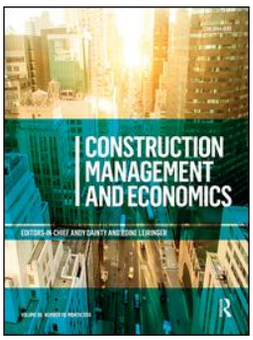

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Managing stakeholder networks for a social license to build

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ABSTRACT

When construction projects are halted or slowed by conflicts with stakeholders, they have lost their social license. Social licenses are granted by stakeholder networks, which include community groups, among others. Project managers would benefit from approaches that can predict which groups or coalitions within the stakeholder network have sufficient influence and motivation to delay progress and that can suggest interventions to reduce that risk. We present an integration of theories and methods that has been successfully used in the extractive industries to maintain a high level of social license. We define the social license concept, noting its embeddedness in stakeholder theory and the resource dependence view of the firm, and how it has been elaborated enough to become measurable. Then we integrate it with social network analysis and methods for quantifying stakeholders' issues and concerns. Key benefits are the ability to identify minority clusters that have sufficient influence to dominate the majority and the specification of network interventions to raise the level of social license. We use an example of a proposed housing project to illustrate how the proposed approach produces practical stakeholder relations strategies for gaining and maintaining a social license to build.

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Social license; stakeholder networks; issues management; social network analysis; network interventions; stakeholder conflict

Introduction

Socio-political risk from stakeholders is one of the most unpredictable types of risk faced by construction project managers. The most severe outcome associated with such risks is the premature termination of a project. Even projects that have all their legal licenses and permits can be shut down owing to opposition from community groups, environmental groups, industry competitors, corrupt officials, or criminal organizations. The problem of assuring project continuity in the face of such challenges has been labelled the social license to operate (SLO) (Joyce and Thomson 2000, Gunningham, Kagan and Thornton 2004, Nelsen 2006, Thomson and Boutilier 2011).

The concept of SLO originated in the mining industry. The original meaning of "to operate", therefore, was to operate a mine (Boutilier 2014). As use of the concept spread, it came to refer to the exploration and construction phases of the mine life cycle as well. Accordingly, it is now often called simply the "social license" and applied in variety of industries. There has been management research and theorizing that tries to provide guidance or tools for project managers in the extractive industries to help them avoid the stoppages or higher costs associated with a lost or low social license (e.g. Thomson and Boutilier 2011, Wilburn and Wilburn 2011, Black 2013, Klein 2013, Moffat and Zhang 2014).

Although the term "social license" began as a simple metaphor with the legal licenses needed to build and operate projects, the concept has been elaborated into an approach to managing project-level social and political risks. Our two main goals in this paper are to introduce the social license concept to project management, which includes all manner of construction projects, and to propose an approach to planning strategic interventions intended to raise the level of social license for a construction project.

As we explain in the remainder of this introduction, the social license concept has logical and practical connections with stakeholder theory, issues management, and social network analysis. Briefly, the social license is granted or withheld by the project's stakeholders. The general public rarely gets involved until much later in the process, if at all. The stakeholders decide how much they oppose or support a project based on how well they see their stakes, broadly defined, as faring with the continuation of the project. The stakes can be seen as the positive and negative impacts that stakeholders experience, or anticipate experiencing. The impacts may be purely local (e.g. fear

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of future traffic congestion) or they may have a broader dimension (e.g. the project's contribution to global carbon emissions). Stakes become political controversies, or social issues, when stakeholders organize into a group, or cluster of groups, and press the project management for changes (Mahon, Heugens and Lamertz 2004). Developing a strategy for obtaining and maintaining a social license requires addressing the issues raised by those stakeholders with the most power and influence over the cost of the company's access to resources that are vital for completing the project. Social network analysis is useful for understanding who has effective influence, as opposed to legally constituted power.

There is considerable scholarly literature supporting the integration of all or some of the following four concepts related to support or opposition to projects: the social license, stakeholder theory, social network analysis and social issues quantification methods for strategy development (Dani and McAdam 2003, Welcomer, Cochran and Gerde 2003, Weible 2008, Thelwall *et al*. 2010, Thomson and Boutilier 2011, Wilburn and Wilburn 2011, Black 2013, Elgin and Weible 2013, Henisz 2013, Boutilier 2014, Bice and Moffat 2014, Syn 2014, Elgin 2015). The benefits of that are (a) reliable frameworks for organizing the welter of information and conflicting demands that must be managed in order to avoid, or deal with, socio-political controversy, (b) greater certainty about the generalizability of the analysis and approach to specific projects and (c) the existence of readily adapted measurement and quantification tools to understand the current situation and track progress.

The second point, that the literature offers greater certainty of generalizability, merits some elaboration, given the differences between the extractive industries, where this approach originated, and the more general gamut of construction projects. The differences between the industrial contexts are generally of an engineering and financial nature (e.g. project duration, flexibility in location of the project, likelihood of requiring an urban location) while the similarities in the problems they face with stakeholder acceptance are supported by evidence from the social sciences. In the limited space available in this article, we mention only two key points related to two theories and methods being imported here from the extractive industries. First, controversies have been well studied in sociology and political science under the headings of social movements (Buechler 1993) and issues management (Hainsworth 1990), among others (e.g. public opinion leadership, political and social change). There are regular stages in controversies (Mahon and Waddock 1992, Post, Lawrence and Weber 2002, p. 36) and sequences of activities that stakeholders must perform to get attention and support for their complaints (e.g. "framing"; Goffman 1974, Gamson 1997). These are relatively universal in their major features, and where they do vary, institution theory (Scott 2001) can usually explain why. For example, the concept of path dependence in the evolution of institutions and cultures (North 1990, 2005, Acemoglu *et al*. 2009) can explain why community opposition to projects is easier to organize in some countries than in others. Second, social network analysis reveals some of the deepest constants in human behaviour. Evolutionary anthropologists, biologists and psychologists have discovered ample evidence that our social networks behaviour was inherited from our human and pre-human ancestors (Barkow, Cosmides and Tooby 1995, de Waal 2007, Dunbar 2011, Pasquaretta *et al*. 2014). Therefore, the engineering and financial specifications of a project are quite unlikely to change how network behaviour affects the dynamics of support for, or opposition to, a project. The structure of networks may vary from project to project and may indeed have impacts on such dynamics. For example, one project may have extremely egalitarian stakeholder network (i.e. everyone tied to everyone, all sharing the same information) while another is characterized by a core-periphery in configuration (i.e. otherwise isolated nodes all tied to a single core who controls the flow of information). Nonetheless, such variations are precisely what social network analysis makes explicit. Once made explicit, network structures can help guide stakeholder engagement strategies (Shepherd and Pryke 2014).

The approach recommended here emphasizes obtaining a solid understanding of the socio-political landscape around a project before attempting to develop and implement a strategy. According to Boutilier and Thomson (2014), there are three kinds of data that combine to produce the best strategy for gaining and keeping the acceptance and support of a project's stakeholders' social license: (a) quantitative measures of the level of social license granted, (b) empirical reports of network connections, (c) quantifications of concerns and priorities. Each of these types of data corresponds to concepts and methods that are discussed in the main sections of this paper. We begin in the next section with a brief description of the social license concept, its theoretical pedigree, approaches to measuring it, and some general strategies for managing it. Then we introduce social network analysis. Rather that attempting a comprehensive overview of network analysis, we highlight the concepts that offer the most help to practicing project managers in understanding the socio-political dynamics in a stakeholder network sufficiently to prioritize strategic interventions (Valente 2012). That is followed by a discussion of how to quantify verbal or textual discursive material on the issues and controversies that might surround a construction project. Finally, a brief example illustrates how the analytical tools

can be applied to detect socio-political risks in ways that readily lead to interventions for raising the level of social license. We conclude by noting some limitations to the approach and with observations about promising future directions for its development.

The concept of the social license

The concept of the social license originated in the mining industry as a metaphor comparing the power of stakeholders with the power of governments. The most fundamental meaning is: *stakeholders' continuous acceptance* (AccountAbility and Business for Social Responsibility 2004) *or approval* (Nelsen and Scoble 2006) *or both* (Joyce and Thomson 2000, Thomson and Joyce 2008) *of a project*. The usage of the term "social license" has spread from mining to other types of infrastructure projects and business activities. Barreiro-Deymonnaz (2013) expects that the social license will soon become a key concern for the construction industry as social pressures increase on governments worldwide to raise environmental and social standards for construction projects. He lists several issues that will need attention to assure the social license of construction projects, including environmental concerns, long-term economic viability, benefit sharing, distribution of local revenues, community monitoring, participation in decision process, expectations management and risk allocation. While there are many issues that generate conflicts with stakeholders of projects, the social license concept narrows the perspective to the most basic challenge of obtaining the acceptance necessary to complete the project.

The control and regulation of business activities is increasingly a shared responsibility between those who grant the legal licenses and those who grant the social licenses. Unlike a legal license that is granted by formal authorities at a fixed point in time, social licensing is done by the project's stakeholders on a continuous, day by day basis. Freeman (1984), the founder of stakeholder theory, defines stakeholders as those groups or individuals who can affect a company's activities (e.g. regulators, financiers, social justice activists) or who are potentially or actually affected by a company's activities (e.g. neighbouring landowners). Very often stakeholders meet both criteria (e.g. employees, suppliers, competitors, local councils). Prno and Slocombe (2012) contend that growing importance of the social license reflects the increasing willingness of governments to permit, or encourage, community stakeholder participation in local decision-making. Social scientists have documented a general trend towards decreased deference to authority (Nevitte 1996) and an increased role for non-government organizations in public policy (Teegan, Doh and Vachani 2004). Indeed, Morrison (2014) contends that increasingly all organizations in society, including governments and non-governmental organizations (NGOs), need a social license for their activities. In an effort to improve the social license of business activities in general, which includes construction projects, frameworks have been offered to help keep business activity within the ambit of what is social socially acceptable (Lynch-Wood and Williamson 2007) and what contributes to a sustainable society (e.g. Pegram *et al*. 2010). The social license framework offers an additional, unique insight to help business attain social acceptability in society. It recognizes that stakeholders have power (Boutilier 2014) and that, therefore, they can restrict the activities of businesses. When a social license is withdrawn, stakeholders use that power to shut down the project, or at least to make its continuance much more expensive. Like the legal license, the social license has an enforcement process, or in common parlance, "teeth".

Stakeholders, however, can seldom have any impact if they act alone. Their ability to withdraw or reduce a social license is usually only effective when they form a group or organization (Bueno de Mesquita 2010). Their impact is even greater when their groups form coalitions of like-minded political actors (Henry 2011). Individuals, organizations and their coalitions collaborate to raise public concern about an issue and thereby try to enhance or reduce the social license and political support for a project (e.g. Bjork-James 2013). Post, Lawrence and Weber (2002) depict this as an earlier stage in the life cycle of a typical issue. Later stages involve pressuring government to take some action on the issues, which subsequently affects conditions for the legal licenses needed. Post *et al.*'s (2002) model of the lifecycle of issues does not explicitly use the phrase "social license" but it describes a process through which the escalation of stakeholder issues leads to a reduction in the level of social license.

Social license and access to resources

When the social license is lost, the project loses access to essential resources through events like the withholding of legal licenses in response to protests from community groups (Aranda 2013), the blockade of roads (Salazar 2009), the demand from financiers for a risk premium (Henisz, Dorobantu and Nartey 2013), the withholding of supplies through strikes (Njanji 2014), the restriction of market access through boycotts (Abad-Santos 2013) and sabotage (Bolling 2013). There may even be violence against project personnel in the forms of kidnapping (Jamasmie 2012) or murder (Aquino and Velez 2009). Aside from the human misery these cause for people involved, for the project they can also cause spiralling problems in accessing the resources held by yet other stakeholders (e.g.

government), which then results in delays or cost overruns that can be fatal to the project.

The challenge of maintaining competitive access to resources, which is the financial motive for maintaining a social license, has been addressed by the resource dependence theory of the firm (RDT). The RDT has been prominent among organizational theories addressing the changing nature of struggles for power, autonomy, and, ultimately, resources broadly defined (Pfeffer and Salancik 1978, Wernerfelt 1984, Barney, Wright and Ketchen 2001, Casciaro and Piskorski 2005, Gulati 2007). The basic insight is that companies depend on external parties for their resources and therefore are motivated to reduce uncertainty in resource access through practices that reduce its dependency or the associated uncertainty. The theory accounts for corporate strategies that cannot be explained by the quest for efficiency or economic rationality of an isolated firm, such as mergers and acquisitions, outsourcing, joint ventures, joint research and development, shared marketing arrangements, and licensing. Because investments in stakeholder relations are examples of the same type of dependency reducing activity, the concept of the social license can be viewed as an application of the RDT to project management (Thomson and Boutilier 2011).

Measuring the social license

Knowing the academic pedigree of the social license helps in adapting and applying it to practical challenges in project management. However, to be useful in practice it must also be measurable so that progress can be tracked. Using construction industry examples from Sweden, Olander (2007) developed a multidimensional construct that he called the Stakeholder Impact Index (SII). It helps identify and prioritize stakeholders on the basis of their likely impact on the progress of a project. It arithmetically combines subjective estimates of several factors including the legitimacy of the groups, their power, their level of vested interest and their probability of having an impact. One factor called "position" (i.e. position on the issue of the project proceeding or being halted) is very similar to the social license. Olander showed that the approach can be useful in guiding relations with stakeholders.

Thomson and Boutilier (2011) developed an approach to measuring the social license based on interviews with dozens of stakeholders. It takes account of the coalitions and divisions among stakeholders, uses a validated measure of the social license (Black 2013), and extracts stakeholder power and influence estimates from their positions in the structure of the network. They elaborated the social license concept into four levels divided by three boundary criteria. The levels range from (a) the lowest, which is a withdrawn or withheld social license, to (b) the bare minimum, which is tolerance or acceptance of the project, to (c) a high social license, signifying approval or support for the project, to (d) the highest, which involves psychological identification with the project. The bottom two levels, withdrawn and tolerance, are distinguished by the boundary criterion of legitimacy. When stakeholders perceive the project to have legitimacy, they will grant a social license. The distinction between the middle two levels of tolerance and support depends on stakeholders perceiving the project as having credibility. The top two levels, support and psychological identification, are distinguished by the presence or absence of full trust. These four levels and three boundary criteria provide the substance for agree/disagree statements presented to stakeholders in interviews about their perceptions of the project and their relationships with the project proponent.

Stakeholder network analysis for stakeholder strategy

Stakeholder analysis and management methods have been acknowledged as a necessity in the tool box of project managers (Newcombe 2003, Atkin and Skitmore 2008, Solomon, Katz and Lovel 2008). Pryke (2004, 2005) proposed using social network analysis for managing the supply chains of construction projects. We are turning its analytic power to the problem of managing stakeholder networks, particularly those that involve conflicts and controversies with community, environmental and political stakeholders.

Considering all the small impacts of a project could create an enormous set of stakeholders. However, because the aim is to develop a practical strategy that will gain or maintain a social license, the population of stakeholder to be included in the network analysis must be constrained. In the first part of this section we deal with considerations related to defining the population of stakeholders. Then we look at the choices available for types of ties to examine among the stakeholders that prepare us for a discussion of the strategic implications of various multi-stakeholder configurations in the network.

Setting boundaries on the stakeholder network

Before attempting to construct a stakeholder network, decisions must be made about which stakeholders to include. The goal is to get a picture of the political landscape around the project and how it embodies and shapes support or opposition for the project. At the very least, this implies obtaining information on, or from, the groups that are most active and influential regarding the project's social license. Foremost, we want the perceptions of those who are most likely to reflect and

shape public opinion. These tend to be leaders of, and spokespersons for, stakeholder groups and organizations (Valente and Pumpuang 2007). They represent a sub-population with definable boundaries. To get a picture of the network connections among the actors in this population, we need information from as close to 100% of them as possible. This amounts to doing a census of the subpopulation.

Although a census has no sample selection technique, no sample size, and no probability of sampling error, there remains the question of how much faith to accord the findings. In a census, it appears as the problem of specifying the boundaries of the sub-population constituting the network of interest (Laumann, Marsden and Prensky 1989). The data collection procedure should include a variety of methods for identifying stakeholders to be interviewed, including referrals from interviewees themselves. Even with this "snowball sampling", however, there is a danger that referrals from identified interviewees might not include isolated stakeholders, or clusters of stakeholders. Laumann *et al.* describe three general approaches to network boundary specification problem: positions, events and relations. The *positional* approach examines stakeholder attributes (characteristics) to decide who is in or out of the population of interest (e.g. residents impacted by the project's effects on the local housing supply). Stakeholder attributes include their concerns about issues. All the issues raised by the project should be represented by at least one stakeholder (Frooman 1999, Mahon *et al*. 2004, Roloff 2008). The *event* based approach includes stakeholders on the basis of participation in an event (e.g. a road blockade). The *relational* approach is based on social connectedness (e.g. interviewees reporting relationships with others). It can often shed light on less formal ties that can be important factors in creating alliances on issues related to the project. In practice, multiple approaches are more likely to ensure that project managers do not overlook any key stakeholders or issues. Moreover, it is better to be over-inclusive than under-inclusive. The inclusion of some non-active, non-influential stakeholders provides information about where the boundaries of the sub-population can be drawn.

For a high-fidelity census, it is also important to get information from every part of the population without an important characteristic of stakeholders being over-represented among those who were identified as members of the sub-population but not interviewed. For example, if the census covers 90% of the identified stakeholders but the missing 10% are all leaders of protest groups, then the network will be distorted in ways that seriously reduce its usefulness as a strategy development tool.

Defining what constitutes a relation between stakeholders

Students of stakeholder network analysis frequently encounter terminology from three different fields of study. The branch of mathematics known as graph theory speaks of networks in terms of nodes (e.g. circles) and edges (e.g. lines). Social network analysis emerged from sociology and describes networks in terms of actors (circles) and ties (lines). Stakeholder network analysis is an application of social network analysis in the field of management theory. It speaks of stakeholders (circles) and the relationships (lines) among them. Many types of connections can be used as network "ties" (e.g. financial transactions, kinship relations, attitudinal similarity, membership in the same organization, participation in the same event) (Simmel 1955/1908, Breiger 1974). Each type of tie is called a "relation". The specific ties within each relation can vary on dimensions like valence (e.g. positive or negative), strength (e.g. strong or weak) and direction (e.g. originator vs. recipient) (Wasserman and Faust 1994). Each discipline has specialized typologies of ties, or relations. Stakeholder network analysis borrows its tie typologies most readily from social network analysis (e.g. Borgatti *et al*. 2009). A full discussion of tie typologies is beyond the scope of this paper. We focus instead on the type of ties that are most interest to project managers aiming to obtain and maintain a social license from stakeholder network.

Research in organizational studies and social psychology highlights the importance of the distinction between socio-emotional ties vs. task-oriented or instrumental ties. For more than half a century, these two categories of ties that have been identified both as common and as supporting distinctive network structures (Gouldner 1954, Blau 1955, Lincoln and Miller 1979). Nahapiet and Ghoshal (1998) reprised the distinction as the relational vs. the cognitive dimension of social capital. Chua, Ingram and Morris (2008) distinguished between organizational networks formed by ties of affect-based trust vs. cognition-based trust. The former were found to be associated with friendship while the later were associated with economic resources and task advice. Similarly, Cross and Thomas (2009) find that a thorough understanding of how organizations really function requires examining the friendship and advice networks in addition to organizational charts and workflow diagrams.

For stakeholder networks around construction projects, we want to select relations that will predict the capacity of a set of stakeholders for socio-political collaboration and coalition formation. The concept of social capital deals with exactly this capacity (Cooke and Wills 1999, Futemma *et al.* 2002). Nahapiet and Ghoshal's conceptualization of social

capital has the advantage of incorporating the socio-emotional component, which they call the "relational" dimension, and the task-oriented component, which they call the "cognitive" dimension. Stakeholders with ties high in this type of social capital are, by definition, high in trust, reciprocity, and information sharing, which in turn, creates a high capacity for collaboration (Flora *et al.* 2006). Moreover, quantifying these relations from interview data is relatively straightforward (Boutilier 2009).

As mentioned, most of the types of ties can vary in strength, direction and valence. Using the relation of social capital, for example, a strong tie, as rated by both parties in interviews, would indicate that they can collaborate on a socio-political project immediately. A weak tie would indicate that they might exchange information and nothing more (Granovetter 1973). A balance of both strong ties and weak ties that bridge to other regions of the network appears to be a factor that promotes the development and diffusion of new ideas and practices (Tiwana 2008). Such a balance might become a strategic goal, for example, when the social license of a project depends on many subcontractors adopting a new sustainability oriented practice.

The direction of the tie can be used to indicate flows of information, support or resources in the network and therefore distinguishes between senders and receivers. When stakeholders are interviewed about their relationships with other stakeholder, it is common for one party to mention a specific relationship, but for the other party to neglect mentioning it. This creates a unidirectional tie. If both parties mentioned the relationship, the tie would be bidirectional. Unidirectional ties can exist for a variety of reasons. Stakeholders can vary in their degree of recency bias, which is a systematic tendency to recall more recent interactions with other stakeholders (Hogarth and Einhorn 1992). People also have an unconscious bias towards perceiving themselves as more central in a network than they really are (Kilduff and Krackhardt 1994), which can result in mentioning relationships that the other party forgets or considers minor. Appearing well-connected can improve one's reputation (Johnson and Orbach 2002) while appearing less important in the network can help avoid unwanted scrutiny of one's activities. Often bidirectional ties are used as more reliable measures of actual relationships (Balkundi and Kilduff 2006).

The valence of the relationship can be either positive or negative, which, in socio-political terms, usually means allied or opposed. Negative ties are relatively under-researched in network studies because social actors are reluctant to talk about their conflicts, rivalries and power struggles. Nonetheless, negative ties can be very important (Chua *et al.* 2008), especially when the topic is a controversy or conflict over an infrastructure project. The negative ties that conflict tends to induce often reflect the exercise of power and can signal impending change (Hardy and Phillips 1998). It is always strategic to be aware of places in the network where pressure for change exists. At times, the proponent of a construction project may even find it strategically advantageous to provoke change in the public policy network (Henisz and Zelner 2006).

Looking at overall network structure

Basing the network data on what stakeholders say about their own relationships permits the construction of a composite picture of the actual stakeholder network based on all participants' knowledge. Johnson and Orbach (2002) showed that the more central members of socio-political networks have more accurate views of their networks and their place in them. In larger networks, no one person ever has complete knowledge about the network in which they are embedded. However, interviews with dozens of network members reveal a truer picture. Walker, Bourne and Shelley (2008) recommend several tools and heuristics for mapping the project stakeholder terrain through a workshop process primarily with project management personnel. Schiffer *et al.* (2010) recommend developing social network maps in a process of group consultation with project stakeholders themselves.

A stakeholder network map can always be expressed as a square matrix in which the same list of stakeholders form the rows and columns. Dozens of free or low-cost programmes exist to create network graphs and perform deeper analyses. Some of the popular ones include Ucinet (Borgatti, Everett and Freeman 2002), Pajek (Batagelj and Mrvar 1998) ORA (Carley 2014), Gephi (Bastian *et al*. 2009) and the Statnet package (Handcock *et al*. 2003). By analysing the overall pattern of ties in a stakeholder network graph, we can discern the alliances, the opposing camps, the bridging groups, and the overall structure of power and influence in the socio-political environment. There are mathematical ways of quantifying all these phenomena (e.g. Wasserman and Faust 1994). In simple networks, like the one shown in Figure 1, the main structural features are discernable from visual inspection, provided a good layout algorithm, such as a spring embedder, is used.

Figure 1 comprises two high density clusters of stakeholders, a pattern referred to in the social capital literature as highly "bonded" groups (Gittell and Vidal 1998). Let us assume that the ties (i.e. lines) represent strong relationships according to some quantification method (Narayan and Cassidy 2001, Krishna 2004). There is one stakeholder providing a "bridge" between them. Many mathematical algorithms exist for automatically identifying tightly interconnected clusters like those at the top left and top right of Figure 1 (e.g. block modelling, Newman community detection, cluster analysis, clique analysis, K-cores)

(Newman 2010). Such clusters have a higher density of ties. Tie density is a measure of ties present vs. the theoretically possible number of ties (Wasserman and Faust 1994). Sociologically, clusters are associated with the bonding type social capital (Szreter and Woolcock 2004) that is characterized by dense ties, mutual trust, shared norms and rules of reciprocity (Prell and Skvoretz 2008). The strategic importance of these structures is that stakeholders have more influence when they form or join such cohesive clusters capable of collaborative action. Even if the cluster is a minority of all stakeholders, it can impose its views on the network if its opponents are relatively unconnected and unorganized (Gardikiotis 2011, Jarman *et al.* 2015). For infrastructure projects, the opponents are often few but concentrated and highly motivated while the beneficiaries are many but unconnected and not very motivated (e.g. future users of a proposed airport expansion). One strategy for getting a social license for such a project is to design network interventions that aim to give project supporters a level of group identity and internal agreement sufficient to at least conduct a dialogue with a cluster of project opponents (Human and Provan 2000). Moreover, when the supporters have at least enough cohesion to create a voice and rallying point, it becomes possible to convert ambivalent stakeholders into supporters (d'Herbemont and César 1998).

In Figure 1, the vertical positions of the nodes, represented as circles, correspond to their eigenvector centrality (2 local version) with nodes B to E and H to K all having the same level. Eigenvector centrality measures how well connect a node is to other well-connected nodes in the network. Sociologically speaking, greater centrality indicates greater social influence and a propensity to be an opinion leader (Friedkin 1991, Rowley 1997, Gabbay and Leenders 1999, Burt 2001). Nodes A and G have equally high eigenvector centrality because they are both connected to the same number of other nodes with the same eigenvector centralities. Their connections to node F make them more central than the other nodes of their respective clusters. In sociological terms, nodes A and G would be the two most influential actors in the network.

The concept of centrality is so important that many varieties of centrality have been meticulously defined in a variety of mathematical formulas (Freeman 1979, Everett and Borgatti 1999, Borgatti 2005, Bonacich 2007, Everett and Borgatti 2012). The key centrality measures of degree centrality, closeness and betweenness were introduced to construction management literature in articles proposing the use of social network analysis for project governance (Pryke 2004, 2005). There is ongoing debate and research about which measures are most appropriate in which circumstances (e.g. Mizruchi and Potts 1998, Kitsak *et al*. 2010, Smith and Fink 2010).

Although cases can be made for the choice of other centrality measures, in the context of gaining and keeping a social license in the network of stakeholders around a construction project, we focus in Figure 1 on the two measures that correspond most closely to social influence through well-connectedness and social influence through strategic bridging (Burt 2001, Tiwana 2008, Smith and Fink 2010, Croci and Grassi 2014). While the vertical positions of nodes in Figure 1 correspond to eigenvector centrality, the sizes of the nodes correspond to their betweenness centrality. Betweenness centrality corresponds well with bridging or brokering influence because it measures the number of times an actor occurs on a census of all the shortest paths among all network members. Nodes A and G are slightly lower in betweenness than node F. In sociological terms, betweenness centrality can indicate social influence in the form of brokerage opportunities like gatekeeping, representation, coordination and liaison (Gould and Fernandez 1989).

The colours of the nodes in Figure 1 can represent any attribute of the stakeholders. Most relevant to project

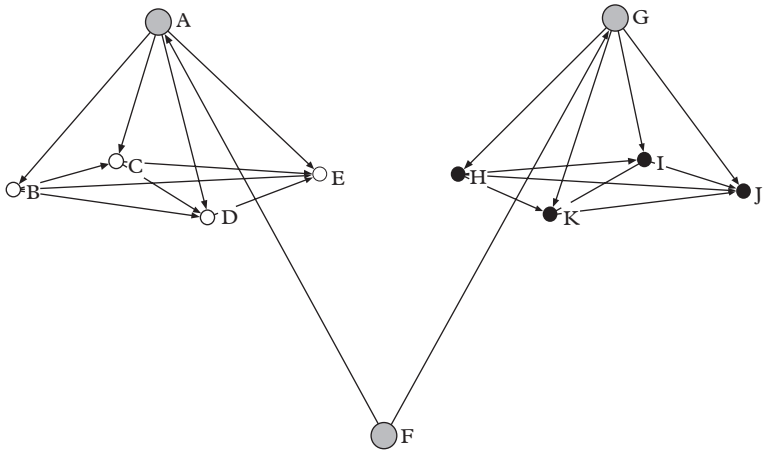

Figure 1. Example of a network graph showing two distinct clusters connected by two bridging.

management would be attributes like the level of social license granted or the position taken on a controversial issue like noise, parking, or preserving local biodiversity. Any number of techniques can be used to quantify concern with an issue, like the number of times the issue is mentioned, the difficulty of different political actions taken by the stakeholder (e.g. tweeting vs. protesting in person), or the rating-scale indication of concern in an interview. The quantification can then be calibrated to a set of colours for the nodes on a network graph. The colours (i.e. shades of grey) in Figure 1 differ strongly between the cluster on the left and the cluster on the right. This would indicate a polarization correlated with existing ties among stakeholders. The grey colour of the high betweenness nodes (i.e. A, F, G) would reveal a strategic opportunity insofar as it would suggest that exposure to alternative perspectives is associated with less polarization.

Quantifying qualitative issues and objections

Eliciting stakeholder concerns and priorities

While examining network graphs, it is valuable to have access to information about which stakeholder groups care about which issues and controversies. Getting that information in an interview typically involves posing open-ended questions to stakeholders about their concern, priorities, perceptions and general comments. The aim is to have stakeholders quickly adopt a problem-solving stance rather than simply repeat rehearsed resentments and entrenched positions. Senge *et al.* (1994) have developed a set of questions that has reliably achieved this in diverse cultural settings. They begin with questions about stakeholders' hopes and fears about the future. Next, they move to a consideration of the stakeholders' strengths and resources that could help them avoid what they fear and obtain what they want. Then they pose questions about the barriers and obstacles that stand in the way. Finally, by way of understanding stakeholder priorities, they ask about what should be done. This way of sequencing the questions yields an understanding of controversial topics without inflaming any controversy in the process.

Coding and counting categories of ideas

The most thorough method for quantifying verbal reports of preoccupations, concerns, or issues from stakeholders is to read them all and group them into categories that all deal with the same theme. Often the categories will divide themselves into classification hierarchies. For example, the broadest category labelled "environment" will have sub-categories like water, biodiversity and climate change. The water category will have narrower categories like water pollution, water shortages and watershed protection. When the categorization has been done, counting the number of times a comment category is mentioned quantifies what began as verbal data. However, a base rate is desirable to make the raw count of mentions more interpretable. In order to compare the prominence of issues across categories of stakeholders, a per capita rate of mentions per category can be calculated using the number of "mentioners" as the denominator. However, because groups might vary considerably in numbers of members, the per capita rates for smaller groups will be more dramatically affected by a single mention of an issue. To make rates between stakeholder groups of different sizes more directly comparable, the deviation from expected per capita rates can be calculated for each group. With approaches like these, each issue's level of priority within each group can be quantified and compared. To view the data on a network graph, group membership for each stakeholder node could be represented by the shape of the node (e.g. squares as environmental groups, circles as government bodies) and the colours of the nodes could show the priority that single issue has across the network (e.g. node colours of red, purple and blue might correspond to concern for biodiversity of high, medium and low). Such a graph would reveal any interconnected clusters of stakeholders campaigning for a given issue. Comparing the same graphs across a set of issues would show how much overlap there is in the membership of supporters of each issue.

Similar analyses can be performed with using data that attributes concern for an issue when the stakeholder's textual data contains certain keywords related to the issue. For example, for an issue about the impact of construction on traffic, trial and error might prove the key words to be "traffic jam", "delay", "commute", "rush hour" and "congestion". The keyword approach can quite efficiently identify variations in dissatisfaction levels. When the base textual data are things like social media texts (e.g. Twitter), blog sites (e.g. Blogger), transcripts of broadcasts, or print media reports, day by day variations can be observed (e.g. Leetaru 2011, Steinert-Threlkeld *et al.* 2015).

Networks based on concept or word co-occurrence

Additional strategic insights can be gained from analyses showing how issues are linked to each other. The number of times a pair of issues is mentioned together by each stakeholder can be counted and recorded in an issue by issues matrix. The corresponding network graph shows how closely the issues are related to each other in the collective perceptions of the whole stakeholder network, or of a sub-group of stakeholders (Boutilier 2011). For example, local officials might associate pollution with human health issues while environmentalists might associate pollution

with biodiversity issues. This can provide insights about what types of initiatives on pollution would win approval from whom. Lindgren (2016) has developed a version of this process for use with bodies of text too large to be manually classified into issue categories.

A related technique for using networks to visualize the state of issues and controversies is to attribute a network tie to pairs of stakeholders that both have a high level of concern for the same issue. Such ties produce an "attitude similarity" graph. The stakeholders may or may not even know of each other's existence, but if a tie of attitude similarity exists, they are more likely to form a tie (Hogg, Hardie and Reynolds 1995) and of aligning themselves with any coalition that arises to address the issue. When an attitude similarity graph is compared with a graph showing known relationships, it becomes evident to what extent those who share common concerns are already linked. This can be useful, for example, when trying to increase the interconnectedness among supporters. Formation of new relationships can be encouraged (e.g. through selective invitations to participate in discussion forums) among the most influential stakeholders with similar attitudes.

An example of strategy development

In this section, we apply the concepts above to an example constructed from elements of three different infrastructure projects studied as part of contract research by the first author. The principles remain true to the cases but the identities and network details have been modified for anonymity and for simplicity. In the cases upon which this illustration is based, all the data came from interviews with stakeholder group representatives. However, it should be borne in mind that the same analytic techniques can be adapted for data from secondary sources like historical documents, online text and print sources.

The illustration shows how an understanding of the structure and dynamics in the stakeholder network suggests strategic interventions, especially interventions to change the structure of the network. By default, the changes that construction projects induce in the social structure around them are often unplanned and go unnoticed until a challenge to the social license emerges. Valente (2012) discusses the many options available for prioritizing and designing interventions to change the structure of networks, but also warns of some of the dangers. For example, those who already have positions of influence in the network have little motivation to support changes to the structure because their influence might be diminished. The following example (i.e. the Lakeside Housing Project (LHP)) may help show how the changes to the social structure can become more visible and therefore more deliberate.

There is a large variety of visual layout algorithms available in network graphing packages. Freeman (2005) identified two basic classes of graphs. The first class optimizes the location and arrangement of points in low dimensional space to reproduce original social proximities. The second class reduces the variance in the observed data to reveal the basic structure and sub-groups within the network. Approaches such as multidimensional scaling (MDS) or spring embedding are the most popular among first class, while singular value decomposition (SVD) or principle component analysis (PCA) approaches are more popular among the second class. In the example presented here, we use the PCA layout because of the ease with which it displays both eigenvalue and betweenness centrality simultaneously.

Community opposition to new housing

LHP was a proposal to build a thousand housing units around an artificial lake recently created by the construction of a dam not far outside a medium sized city in an OECD country. The surrounding land was rangeland for livestock prior to the construction of the dam. The proposal included a new highway east of the lake that would connect two points on the old highway out of the city, thereby making the transit time shorter. The state government had the authority to permit this part of the proposal. State authorities were delighted with the proposal because it accelerated their existing plans and lowered their costs. The part of the old highway that would be circumvented by the new section of highway included a village near the west side of the lake called Westville. The end of the new highway closest to the city was at the edge of an outer suburb called Edgerton. Edgerton had all the public facilities closest to the new housing, including shopping, schools and a community centre. This community and the whole region around the lake belonged to a single municipality that had the authority to grant legal permits for construction on the site. The proposal also included the dedication of some of the land around the lake for public recreational facilities such as camping, boating and bicycling. Project managers had informally contacted three recreation organizations that might want to use the public recreation facilities. The groups appeared to be quite supportive of the project.

On Figure 2, the shapes of the nodes correspond to the primary issues of concern. Circles indicate concern for population strain on public facilities in Edgerton. Squares indicate concern about less traffic through Westville. Diamonds indicate concern for the expansion of regional recreation facilities. Accordingly, the recreation groups are indicated by the diamond shaped nodes with labels RecA, RecB and RecC. As in Figure 1, higher vertical positions

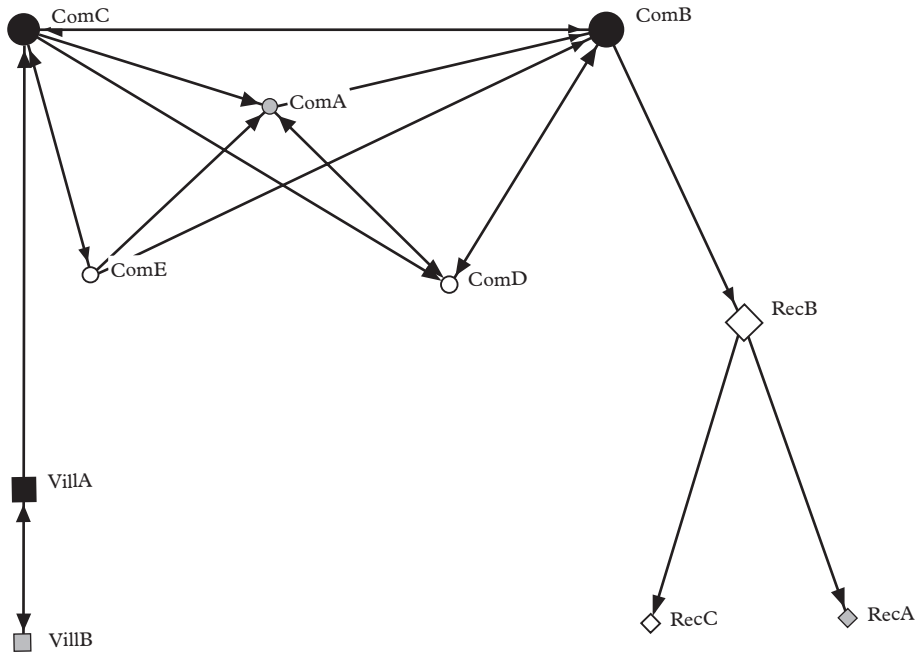

Figure 2. LHP stakeholder network laid out using PCA algorithm.

indicate more eigenvector centrality and larger nodes indicate more betweenness centrality. The shades of grey of the nodes represent the level of social license discovered to be granted by each stakeholder. White, grey and black correspond, respectively, to approval, tolerance and rejection of the project. The lines indicate the relationship between any pair of stakeholder organizations as rated in interviews with representatives of each organization. Relationship strength was calculated as the average for the ratings on satisfaction with the relationship and degree of agreement on goals. Only the stronger relationships (i.e. top tercile in rated strength) are shown on Figure 2. The arrowheads on the relationship lines between pairs of stakeholder indicate which stakeholder mentioned the relationship. Most relationships were mentioned by both parties.

The first grumblings of discontent, however, came from the village of Westville. They feared the new section of highway would reduce traffic to an extent that would effectively kill their local businesses and turn the town into little more than a bedroom community. Two organizations from the Westville are represented by the squares on Figure 2 and are labelled VillA and VillB. The VillA group presented their concerns to the municipal council urged rejection of the proposal. After this council meeting, groups from Edgerton became active. They are shown on Figure 2 as circles labelled ComA, ComB, ComC and ComD. Three years earlier ComB had successfully lobbied the municipal council to reject a proposal for a new shopping mall in Edgerton on the grounds that it would generate too much traffic from the city. ComB and ComC began preparing a brief for the municipal council arguing that the LHP should be rejected because the population increase would completely overwhelm the public services of Edgerton. ComD and ComE welcomed the LHP for the economic growth it would bring to Edgerton. It was at this point that interviews were done with stakeholders and the network structure in Figure 2 became visible.

Strategies suggested by the network structure

Figure 2 indicates that the Edgerton stakeholder groups are very interconnected among themselves. ComD and ComE are slightly less connected with other in Edgerton and are the ones that support the LHP. ComA is tolerant of the LHP while ComB and ComC reject it. Overall, Edgerton stakeholders are evenly divided about what level of social license the LHP should have. The greater interconnectedness of the circles indicates that the issue of strain on public facilities in Edgerton is the one that presents the highest risk to the project.

The directions of the arrows provide some insight as well. ComB mentioned RecB but not vice versa. This suggests that ComB, an opponent, is taking the initiative to influence RecB. The other two recreation groups, RecA and RecC, appear to depend on RecB for information. At the bottom of Figure 2, VillA reported a relationship with ComC but not vice versa. VillA might be seeking support for Westville's concerns about losing traffic. Although both oppose the LHP, ComC's opposition is based more on a concern about too much traffic, not too little.

The vertical positioning of the nodes shows that ComC and ComB have higher eigenvector centrality than anyone else, indicating more influence. The structural reasons are that they both have links to groups outside the Edgerton cluster, which gives them more influence than ComA, and they both have links to all other members of the Edgerton cluster, which gives them more influence than ComE and ComD. The strategic importance is that their greater influence in Edgerton, and Edgerton's greater influence in the whole network, means that ComC and ComB could potentially convince other stakeholders that they represent the dominant opinion, or even the majority opinion, which happens to be rejection of the LHP. The supporters of the LHP, ComE and ComD, have no way of knowing that they have allies outside the Edgerton cluster who think as they do. Indeed, they do not even have a strong direct relationship with each other. Reciprocally, RecB is unaware of supporters in the Edgerton cluster. Similarly, VillB is unaware of more moderate positions in the Edgerton cluster. This suggests that LHP management should explore ways to (a) connect ComE and ComD in order to strengthen support in Edgerton, (b) connect VillB to other network members who do not reject the LHP, and connect RecB to other LHP supporters in the network.

Strategies suggested by analyses of issues

Strategies for changing the structure of a stakeholder network must be implemented in real-world circumstances where building relationships requires more than drawing an additional line on a graph. The quantification of data on issues and concerns becomes quite valuable at this stage because it suggests grounds for conversations and collaboration among the stakeholders. In this case, the Westville moderate group, VillB, has an overlapping interest with the recreation groups. Getting to outdoor recreation activities generates traffic, which is what Westville wants. The possibility of locating the proposed recreation facilities close to Westville has the potential to address both concerns. Just as importantly, conversations to explore the possibility would change the structure of the network. VillB might become a supporter who is tied to other supporters. This would increase the connectedness of supporters and thereby increase their influence.

A rationale needs to found for introducting the two LHP supporters inside the Edgerton cluster to one another. All Edgerton stakeholders are concerned about strain on public facilities but while ComB and ComC have simply taken the position that the facilities cannot be expanded to meet the increased population demands, ComD, ComE and ComA may be open to considering the feasibility of expanding the facilities. Expanding the schools would involve the state department of education, an organization that has not yet been graphed as a stakeholder. Moreover, adding another community centre could be made a requirement for approval of an additional shopping centre. That would involve yet another stakeholder, namely, a commercial property developer that might be interested in revisiting the proposal for a new shopping centre in Edgerton. This an interpretation of Figure 2 therefore suggests that progress on the issue that presents the highest risk will require additional stakeholder relations work to involve new stakeholders. If those new stakeholders could be brought into a dialogue, the current rationale for rejecting the LHP loses the perception of being the only alternative, or even the most desirable alternative, especially when the convergent interests of Westville and the recreation groups are also represented in the dialogue. From a structural perspective, the LHP supporters become more connected and therefore more influential. The network graphs focus attention on exactly which pairs of stakeholders' interests need to be examined for common ground.

Implications for getting and keeping a social license

The LHP example illustrates the two main objectives of this paper. First, the example shows how the social license concept focuses on the political leverage points. Rather than assess support for the project among a random sample of the general population, most of whom are uninterested, the social license concept looks at project support among specific, interested stakeholder groups. In the LHP case, these are the groups shown on Figure 2. Second, rather than depict the level of support as an average across the general population, the social license concept identifies pockets of opposition and of support along with more diffuse, poorly connected fields and peripheries of opposition and support. In the LHP example, the opponents formed a well-connected pocket while the supporters were scattered and unaware that others held opinions similar to their own. Moreover, rather than leave the reasons for the support or opposition unconnected to the identities of the supporters or opponents, the approach suggested here shows exactly which pockets or peripheries are concerned most about which issues. In the LHP example, the three issues of (a) Westville's potential loss of traffic, (b) Edgerton's potential lack of facilities and (c) the recreation groups' access to recreational facilities, were each prioritized differently in different pockets and peripheries of the network.

In terms of showing how the approach leads to well-informed stakeholder engagement strategies, the LHP example first, made visible the need for more interconnectedness among project supporters and moderates, and second, focussed attention on finding common ground on the two issues of concern to supporters. That common

ground, in turn, led to the realization that a plan that would unite existing supporters into a well-connected, influential coalition would also require involving new stakeholders (i.e. state department of education, private commercial developers) in a way that would address the objections to the project.

Conclusions

The approach suggested here combines network graphs with issues quantification and measures of the social license granted. This not only makes explicit the theoretical linkages among these fields, but from a practical perspective also offers information that is directly applicable to the challenge of developing strategies and tactics for gaining and maintaining a social license. The approach makes otherwise hidden structural barriers to project completion visible and helps focus the search for common ground among stakeholders and project proponents. Because the social license itself summarizes the insights of many disparate theories and practical principles for stakeholder relations, it helps focus strategies on the challenges of maintaining legitimacy, gaining credibility, and building trust. As Valente (2012) cautions, our knowledge of how networks evolve in planned and unplanned ways is still quite limited. Structural interventions might have unexpected effects. Nonetheless, proponents of construction projects are already making predictable and unpredictable changes to stakeholder networks simply by making their proposals. The approach proposed here promises to make more of those changes predictable, and even intentional.

The approach also has limitations. One limitation is that even the best strategy will not dissolve opposition altogether after polarization has led supporters and opponents into mutual demonization. In such cases, conflict is likely to continue even as the social license from supporters generates enough political support to allow the project to move ahead. Maintaining the social license then depends on respectful engagement with the remaining opponents while carefully avoiding the creation of opportunities for those who reject such overtures to portray themselves as victims or martyrs. Another limitation is that getting valid data on network connections, stakes, and priorities can be nearly impossible when the project is embedded in a socio-political network characterized by corruption, criminality, or other covert activities. Interviews will produce false data and text based evidence of true relations and priorities will be deliberately kept to a minimum and kept from public access. The approach also has limited utility when a controversy has evolved into open violence. In such cases, the veracity of textual data may be reduced by fear or deliberate misrepresentation and attempts to conduct interviews may provoke accusations of spying.

On the positive side, the social license stakeholder network approach promises to be applicable across many different cultures and historic periods because it is based in relatively universal principles of social psychology (e.g. social capital, network structures). The approach also has parallels with emerging approaches in community development and poverty reduction. The World Bank sponsored work of Woolcock, Narayan and colleagues (Woolcock 1998, Narayan 1999, Krishna 2001, Narayan and Cassidy 2001, Szreter and Woolcock 2004) points towards a similar approach, but in the language of social capital. With more research and theoretical integration, there may be possibility to routinely integrate more sustainable development goals (e.g. United Nations 2015) into construction projects by paying as much attention to the social network structures created as the physical structures created.

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