of the integration of stakeholders and issues.

Since the twentieth century, LEPs, sometimes also called “superprojects” [Levitt, 1984], “megaprojects” [Flyvbjerg, Bruzelius, and Rothengatter, 2003] or “macro-projects” [Bolonkin and Cathcart, 2009; Merrow, 2011], have become a remarkable phenomenon emerging from the interactions between human society and the natural environment, such as telephone networks, electric grids, national highways, oil fields, space stations, and so on. These LEPs are made possible by technological advancement, especially after individual “inventions begin to be

connected” [de Weck, Roos, and Magee, 2011, p. 3] into large and complex systems. The main contents of LEPs can be categorized in the following way [Lessard and Miller, 2013]:

“LEPs are games of ambition in which sponsors aim to build solutions to unmet needs. LEPs may involve the development of major engineering breakthroughs, pushing the engineering envelope of production systems through major capital investments, and/or developing new institutional constructs that allow diverse project actors and stakeholders to collaborate.”

Meanwhile, the impacts of LEPs are far-reaching from multiple perspectives: On the one hand, LEPs not only substantially improve the quality of human life, but are strongly connected to the productivity and competitiveness of a country [Hirschman, 1957] and “constitute one of the most important business sectors in the world” [Miller and Lessard, 2001, p. 1]; On the other hand, LEPs also bring potential externalities (i.e., overuse of natural resources, environmental pollution, etc.) as well as unintended consequences (i.e., traffic congestion, power outages, etc.), and further, because of their scale and complexity, LEPs are challenging to shape and execute, and often go terribly wrong, with serious implications for their sponsors, other stakeholders, and society at large. In particular, for the shaping of LEPs, Lessard and Miller [2013] point out:

“... the ‘fuzzy’ front-end of opportunity or the shaping of LEPs, where the project concept, the projects sponsors and core team, and the engagement of various stakeholders co-evolve through the concerted efforts of a small number of players interacting with many emergent factors,” [is a crucial but often-overlooked aspect of LEPs.] “LEPs are not simply selected. Instead, they are shaped over multiple episodes through strategic moves with risk resolution in mind. In ‘one off’ multi-party projects, these early stages include not only developing the project concept, but also the project coalition itself.” [In addition,] “Front-end shaping is most important for LEPs that are pioneering in either the technical or institutional domain, or both. Many LEPs are pioneering in that they require significant departures from business as usual.”

A critical element of the shaping of LEPs is associated with the multi-type and networked relationships between the LEPs and their various stakeholders, in both market and nonmarket environments. In this chapter we advance a multidisciplinary network approach, namely Stakeholder Value Network (SVN hereafter) [Cameron, 2007; Feng, 2013; Sutherland, 2009], as a lens to examine, understand, model, and manage these stakeholder relationships in LEPs. It brings together knowledge from three domains:

- **Engineering Systems:** LEPs are typical “engineering systems”— systems “characterized by a high degree of technical complexity, social intricacy, and elaborate processes, aimed at fulfilling important functions in society” [de Weck, Roos, and Magee, 2011, p. 31]. The tools and models for managing the structural complexity of engineering systems—more specifically, the Dependency Structure Matrix (DSM, a.k.a. Design Structure Matrix) [Eppinger and Browning, 2012; Feng, Crawley, de Weck, et al., 2012] and the Utility Model of Network Exchanges [Cameron, Crawley, Feng, et al., 2011]—make it possible for us to quantitatively analyze the interorganizational relationships between the LEPs and their stakeholders.
- **Organizational Sociology:** In the eyes of sociologists [Stinchcombe, 1965], interorganizational relationships provide the microfoundations for broader social structures, which in turn shape the organizational actors and their activities, and also determine the power, conflict, authority, identity, and other interesting phenomena on the macro-level. Specifically, we apply Social Exchange Theory (SET) [Malinowski, 1922; Lévi-Strauss, 1949; Homans, 1958; Emerson, 1976] to unify both social and economic relationships into a common framework for analysis, and then to link these relationships to macro-level phenomena, especially the power of stakeholders.
- **Strategic Management:** In order to better understand the power of stakeholders, the importance of strategic issues simply cannot be ignored—not only because of the underlying connections between stakeholders and issues from the perspective of network analysis, but the inseparability of these two concepts in the context of strategic management, as recently proposed by management scholars [Frooman, 2010; Lucea, 2007; Mahon, Heugens, and Lamertz, 2003; Roloff, 2008]. Following these proposals, the

main focus of our chapter is to develop the “Issue-based SVN” as a practical means to integrate the strength of Stakeholder Theory [Freeman, 1984; Freeman, Harrison, Wicks, et al., 2010] and Strategic Issue Management [Ansoff, 1980; Chase, 1982, 1984] for the shaping of LEPs. Based on this development, we will also compare and contrast the “Issue-based SVN” with more traditional “Stakeholder-based SVN” to demonstrate the benefits of this integration.

The remainder of our chapter is organized as follows: First, we build up the theoretical foundations along with three key assumptions for the SVN approach as background. Second, we discuss the connections between stakeholders and issues, develop the concept of “Issue-based SVN” from “Stakeholder-based SVN”, and generate three propositions about the strategic implications of the new concept; Third, we briefly demonstrate the kinds of insights one can get from a rigorous multi-relational network analysis of “Issue-based SVN”; Last but not least, we conclude with a discussion of the merits of our approach and a few promising directions for future research.

2. THE SVN APPROACH AND ITS THEORETICAL FOUNDATIONS

We first define five important concepts and introduce three ways of mapping stakeholder relationships. After that, we briefly lay out the theoretical foundations and key assumptions for the SVN approach.

2.1 Concepts and Definitions

- **SVN:** A multi-relational network consisting of a focal organization (i.e., LEPs in the context of this chapter), the focal organization’s stakeholders, and the tangible and intangible value exchanges between the focal organization and its stakeholders, as well as between the stakeholders themselves [Feng, 2013];
- **Value Exchange:** The processes during which the specific needs of stakeholders (including the focal organization) are satisfied at a desirable cost [Crawley, 2009];

- **Value Flow:** Derived from the specific needs of each stakeholder, a value flow is the output of one stakeholder, and at the same time, the input of another;
- **Value Path:** A string of value flows connecting a group of stakeholders;
- **Value Cycle:** The value path beginning from and ending with the same stakeholder (e.g., the focal organization).

2.2 Mapping Stakeholder Relationships

There are three canonical ways to map the relationships between stakeholders: the “Hub-and-Spoke” model, the “Stakeholder-based SVN” model, and the “Issue-based SVN” model. As [Feng, Lessard, Crawley, et al., 2012] have demonstrated, the “Hub-and-Spoke” model, which only includes direct relationships between the focal organization and its stakeholders, is typically incomplete as it allows important stakeholder relationships/balances to be ignored, and the “Stakeholder-based SVN” model is superior to the “Hub-and-Spoke” model by capturing the impacts of both direct and indirect stakeholder relationships. Compared to the “Stakeholder-based SVN” model, the “Issue-based SVN” model also includes both direct and indirect relationships between stakeholders, but only those relevant to a specific “Issue”. Since the “Issue-based SVN” is a subset of the “Stakeholder-based SVN”, it involves a smaller number of stakeholders and relationships and hence reduces the modeling complexity.

The first step in creating either of these network models is to map the stakeholder relationships, and no prior theory is needed to do so. However, in order to make sense of the more complicated relationship maps in anything but the most trivial of cases, it is necessary to analyze the networks quantitatively, which requires a new theory.

2.3 Theoretical Development of SVN

Based on the above discussion, multiple types of relationships are the key to systematically analyzing the strategic implications of the SVN. In the social sciences, social and economic relationships are two basic and distinct types of interactions between individuals or organizations. Although they are different in many ways and are often studied separately by sociologists and economists, two ambitious efforts have been made in recent years to unify both

social and economic relationships into a common framework for analysis: One is the New Economic Sociology (NES hereafter), which begins with social relationships and uses the concept of “social embeddedness” to study various economic phenomena (see the work of Harrison C. White, Mark S. Granovetter, Ronald S. Burt, Paul J. DiMaggio, and Joel M. Podolny among others); The other is the Social Exchange Theory (SET hereafter), which begins with economic relationships and uses models analogous to economic exchange, but based on the exchange of favors and reciprocal obligations between individuals, to study various social situations (see the work of George C. Homans, Peter M. Blau, Richard M. Emerson, Karen S. Cook, and Peter P. Ekeh among others). These two efforts can be viewed as dual theories, echoing the distinction of “Structure vs. Process” by Van de Ven [1976], or “Structural vs. Relational” by Granovetter [1992], or “Structuralist vs. Connectionist” by Borgatti and Foster [2003], for the relationships between either individuals or organizations.

Following the NES approach, Rowley [1997], Mahon, Heugens, and Lamertz [2003], and Lucea [2007] propose the application of Social Network Analysis (SNA hereafter) for stakeholder research. The SNA views stakeholder relationships as empty social ties without content and studies the impacts of network structures on stakeholders’ behavior. The strength of this approach lies in providing a way to measure the structural properties of the whole network (i.e., network density, etc.) and the structural position of individual stakeholders (i.e., degree-, closeness-, and betweenness-centralities, etc.), with a rigorous basis in graph theory. The weakness of this approach lies in the separation of the different types of relationships: Only a single type of relationships (e.g., economic or social) are put into one network and all these structural measurements are defined for this single-relational network.

In order to overcome this weakness of SNA, we develop a new network approach following SET—the SVN analysis—which views multiple types of stakeholder relationships as value exchanges and studies the strategic implications of the exchanged value flowing through the whole stakeholder network. Under the SET framework, social relationships involve the exchange of socially-valued favors and obligations, and so can be viewed as an extension of economic relationships [Coleman, 1990; Emerson, 1976; Homans, 1961]. Thus, “concepts and principles

borrowed from microeconomics” [Cook, 2000, p. 687] can be applied to conduct “the economic analysis of noneconomic social situations” [Emerson, 1976, p. 336].

Specifically, we apply the classic concept of “utility” in economics to create a mathematical model for the purpose of comparing the relative importance of value flows in the SVN: Each value flow, no matter what type it is, is assigned a numeric score according to the satisfaction level perceived by the stakeholder who receives the benefits from that value flow. These value flow scores are comparable and actually reflect the degrees of desire for stakeholders to be involved in the relevant direct value exchanges. Further, these scores, or the importance levels of value flows, provide a basis to rank the relative importance of value paths and value cycles, which are then taken as the basic units to measure the aggregate impacts of both direct and indirect stakeholder relationships for the focal organization. Based on the SET, we posit that all the stakeholder relationships are formed by the use of subjective utility analysis (rational choice theory) and the comparison of alternatives (behaviorist psychology).

From the above discussion, value flow and value path are obviously two essential concepts in the SVN analysis, and it would be helpful to link these concepts with similar ones in the SET. In SET, a pair of value flows between two stakeholders represents a “restricted exchange” [Lévi-Strauss, 1949], which is defined as a two-party reciprocal relationship that may be shown as “ $A \Leftrightarrow B$ ”. A closed value path, or a value path beginning from and ending with the same stakeholder, actually represents a “generalized exchange” [Bearman, 1997; Ekeh, 1974; Lévi-Strauss, 1963; Malinowski, 1922; Sahlins, 1965], which is defined as the univocal reciprocal relationships among at least three parties in the exchange situation that may be shown as “ $A \Rightarrow B \Rightarrow C \Rightarrow A$ ”.

2.4 Key Assumptions for SVN

Having reviewed the relevant literature, we formulate three key assumptions, which have a solid foundation in SET, for the SVN analysis:

- **Relationship Types:** Social exchanges are the extension of economic exchanges [Coleman, 1990; Emerson, 1976; Homans, 1961], and thus monetary and nonmonetary relationships

between stakeholders can be analyzed in a common framework, with the use of subjective utility judgments as well as comparison of alternatives;

- **Exchange Patterns:** Multilateral and indirect value exchanges exist widely in the strategic behavior of modern organizations [Levine and Shah, 2003; Olson, 1965; Westphal and Zajac, 1997], and thus the value cycles for the focal organization can be taken as the basis to understand the impacts of indirect relationships between stakeholders;
- **Strategic Implications:** Stakeholder power is the outcome of both exchange relations and network positions [Blau, 1994; Emerson, 1972; Molm, 1990] and thus, network statistics can be constructed from the sample space of value cycles to measure the power of stakeholders, as well as other metrics of interest.

3. ISSUE-BASED SVN AND THREE PROPOSITIONS

In this section, we first examine the underlying connections between stakeholders and issues from the perspective of network analysis, and also review several recent proposals from management scholars for integrating stakeholders and issues. Next, we discuss the motivations for us to integrate issues into the above SVN approach. Finally, we generate three propositions about the strategic implications of “Issue-based SVN”.

3.1 *Connections between Stakeholders and Issues*

Based on their deep appreciation for network analysis in the social sciences during the past century, Laumann, Marsden, and Prensky [1983] point out that “nodal attributes”, “relations”, and “participation in specified events or activities” are three foci to define the boundary of a network. We further infer that “Actors”, “Relations”, and “Events” are three types of basic units in network analysis. It is straightforward to understand the inclusion of “Actors” and “Relations”, because we can easily find the corresponding concepts in graph theory (“vertices/nodes” and “edges/links”, respectively), in the social sciences (“individuals/organizations” and “individual/organizational relations”, respectively), as well as in our SVN approach to be more specifically (“stakeholders” and “stakeholder relationships”, respectively). However, it is not that

intuitive to identify a concept similar to the “Events” in the SVN approach. After an intensive investigation of relevant literature, we argue that the concept of “Issues” is the most appropriate way to match the concept of “Events”.

In the field of strategic management, “Issues” are a mature and important concept, which often means “events, trends, or developments that could have a negative impact on the organization’s ability to reach its objectives if left unattended” [Mahon, Heugens, and Lamertz, 2003, p. 171], or more accurately, “focal and concrete events such as a project, a product, or a firm policy that generate gaps between the expectations of a number of stakeholders and the firm’s behavior” [Lucea, 2007, p. 26]. Thus, “Stakeholders” and “Issues” are essentially connected in the way that both of them provide the foci for the definition of the network’s boundary as well as the subsequent network analysis.

Others who have sought to integrate issues with stakeholders via a network approach include:

- Mahon, Heugens, and Lamertz [2003] employ the SNA to make “a number of theoretically grounded conjectures about the delicate relationships between stakeholder behavior and issue evolution” [Mahon, Heugens, and Lamertz, 2003, p. 170];
- Lucea [2007] develops the concept of “global issue space” as an integrative framework that “helps make sense of the multiple relations established between a focal firm and its stakeholders across issues and geographies” [Lucea, 2007, p. 16];
- Roloff [2008] identifies two types of stakeholder management in companies’ practice, that is, “organization-focused” and “issue-focused”, and then demonstrates that “issue-focused stakeholder management dominates in multi-stakeholder networks” [Roloff, 2008, p. 233];
- Frooman [2010] introduces the idea of an “issue network” and argues that “members of an issue network can be identified as those with grievances, resources, or opportunities” [Frooman, 2010, p. 161], by drawing on concepts from the fields of social movements (sociology) and interest groups (political science).

We observe that the above proposals are still in the early stages of modeling the ties between stakeholders and issues—most of them only focus on justifying the need of integration, developing theoretical hypotheses, and/or building descriptive models. More importantly, except for the proposal from Lucea [2007], none of the other three provide an analytical and instrumental framework, nor do they address the importance of a multi-relational approach.

3.2 Integration of Issues and SVN

After understanding the strong connections between stakeholders and issues, now we propose to integrate “Issues” into the SVN approach (i.e., Stakeholder-based SVN). The motivations of our proposal are mainly three-fold:

- Stakeholder relationships and issue evolution are intricately intertwined with one another: On the one hand, stakeholders may be involved in multiple issues [Mahon, Heugens, and Lamertz, 2003]; On the other hand, the interaction of multiple issues may be shaped by the awareness and influence of stakeholders [Bigelow, Fahey, and Mahon, 1991, 1993]. Bigelow, Fahey, and Mahon [1993] once summarize: “Stakeholders are only mobilized around issues, and issues only emerge when stakeholders advocate them.”
- Each method has its own strength and weakness: As discussed before, the Stakeholder-based SVN model provides better descriptive accuracy than the “Hub-and-Spoke” model through the inclusion of indirect stakeholder relationships. However, without the consideration of “Issues”, it is difficult to see through the causal mechanisms behind the balance of stakeholder relationships and to use such an understanding to formulate meaningful strategies.
- Last but not least, a focus on “Issues” provides a practical principle to restructure large-size SVN networks in order to reduce modeling complexity, as the stakeholders and relationships included in the Issue-based SVN model are generally fewer than all the stakeholders and relationships included in the Stakeholder-based SVN model.

3.3 Three Propositions for Issue-based SVN

We are now ready to generate testable propositions on the strategic implications of the integration between stakeholders and issues. Specifically, we are interested in ranking the importance of different issues as well as understanding the inherent connections between stakeholder power and their relationship balance.

In order to rank the importance of different issues, we need to compare the characteristics of each Issue-based SVN—i.e., the subset of the SVN model obtained by excluding the stakeholders and relationships irrelevant to that specific issue. Drawing on a common principle of network analysis in the social sciences, “network density”—the proportion of the maximum number of possible edges that are actually present in a network—is arguably the most common measurement for the characteristics of a whole network [Wasserman and Faust, 1994, p. 101]. We use the relative density of each Issue-based SVN to rank the importance of each related issue. Specifically, if an Issue-based SVN has a higher density than others, we interpret that it is more important than other issues because: (1) a higher density indicates a higher concentration of critical relationships from the perspective of the recipient stakeholders; (2) a higher density indicates more efficient communications between stakeholders [Rowley, 1997, p. 897]; and (3) a higher density indicates a larger likelihood for stakeholders to establish shared behavioral expectations [Oliver, 1991, p. 171]. Thus, we derive the following proposition:

Proposition 1: *The importance of a specific issue increases with the network density of the SVN based on that issue.*

Second, in order to understand the power of stakeholders in the Issue-based SVN, we resort to the SET—the theoretical foundation of our SVN approach—recall the third key assumption stated before: “Stakeholder power is the outcome of both exchange relations and network positions.” More specifically, here we apply Power-Dependency Theory [Emerson, 1962, 1964, 1972a, 1972b] to link the relative power between two stakeholders to the balance of their value exchange relationships. In Emerson’s theory, the power of Actor “a” to Actor “b” in an exchange network equals the dependency of Actor “b” on Actor “a”, or simply written as “ $P_{ab} = D_{ba}$ ”. Further, as he points out, dependency is a function of both the value of that source and its availability from alternative sources. This dependency can be measured by aggregating the

exchange relationships between two stakeholders in the Issue-based SVN. A more detailed explanation can be found in Feng [2013]. Thus, we derive the following proposition:

Proposition 2: *For a specific issue, the power of Stakeholder A over Stakeholder B increases with the dependency of Stakeholder B on Stakeholder A in value exchange relationships around that issue.*

Last but not least, based on our relevant work [Feng, Lessard, Crawley, et al., 2012; Feng, 2013], we must recognize the importance of indirect relationships in measuring the stakeholder balance and thus in predicting the relative power between two stakeholders. As stated in the second key assumption for the SVN approach: “Multilateral and indirect value exchanges exist widely in the strategic behavior of modern organizations, and thus the value cycles for the focal organization can be taken as the basis to understand the impacts of indirect relationships between stakeholders.” We, thus, extend Emerson’s notion that relative power is based on relative levels of dependency in exchange relationships to include indirect as well as direct relationships. We postulate this is also true for the Issue-based SVN:

Proposition 3: *For a specific issue, the stakeholder dependency based on both direct and indirect relationships is more accurate than the stakeholder dependency based only on direct relationships to describe the relative power between those two stakeholders.*

4. INSIGHTS FROM ISSUE-BASED SVN

In our original paper [Feng, Lessard, Cameron, and Crawley, 2013], we conduct a detailed SVN analysis for a retrospective case study of a large real-world engineering project, Project Phoenix, first on a “Stakeholder” basis and then on an “Issue” basis. At the end of this case study, we perform three tasks: (1) Validating the strength of the SVN approach in general; (2) Testing three propositions generated previously regarding to the strategic implications of Issue-based SVN; and (3) Demonstrating the benefits of integrating stakeholders and issues.

Specifically, in Project Phoenix, there are four different issues (i.e., Local Economic Stimulus, General Economic Performance, Local Environmental Protection, and National Strategy Supply Security) emerging from 74 relationships (i.e., value flows) between 14 stakeholders (including the focal organization itself). Further, we successfully demonstrate: (1) Either the Stakeholder-based SVN model or the Issues-based SVN model would have overcome the blind spots in the Managers' Mental Model, based only on data that would have been available to them; (2) The Issue-based SVN model arrives at the same conclusions as the Stakeholder-based SVN model, with a much simpler analysis; (3) The Issue-based SVN model has the greatest normative power since it identifies those stakeholders that place large values (positive and negative) on particular issues and can thus link them internally, as well as those stakeholders that are "closest" to each other to effect this "issue trade"; and (4) Under the above circumstance, generalized exchanges, which include more than two parties in value exchange, can help to shed light on formulating "indirect" strategies to negotiate with stakeholders with positive balance and those with negative balance simultaneously.

In this chapter, we choose to not repeat the detailed analysis for Stakeholder-based SVN and Issue-based SVN of Project Phoenix, but only showcase two critical insights one can get from a rigorous multi-relational network analysis of "Issue-based SVN": one is the importance of different issues (see Fig 3.2) ranked by the network density of each Issue-based SVN, and the other is the power balance (see Fig 3.3) characterized by the net transaction value between a focal organization (Project Phoenix, abbreviated as PP) and one of its stakeholders (Local Public, abbreviated as LOP). To help readers have a vivid impression for the Issue-based SVN, we also provide the stakeholder map for the issue of "Local Economic Stimulus" in Project Phoenix (see Fig 3.1).

5. CONCLUSIONS AND FUTURE WORK

Motivated by the underlying connections and potential synergies between stakeholders and issues in the shaping of LEPs, we first extended the concept of "Stakeholder-based SVN" to "Issue-

based SVN” and then generated three propositions regarding the strategic implications of the Issue-based SVN. Through a retrospective case study of a large real-world engineering project, which is detailed in [Feng, Lessard, Cameron, and Crawley, 2013], the benefits of the integration of stakeholders and issues were clearly demonstrated:

- **Reduced Complexity:** Issue-based SVN is generally a subset of Stakeholder-based SVN, and can, thus, reduce the dimensionality of network models;
- **Simpler Analysis:** Issue-based SVN is able to overcome the blind spots of the Managers’ Mental Model, but with a much simpler analysis than Stakeholder-based SVN;
- **Normative Power:** Issue-based SVN helps project managers to see through the causal mechanism behind the relationship balance—Specifically, Issue-based SVN identifies those stakeholders that place large values (positive and negative) on particular issues and thus can link them internally, as well as those stakeholders that are “closest” to each other to effect one or more “issue trades”.

At the same time, we would like to point out the following limitations of the SVN approach:

- **Normative Justification:** The SVN approach is mainly developed with the goals of descriptive accuracy and instrumental strength, and thus lacks a consideration of normative justification. It is in the spirit of Freeman’s strategic and ego-centric view of stakeholder management. Issue-Based SVN can thus be a valuable tool for proponents of PPP projects or other large engineering projects who seek to identify powerful opposing stakeholders early in the conceptual design stage, when it is still relatively easy to make changes in the project’s scope and design, and to identify issues that can be used to make trade-offs with the opponents that will allow the project to proceed without unduly compromising its attractiveness to the sponsors.
- **Meso-Level Networks:** The SVN approach often deals with the interorganizational networks on the “meso-level” of human society, and the linkage between the SVN and other networks at the individual, micro-, or macro- levels has not been fully understood. Again, this makes the technique attractive to PPP projects whose stakeholders can be meaningfully dealt with at the organizational level.

- **Static Characteristics:** The SVN approach is static and more like a “snapshot” for the value exchanges among stakeholders at a specific temporal stage, and thus is unable to illustrate the longitudinal evolutions of the network. This is not necessarily a concern when applying this method to PPP projects, because, as pointed in **Chapter XX**, the composition of the stakeholder network and the centrality of different stakeholders in PPP projects changes dramatically across project phases, so tradeoffs across project phases may not be as relevant.
- **Homogeneous Utility:** The SVN approach utilizes Multi-Attribute Utility Theory (MAUT) as a powerful tool to quantify the value flows based on the subjective utilities of the recipient stakeholders, but for simplification, the same utility function is used for all stakeholders, and additionally, the utility function has not been calibrated with experimental data.
- **Egocentric Distortion:** Value cycles, the representation of generalized exchanges, are the basic units to measure the impacts of indirect stakeholder relationships in the SVN model (both Stakeholder-based and Issue-based), but the sample space of important network statistics is centered on the focal organization and thus omits those cycles bypassing the focal organization, which may cause distortions of the network structure from a descriptive perspective, as well as of the resulting stakeholder strategies from an instrumental perspective.
- **Strategy Implementation:** Last but not least, the SVN approach does not provide practical guidelines to effectively implement the derived strategies for stakeholder engagement (for example, how to avoid the social dilemma of moral hazard and free-riding), and these guidelines are much desired in the real world. We have made some progress toward addressing this limitation: in Feng, Crawley, Lessard, et al. [2013], we discuss the application of “structural” and/or “exchange” strategies for the focal organization to engage its stakeholders and reposition itself in the SVN. Further articulating these limitations will actually help with the appropriate usage of the SVN approach and also the identification of the directions for future development and improvement.

Although the above is by no means a complete list, one should not be intimidated by these limitations. As wisely commented by Box and Draper [1987, p. 424], “Essentially, all models are wrong, but some are useful” and “Remember that all models are wrong; the practical question is how wrong do they have to be to not be useful.” [Box and Draper, 1987, p. 74].

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