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Identification and Use of Sustainability Performance Measures in Decision-Making

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An issue of increasing importance is corporate social responsibility (CSR) in which organisations must consider multiple stakeholders and their objectives when deciding on organisational actions. The broad objective of this study is to provide insights useful for decision-making to facilitate more informed decisions. In this study, we investigate in its natural and complex environment a conflict that interested parties believe involves a trade-off between energy development and protection of wildlife. We collect three types of data for use in a qualitative analysis. We describe the process of how managers can identify stakeholders and build a stakeholder network. We identify feasible measures of sustainability performance (i.e. social, environmental and economic impacts). We conclude with a discussion of how this information can be used to inform decision-making for CSR. This study contributes to the literature by providing a process for managers to identify relevant stakeholders, measure sustainability performance and use this information to inform decision-making.

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One issue of increasing importance to many stakeholders is corporate social responsibility (CSR), defined as ‘policies or actions which identify a company as being concerned with society-related issues’ (Roberts 1992: 595). Organisations must be able to evaluate the social, economic and environmental impacts (collectively referred to as ‘sustainability performance’) of their actions in order to make effective operational decisions that positively impact organisational objectives and satisfy the differing objectives of multiple stakeholders (Donaldson and Preston 1995). Management accounting can facilitate decision-making in the CSR arena by providing information useful in making decisions (Demski and Feltham 1976). This information can improve employees’ knowledge and reduce ex ante decision uncertainty, thus ultimately enhancing managers’ abilities to make better-informed decisions (Sprinkle 2003) and to act as more responsible leaders in interacting with a broad stakeholder network (Maak and Pless 2006). In this study we provide a process for managers to identify stakeholders, measure sustainability performance and use this information to inform decision-making for CSR (e.g. Gray 2002).

In this study, we move beyond an investigation of internalised quantified information incorporated in a cost-accounting system to understand how non-traditional sustainability performance information can be measured and utilised to inform decision-making. Collecting this information differs from obtaining financial measures from a cost-accounting system since organisations must identify multiple stakeholders and their objectives prior to collecting measurement information. Moreover, the sources of CSR information extend past the bounds of the cost-accounting system to include various sources of non-traditional information such as interview data, survey data and other external databases. This is a particularly important contribution for the managerial decision-making literature; Ibrahim et al. (2006) find that accountants lose some of their responsiveness to CSR issues after making the transition from school to practice as they become more concerned with firm economic performance. Since managerial accountants are often in charge of measurement systems and the provision of information to facilitate decision-making, quantifying all the impacts of CSR decisions, especially those social impacts and environmental impacts that exist outside traditional information systems, is a significant contribution.

In this article, we investigate in its natural environment a conflict that parties believe is a trade-off between energy development and protection of wildlife. We develop a rich data set that includes three types of data: (1) extensive interviews with major stakeholders conducted by the authors and two research assistants who worked on this project full-time in the field for six weeks; (2) archival data collected from a wide variety of sources including governmental organisations, local businesses and non-profits; and (3) personal observations of the specific setting. We use a qualitative analysis to provide guidance on how to identify stakeholders through a network analysis. We build a stakeholder network that identifies all interested parties, which in turn facilitates a more complete measurement of sustainability performance. Through triangulation of observations, interviews and archival data, we provide a tractable set of measures of sustainability performance and find that the conflict extends beyond the protection of wildlife to include many other environmental, social and economic impacts. We rely on the notion of the ‘triple bottom line’ (Elkington 1998).

1 Social, environmental and economic impacts are three common outcomes that organisations are increasingly attempting to measure with respect to sustainability and CSR. See, for example, the
2 The two research assistants were paid for their time and reimbursed for travel costs. Neither of the authors involved with this project acted as a consultant or accepted any funds in conjunction with this project. The University reimbursed only our travel expenses and covered other out-of-pocket costs related only to the research. We were present only in the capacity of independent researchers and, accordingly, visited the site and were involved in all phases of the research.
Identification and use of sustainability performance measures in decision-making

The rest of the paper is organised as follows. In the next section, we discuss theories pertaining to CSR, stakeholders and performance measurement. We integrate this discussion within the decision context of the study. Then, we discuss our research methods and our identification of stakeholders using network theory. In a later section, we present a qualitative analysis of sustainability performance, which we corroborate and triangulate with observations and archival data where possible. We discuss recommendations and implications for managers in the penultimate section, followed by a discussion of our conclusions and implications.

Integration of the setting and background literature

Setting

Sublette County, located in south-western Wyoming, contains one of the largest natural gas reserves in the United States. Natural gas production has grown rapidly over the last decade in two main fields: the Jonah Field in south-east Sublette County and the Pinedale Anticline, north of Jonah. The Jonah Field began production in 1992 and is now Wyoming’s second largest gas field with a 13.5% share of total production. The Pinedale Anticline has been productive since 1982 and is now the fifth largest gas field in the state. There are currently six primary oil and gas companies that operate in these areas.

In addition to housing natural gas reserves, this area is considered crucial winter range habitat for various species of ungulates, in particular the pronghorn antelope, elk and mule deer. The natural gas reserves also encroach on an important migratory corridor between the summer ranges in Yellowstone and Grand Teton National Parks and the winter ranges 150 miles south. The big game animals migrate south during the winter months to enjoy the milder weather conditions found in Sublette County. The sagebrush provides them with a food source and the animals are able to move with greater ease because there is less snow. The migration corridor is framed by mountain ranges and streams, which form a natural bottleneck. Development, due in part to natural gas drilling, threatens to magnify the bottleneck. The sage grouse also makes use of this habitat to mate and nest during the summer months. Sage grouse populations have declined by 90% over the past century because of the loss, degradation and fragmentation of sagebrush habitats. Many concerned citizens and conservationists are petitioning the US Fish and Wildlife Service to list the sage grouse as an endangered species.³

Decision context (conflict)

The rapid expansion of energy development has triggered environmental concerns with respect to narrowing of big game wildlife migration corridors, loss of winter range and harmful effects on sage grouse habitat. These concerns are illustrated in the following newspaper clips from the Casper Star Tribune (9 June 2004) and the Pinedale Roundup (1 April 2004), respectively:

Grand Teton National Park’s dwindling antelope herd got a break June 7 when Wyoming Governor Dave Freudenthal protested BLM’s plans to lease more land in Sublette County for oil and gas development . . .

Biologist Claire Braun predicted steep declines in sage grouse numbers as more and more habitat is disrupted by oil and gas development.

To partially alleviate concerns, there is a winter moratorium on drilling of natural gas wells. During this annual moratorium (15 November to 30 April), energy companies operating on public lands can only service gas wells that were productive prior to the beginning of the moratorium. In addition to the moratorium, there are restrictions on the spacing of wells in an attempt to preserve winter range for big game animals. The leks, or strutting grounds for sage grouse, are also protected from drilling activity within a quarter of a mile radius during the mating period, which occurs during March and April.

Sublette County is the primary decision-maker in this conflict. The main decision it faces is whether to remove the moratorium and allow year-round drilling. The county is challenged with balancing the national needs of gas exploration and production and government tax revenues with those of various stakeholders, including local communities, ranchers, hunters, conservationist groups and energy companies. The remaining stakeholders must decide how to influence the decision-making process. For example, energy companies must decide the extent of pressure they wish to bring to bear on the county to set aside the moratorium while trying to balance that desire with the needs and wishes of their other stakeholders. The secondary decision Sublette County faces is whether to relax drilling restrictions and allow for development on additional public lands that provide crucial habitat for the sage grouse and big game animals. Multiple organisations have a vested interest in this conflict, each with their own decision to be made relative to the two key decisions faced by Sublette County. In this study, we choose not to adopt the perspective of any one party to the decision (e.g. Sublette County, an energy company, a conservation organisation, etc.). We argue that all organisations need similar information to use in decision-making regardless of whether the decision-maker is the energy company deciding to push for more drilling rights or a governmental agency serving its constituents. The information needs are the same; what may differ is how each organisation uses the information in its decision-making process. We discuss recommendations and implications for managers in the penultimate section.

Sustainability performance

Based on their underlying strategy, organisations take actions which result in positive and negative social, environmental and economic outputs that can be measured to evaluate sustainability performance (Epstein and Roy 2001). Various stakeholders may react differently to the sustainability performance. These stakeholders are relevant to the organisation if their reactions are such that the organisation’s long-term objectives are affected. The organisation must first identify a full set of stakeholders and then its managers must develop measures of sustainability performance that capture social, environmental and economic performance for a specific sustainability initiative. The measures should capture the outcomes for each of the potential impacts. The following sub-sections provide background literature first on stakeholders, followed by performance measures.

Stakeholders

An important input of sustainability performance is identification of the stakeholders, as only when the stakeholders are identified, are managers able to measure the effects that CSR decisions have on those stakeholders (Epstein and Roy 2001). This
is a problematic process since identification of stakeholders and understanding their interests involves tremendous complexity (Ogden and Watson 1999). Moreover, there is limited research available to guide managers in identifying stakeholders (Harrison and Freeman 1999). Indeed, when firms do attempt to collect this information for use in a sustainability decision, they often take a narrow approach to both defining the set of stakeholders and measuring potential stakeholder reactions (Epstein and Wisner 2006). Agle et al. (1999) suggest that stakeholders high in power, legitimacy and urgency may matter more to corporate managers than those low in those attributes. In addition, the importance of stakeholder groups may vary depending on the firm’s commitment to environmental issues (Agle et al. 1999). Henriques and Sadorsky (1999) find that firms that are proactive in their environmental commitments perceive regulatory, community and organisational stakeholders to be important; however, firms that only react to environmental issues place great importance on the media as a stakeholder. Thus the process of identifying stakeholders is of importance to managers.

Performance measures
Performance measures are used for multiple purposes, one of which is to facilitate decision-making. ‘The use of managerial accounting information for decision-facilitating purposes is intended to improve employees’ knowledge, thereby enhancing their ability to make organisationally desirable judgments and decisions and better-informed action choices’ (Sprinkle 2003: 302). In this role performance measures provide information that reduces pre-decision uncertainty. Uncertainty occurs when decision-makers desire additional information because there is a gap between the information they possess and the information they would like to have to make better-informed decisions (Galbraith 1973).

Certain characteristics of performance measures, such as accuracy, completeness, timeliness and consistency (Ballou et al. 2004), make them desirable for the decision-facilitating role. Bharati and Chaudhury (2004) provide empirical evidence that information quality, measured as a composite of accuracy, completeness, relevance, content and timeliness, is positively associated with the decision-maker’s satisfaction. When asked, managers indicate that relevance, reliability and accuracy are the most important characteristics of information for decision-making (Feeney and Pierce 2007). In addition, measures that are stable and have low noise and variation are desirable to facilitate diagnostic types of decision problem since goals can be set and variances can be computed (Simons 2000). It is interesting, though, that even with high-quality performance measures, managers do not necessarily make optimal decisions (Sprinkle 2003); the decision-process is still dependent on contextual and individual difference factors (Sprinkle 2003; Ballou et al. 2004).

In addition to evaluating the properties of the measure, the decision-maker must consider strategic issues and ensure that the analysis and resulting decision is aligned with the firm’s long-term strategic objectives (Blocher et al. 2008). Measures with desirable properties that are high in relevance may still lead to poor decision outcomes if the decision-maker fails to understand the firm’s long-term strategic objectives and how the decision outcome will help the firm achieve its strategic goals. In sum, there are varying properties of performance measures that are associated with the quality of the measure for use in decision-making. Moreover, these qualities differ depending on the decision context and the user’s perception of those qualities (Ballou et al. 2004). The decision-maker must consider the performance measures in light of their relevance to the specific decision context and in terms of the organisation’s long-term strategic objectives (Blocher et al. 2008). Ittner and Larcker (2003) argue that often organisations fail to gain value from softer, non-financial measures because they do not consider strategy, or if strategy is considered, the organisation still fails to validate the existence of a cause-
and-effect link among the measures. Moreover, organisations often use measures that are not valid or reliable (Ittner and Larcker 2003). Ittner and Larcker (2003: 7) find that, when managers fail to rely on non-financial measures, this ‘denies them a comprehensive picture of their performance’.

In a later section, we develop a ‘comprehensive picture’ of social, environmental and economic sustainability performance measures. While we recognise that the quality of the measurement properties varies, we agree with Ittner and Larcker (2003) and argue that decision-makers reduce pre-decision uncertainty through access to a complete list of performance measures. This perspective is also consistent with Galbraith (1973), who states that information needs increase as uncertainty increases. Uncertainty is inherent in the CSR decision-making arena, yet information gaps remain wide. In the section, ‘Recommendations and implications for managers’, we discuss how information derived from sustainability performance measures can be used in the decision-making process.

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**Research methods and identification of stakeholders**

This section first discusses the research methods we use in this paper. We then describe how we identified the stakeholders we interviewed and thought were relevant for this study.

**Description of research methods**

This article uses both archival and interview data along with observations of the field site. We began data collection during the spring of 2004. Our initial contact was with the vice-president of external relations of Shell Oil Company. We had several phone conversations with him and arranged to meet with him and several other representatives from Shell Oil Company at the field location in June. Prior to arriving in the field, we inspected company documents and newspaper clippings to familiarise ourselves with the concerns surrounding energy development in the Pinedale area. In June 2004, we conducted semi-structured and informal interviews with representatives from Shell Oil Company, along with other stakeholders in Sublette County, visited gas fields, viewed the migratory paths of the big game animals and toured the general area. In addition, a team of two research assistants lived in Sublette County and worked full-time on this project for six weeks during the summer of 2004. During this time interviews were conducted with 24 stakeholders (see Appendix) and representatives of various local organisations in order to gain institutional knowledge of the setting, understand the key sustainability issues and attempt to develop measures of sustainability performance. Because we did not want to inhibit the free flow of information exchange on this volatile topic, we chose not to tape-record interviews. However, during each interview at least two interviewers took detailed notes and immediately following the interview typed a full transcription of the notes. These interviews were supplemented by telephone interviews, observations, inspection of archival data, newspaper clippings and photographs. We used archival data and observations to substantiate the interview data, where available. We collected data from sources including the Bureau of Land Management.

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4 We make no claims that we have uncovered all possible performance measures. First, our study focuses on the most critical performance measures, which are those that are relevant to the network of stakeholders identified in the study; second, the set of performance measures must be tractable.

5 The interviews are conducted at the individual level and represent the various stakeholder groups (i.e. homeowners, energy companies, etc.).
identification and use of sustainability performance measures in decision-making

(BLM), the Pinedale school district, Wyoming Game and Fish (WGF), crime reports, the Sublette County Chamber of Commerce, environmental organisations, newspapers and several gas companies. We observed winter habitat range, leks, drilling pads, migratory corridors and bottlenecks. We documented our observations through photographs. The use of multiple sources of evidence enables us to triangulate our findings and thus provide more convincing evidence in our analysis (Yin 2003).

All data from interviews, archival records and observation summaries were maintained both electronically (interviews, newspaper clippings and photographs) and in manual folders (archival records) for frequent reference. Data were analysed in a three-phase process to ensure that all information was consistent across different sources. In the first phase, we analysed interview transcripts for similarities and differences across interviewees, to surface measures of interest to our study and to understand the pattern of relations that supported the development of our stakeholder framework. In the second phase, we investigated alternative information sources (archival records, observation summaries and photographs) to highlight any inconsistencies that required further examination and to cast evidence of a supporting nature. In the third phase, we re-examined the evidence to surface the measures of financial, environmental and social performance.

Identification of stakeholders

We conducted the first interview with the vice-president of external relations of Shell. He identified major stakeholder groups as the Town of Pinedale, Sublette County, non-governmental agencies including the Upper Green River Valley Coalition (UGRV) and the UGRV Land Trust, the BLM and the State of Wyoming. Using the first interview as the point of origin, we began to build an interlocking network model of stakeholders with nodes defined as groups of stakeholders with common interests (e.g. energy companies, environmentalists and Sublette County). This approach is consistent with the ‘co-creative’ approach emerging in stakeholder theory. Traditionally, the corporation initiated stakeholder engagement, considered only powerful, influential stakeholders, and was at the centre of all relations. However, recently, organisations and individuals have begun voluntarily forming stakeholder networks based on shared interests in which all parties jointly own the network and no one organisation is at the centre (Svendsen and Laberge 2005, 2007).

Figure 1 (a and b) depicts the strong and weak identifications revealed in the interviews, respectively. For example, Figure 1(a) depicts arrows from the vice-president of external relations at Shell (‘FP’) to ‘AD’ (land analyst, Shell), ‘PM’ (field manager, BLM), ‘BH’ (WGF), ‘GJ’ (county commissioner), ‘JM’ (county planning and zoning), ‘RS’ (mayor of Pinedale), ‘LB’ (director, UGRV Coalition), and ‘MM’ (director, UGRV Valley Land Trust) (see Appendix for a full list of the interviewees). These arrows indicate those people that one stakeholder directly identified as another stakeholder in his or her interview. In Figure 1(b), the arrows depict the weak identifications that we found to be implied within the interview; however, the interviewee did not specifically identify the party as a potential stakeholder nor suggest that we interview the party. For example, in his interview, the WGF field manager primarily discussed this conflict in terms of: future generations; tourists, visitors and hunters/fishermen; the local community; ranchers; and the energy companies (thus the arrows flow to a node and not to a specific person since none was mentioned). We continued the interview process until we discovered that it was not leading to any new nodes in the network, which suggests that we had
Figure 1 Stakeholder Network: (a) Strong identifications; (b) Weak identifications

(a)
developed a comprehensive network of stakeholders. This conflict generated substantial press attention, thus we buttressed the validity of our network by scanning the media for potential stakeholders we might have missed during the interview process. In sum, the stakeholder network captures the web of interested parties who share concern and interest in a particular issue.

The initial identification of stakeholders by each stakeholder appears consistent with the traditional literature on stakeholder engagement (e.g. Epstein and Wisner 2006) in that each stakeholder typically identified a narrow list of other stakeholders that appeared high in power and legitimacy (Agel et al. 1999). For example, during the first interview with the Shell representative, the stakeholders strongly identified were environmental and conservation groups active in the media, along with local, county and state agencies that have decision-making powers. The stakeholders that appear to be neglected are the local citizens, tourists, ranchers, hunters and future generations. The complete stakeholder network was not identified until we developed an interlocking network of stakeholder relations in which no one organisation was at the centre, consistent with the co-creative approach (Svendsen and Laberge 2007). It is important to identify all stakeholders because they are necessary for understanding sustainability performance in the section that follows. For tractability in the following discussion we categorise the identified stakeholders into four groups: (1) corporate entities, (2) governmental organisations, (3) non-profit advocacy groups, and (4) other.

Corporate entities
In 2000 the state of Wyoming was the third largest producer of natural gas in the US (Petroleum Association of Wyoming 2002), while Sublette County was the leading producer of all Wyoming counties. Six main energy companies operate in Sublette County: Anschutz Exploration, EnCana Corporation, Questar, Shell, Stone Petroleum and Ultra Petroleum. The companies use drilling and construction services from a variety of contractors including Baker Hughes, Halliburton and Schlumberger in production processes, KS Industries in construction, Newpark in the disposal of oil muds, and Duke Energy and Western Gas in pipeline gathering systems for gas transportation.

Governmental organisations
There are several governmental stakeholders. The US BLM Pinedale Field Office manages approximately 928,000 acres of public land and 1,144,000 acres (1 acre = 0.4047 hectares) of federal mineral property. Their primary responsibility is to manage multiple, and often conflicting, uses of public lands including gas production, livestock grazing, wildlife habitats and outdoor recreation. In addition to monitoring environmental concerns, the BLM is the custodian of archaeological and cultural sites located on public lands. The function of the WGF is to preserve and maintain wildlife. Its charge is to balance the needs of hunters, while also ensuring that animal populations are sustainable. The WGF is partially funded through hunting licence fees, which totalled US$19.3 million for the fiscal year ended June 2003. Sublette County’s Planning and Zoning Committee attempts to anticipate and then regulate impacts to privately owned land. Although only 20% of the land in Sublette County is private, its strategic location in big game migratory corridors makes it a stakeholder in this situation. The Pinedale

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6 This conflict is broad thus our use of the term ‘stakeholder’ is also broad. We use it to signify the move from a corporate-centric focus on shareholders to a more global view of an organisation’s base of stakeholders that can potentially include all of society. This is similar to the discussion in Steurer et al. 2005 of a closed shareholder system as opposed to an open business–society relationship.

7 The BLM is an agency within the US Department of the Interior. The relevant field office is located in Pinedale, which is the most populous town in Sublette County.

8 The WGF is a state governmental agency.
The mayor’s office is responsible for developing the area in a sustainable way. It tries to provide adequate infrastructure and living conditions for the town’s benefit while balancing economic development with social and environmental stewardship.

Non-profit advocacy groups
Three primary environmental and conservationist groups active in the Pinedale area are the UGRV Coalition, the Wildlife Conservation Society and the Greater Yellowstone Coalition. These organisations take leadership in voicing their concerns on the potential impacts of oil and gas development on biodiversity and the environment.

Other
Other stakeholders include homeowners, local ranchers, hunters, tourists and future generations. Although Wyoming is not a densely populated state, the population of Sublette County has grown by 22% during the last decade and has the second highest population growth rate in the state of Wyoming. Residents are attracted by the natural beauty and opportunity to live in a more rural area and enjoy the wildlife and outdoors. Ranching is a valuable component of the area in and around Sublette County. Ranchers are provided with allotments on public lands for livestock grazing during the early summer months (usually between 15 May and 30 June when vegetation cover is adequate). Hunting in Wyoming is an attraction for both residents and tourists. In addition to providing a source of income for the WGF, hunting acts as a short-term controlling agent for wildlife population sizes. Most hunting occurs during the months of September through November, with different hunting periods for each species. Tourists are an important source of revenue for Sublette County as the county is situated just south of the Grand Teton and Yellowstone National Parks. Finally, future generations are included in the stakeholder analysis. By definition, this group is at the centre of sustainable development.

**Sustainability performance**

Sustainability performance includes the social, environmental and economic impacts of an organisation as it relates to the multiple and differing objectives of the complete set of stakeholders (Epstein and Wisner 2006). We summarise measures of sustainability performance in Table 1, and in the next sub-sections we broadly discuss each of the three types.

We first identified the issues and impacts through the interviews of the stakeholders identified in Figure 1 (the stakeholder network). We then gathered quantitative archival data to either substantiate or refute the interview data. We assessed the outcome based on a combination of interview, archival and observational data.

**Environmental performance**

I’m glad I lived here when it was wild, because it’s never going to be that way again (local community member and head of the Wagon Wheel Citizens Committee).

Overview of environmental performance
Our initial telephone interviews and review of media clippings indicated that the primary issue at the heart of the conflict on natural gas development is the impact that it has on wildlife populations, particularly those of big game animals such as pronghorn antelope and mule deer that migrate from the Yellowstone National Park area to Sublette...
### (a) Environmental performance

<table>
<thead>
<tr>
<th>Issue</th>
<th>Potential impact</th>
<th>Source</th>
<th>Measure</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wildlife conservation: loss of habitat</td>
<td>Natural gas development could further fragment the land, which could restrict the bottleneck on the migratory corridor and further restrict winter range</td>
<td>Interviews and observations</td>
<td>Width of bottleneck</td>
<td>Observations verified the existence of a bottleneck, which is currently 0.5 km in width. Mixed results from interview data</td>
</tr>
<tr>
<td>Wildlife conservation: loss of population</td>
<td>Decrease in population</td>
<td>Wyoming Game and Fish 2003–2004 Annual Reports</td>
<td>Variance from plan for population objective by animal type</td>
<td>A five-year trend (1999–2003) of population objectives were not met for either the mule deer or the pronghorn. The mule deer population has fluctuated between 485,000 and 545,000 while the objective has ranged from 561,000 to 568,000. The antelope population has ranged from 416,000 to 457,000 animals while the objective has ranged from 450,000 to 462,000 animals. In all years for both animals the population objectives were not met. The population objectives for elk were exceeded in all five years. Records are not maintained for the sage grouse.</td>
</tr>
<tr>
<td>Precipitation</td>
<td>Number of inches of rainfall</td>
<td>National Climatic Data Center 2004</td>
<td>Precipitation, on average, is 13.5 inches. Precipitation was average in 1999 and 2004 but unusually low between 2000 and 2003 when the annual rainfall was 8.6, 5.4, 8.1, and 10.2 inches, respectively. The drought may have contributed to the decline of sage grouse and other animals in the area. Precipitation was measured in Lander, Wyoming, located approximately 50 miles east of Pinedale.</td>
<td></td>
</tr>
<tr>
<td>Hunting licences</td>
<td>Number of licences issued</td>
<td>Wyoming Game and Fish 2003–2004 Annual Reports</td>
<td>As stated above the population objectives were not met for either the mule deer or the pronghorn antelope. However, during the same five-year period the number of hunting licences increased: 38,467 and 43,827 hunting licences were sold in 1999 and 2003, respectively, for the pronghorn antelope while 79,452 and 84,557 hunting licences, respectively, were sold for the mule deer</td>
<td></td>
</tr>
<tr>
<td>Issue</td>
<td>Potential impact</td>
<td>Source</td>
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<td>Outcome</td>
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<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Visual disturbances</td>
<td>Rigs could be unsightly</td>
<td>Interviews and observations</td>
<td>Days new drilling rig is in existence</td>
<td>Observations verified the existence of rigs. The drilling rigs were each in existence for 50–60 days, on average, during 2003. Mixed results from interview data.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Petroleum Association of Wyoming: Wyoming Oil and Gas, Facts and Figures, 2004 edition</td>
<td># of working rigs in 2003</td>
<td>There were 54 working rigs in 2003</td>
</tr>
<tr>
<td>Noise pollution</td>
<td>Flaring creates noise disturbance</td>
<td>Interviews</td>
<td>*</td>
<td>Concern voiced in interviews and substantiated in newspaper clippings</td>
</tr>
<tr>
<td>Air pollution</td>
<td>Air could be polluted from road dust and emissions</td>
<td>Interviews</td>
<td>*</td>
<td>Concern voiced in interviews and substantiated in newspaper clippings</td>
</tr>
<tr>
<td>Water pollution</td>
<td>Water could be polluted from the oil rigs</td>
<td>Interviews</td>
<td>*</td>
<td>Concern voiced in interviews</td>
</tr>
</tbody>
</table>

* We were unable to obtain archival data to triangulate with the interview data.

Note: 1 inch = 25.4 mm
### (b) Social performance

<table>
<thead>
<tr>
<th>Issue</th>
<th>Potential impact</th>
<th>Source</th>
<th>Measure</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Fluctuation in enrolment</td>
<td>Sublette School District #1, monthly enrolment by grade level</td>
<td>Count of monthly school enrolment for the Pinedale School District</td>
<td>Yearly enrolment in the Pinedale public school district appears to be increasing as more people are moving to Pinedale; however, during the year the enrolment appears to decrease. In winter 2002 enrolment ranged from 654 to 660, in autumn 2003 from 679 to 683, in winter 2003 enrolment dropped and ranged from 662 to 670 and in autumn 2004 enrolment increased and ranged from 685 to 697. This may be due to parents employed by the energy industry who are moving away to find work during the 6-month moratorium from November until April</td>
</tr>
<tr>
<td>Security</td>
<td>Increased criminal activity due to influx of seasonal workers</td>
<td>Sublette County Sheriff’s Office incident report</td>
<td>Monthly count of incidents</td>
<td>In Pinedale, there are 24.4 incidents on average during the moratorium. There are 45.2 incidents on average during the drilling season. Significantly different at $p &lt; 0.05$. National data on theft incidents indicates a similar pattern with a higher rate in the summer (52.9) than in the winter (47.1); although the spread does not appear as significant as it is in Pinedale</td>
</tr>
<tr>
<td>Safety</td>
<td>Increased potential for worker injuries due to seasonal operations</td>
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County in the winter months. The criticality of this issue was substantiated throughout the interview process. For example, it is the opinion of two local community members and heads of the Wagon Wheel Citizen Committee that energy development destroys animal habitats and harms the animal population. Although a minority opinion, some interviewees, such as the head of the Chamber of Commerce, support energy development and state, ‘Road kill [i.e. animals killed by road traffic] is a bigger concern to the animal populations than gas drilling’.

The head of the UGRV Coalition says that ‘the UGRV is part of the longest migration corridor for ungulates, of which there are over 100,000 animals’. One of the primary problems with this migration route is the existence of a bottleneck known as Trapper’s Point. Although this half-mile section is public land, energy companies are interested in developing the land parcel. The concern is that further development and fragmentation of this land could cause the animals to be cut off from the Teton area or from their winter grazing areas in Pinedale. She says:

[the Jonah Field] is now single use, as there is virtually no animal habitat or area for recreation left. The whole valley cannot be developed, and it is important that some areas, such as Trapper’s Point, are marked as off limits to development.

On the other hand, the BLM field manager states,

Conservationists often operate on emotions. Without education on the topics, it is very easy to become caught up in feelings. In order to function, these groups must keep issues and concerns afloat because they can only operate and get funded when there is controversy. They often take the needs of man out of the picture. Man has always used the environment around him to live, and it is important to address the needs of everyday life.

But the WGF field manager agrees with the head of the UGRV Coalition and states,

The bottleneck is a high priority—any development in the area is a concern because so many animals travel through the area. The antelope have been migrating around the development on the Jonah Field. There is much concern about development near Trapper’s Point. Housing developing occurs on private lands, and oil and gas development occurs on public lands, and the crucial area in the bottleneck is public lands.

There are also concerns regarding the impact of energy development on non-migratory animal populations, particularly the sage grouse. The sage grouse is a ground-dwelling bird that depends on sagebrush for shelter and food. The Pinedale Anticline, a major field for gas drilling, is considered crucial habitat for the sage grouse. Activity in the Pinedale Anticline during the winter could impact wildlife by impeding migration and the search for food and shelter. Therefore, crucial winter ranges are currently restricted from any new developmental drilling annually from 15 November to 30 April. However, other factors besides drilling may affect wildlife populations. Both the head of the UGRV Coalition and the BLM field manager stated their belief that drought conditions in recent years are a contributing cause of the decline in wildlife populations as drought is detrimental to the animal’s ability to sustain itself on the available land and vegetation.

The WGF has a vested interest in animal populations and natural gas development since it has a ‘trust’ to preserve and maintain wildlife, yet its source of funding is derived from hunting licence fees. The WGF field manager stated that ‘the impacts of improper land development could cause game population to decrease exponentially and that the negative effects would be irreversible’. Yet all of the animals in question are legally hunted. He pointed out, however, that ‘hunting, rather than depleting the deer and antelope populations, controls them’. In other words, his perspective is that hunting is used as a controlling mechanism to regulate animal populations.
Other environmental issues related to gas drilling that emerged from the interviews include visual disturbances, such as flaring (the ignition of gas particles during the well-completion process), the lighting of rigs at night, and noise pollution. These issues are also tied to air and water pollution resulting from an increase in traffic to service wells and the production process. When gas starts to surface for the first time it is contaminated with a mixture of sands, water, condensates and drilling mud. The energy companies ignite this mixture, producing a flare, which results in noise (comparable to a jet engine), a visual disturbance in terms of a glow at night, black smoke and white clouds of water vapour. The existence of the problem is documented through several news clippings from the *Pinedale Roundup* (11 March 2004) and the *Casper Star Tribune* (25 March 2004):

Pinedale residents complain to Wyoming state regulators about the haze coming off a flare at the Anschutz natural gas well . . .

The Wyoming Outdoor Council petitioned the state DEQ [Department of Environmental Quality] to require the energy industry to pursue alternatives to flaring in Sublette County . . .

Energy companies have taken steps to reduce flaring, and minimise traffic, noise and visual impacts.

Environmental performance measures
Our interviews revealed that the environmental issues due to energy development centred on wildlife, including the potential loss of animal population and habitat, and various types of pollution. A search of archival data revealed several viable environmental performance measures that could provide useful information to decision-makers. The variance from plan objective by animal type and the width of the bottleneck provide information on the primary conflict. Both measures provide important pieces of information since animal habitat and population are the inflammatory issues in the conflict of whether energy companies should be allowed to operate more rigs, develop more land in the Pinedale area, and operate year-round. The data verified the existence of a bottleneck. The migratory route currently goes through a spot in the Trapper’s Point area that is now only 0.5 km in width. Data also verifies that the population objectives for both the pronghorn antelope and the mule deer were not met during any of the years 1999–2003. Two other potential measures that probably affect animal populations, but are not caused by energy development, are the number of inches of rainfall and the number of hunting licences issued. Although none of the interviewees disputed the potential harmful effects that drilling has on wildlife, data from the National Climatic Data Center shows that the area has experienced below average precipitation amounts in 2000–2003. Furthermore, although the population objectives were not met, the hunting licences issued for both types of animal increased during the corresponding time period.

Objective measures that are likely to be associated with environmental pollution include the number of days new drilling rigs are in existence and the number of working rigs. Both of these measures provide information on visual disturbances. There are other environmental factors that arose during the interview process that we were unable to develop objective measures for including noise, air and water pollution effects associated with drilling, which would increase with increased drilling.
Social performance

Because of the 6-month moratorium on drilling families become nomadic to follow employment. This results in a change of local citizens in the community each year (vice president of external relations for Shell).

Overview of social performance
The interviews revealed that the six-month moratorium on drilling causes concerns with the educational system, community safety and plant safety as a result of the unstable populations associated with the moratorium. Several interviewees suggested that when drilling stops and energy workers leave town, school enrolment declines. Thus a potential effect of the moratorium is the fluctuation it causes in school enrolment. However, the superintendent of the Pinedale school system noted that enrolment is fairly stable and said that he believed that most energy workers do not bring families with them during the work season. The General Manager at Questar believes that criminal activity increases in the summer when the energy firms are actively drilling. Consistent with the school superintendent’s beliefs, blue-collar workers leave the family behind to work during the six-month active season. While away from home, it is alleged consistently and across various interviews that the seasonal workers engage in increased drug and alcohol use that drives up the local crime rates. Finally, the moratorium on drilling also triggers safety concerns for the energy companies since they must set up and ramp down their rigs in a short period of time. For example, the vice-president of external relations for Shell indicated that they operate 36 rigs year-round, but only operate eight during the moratorium. Furthermore, following the moratorium, many employees do not return, which increases the need to constantly train new employees, resulting in increased safety concerns. He stated that it is his opinion that ‘the primary drive for year-round drilling is the safety concern. Very rapid ramping up and down stresses the system to meet deadlines, and injuries can and have occurred’.

Two additional social impacts related to energy drilling include the discovery of archaeological sites and increased road access. Energy companies are required to report the discovery of archaeological sites to the BLM. According to a BLM archaeologist, ‘if it were not for gas development in the Sublette area, there would not be any discoveries of archaeological sites’. Energy companies are also responsible for building and maintaining adequate access roads to their drilling sites. These access roads are open to the public and used by hunters, birdwatchers and others.

Social performance measures
Decision-makers now have three objective measures that capture social outcomes which will help to facilitate their decision process. The count of monthly school enrolment for the Pinedale school district provides decision-makers with information about Pinedale’s school enrolment, which is one of the issues associated with the moratorium on energy development. The Pinedale School District provided us with monthly enrolment figures from 2002 through 2004 and we did note a distinctive pattern in which the monthly enrolment was lower during the winter moratorium when energy workers leave town and higher during the autumn when the workers are in residence. However, on further inspection of the levels of school enrolment, we noted that the maximum change in enrolment is about 20 students or approximately 3% of the base enrolment, suggesting that the effect, if any, may be minimal. The monthly count of incidents provides information related to the issue of safety, which arose during the discussions about the moratorium. To provide evidence on this issue we obtained five years of records (ending in 2003) from the Sublette County Sheriff’s Department. The incidents were reported for the five following categories: driving under the influence (alcohol or drugs); controlled
substance programme; theft; trespassing; and vandalism. Pooling over time and across categories (n = 25; number of incidents), we found that the mean number of incidents during the period 1 May–31 October was 45.2 (i.e. 45.2 incidents per month on average across all categories), while during the period 1 November–30 April it was 24.4. These are statistically significant from one another (p < 0.05), which may suggest that there are reduced crime rates during the moratorium.9

Cultural exploration is a social impact that arose during our interviews. The number of archaeological sites is an objective measure that provides decision-makers with information about a little-discussed, but culturally significant, social aspect of energy development. Thus far the field office has recorded 5,334 sites on the National Register of Historic Places. There are two issues identified, safety and road access, for which objective measures could not be developed during our fieldwork.

Economic performance

The wildlife brings money to the county through tourism and hunting licenses, and should be valued in the same way that development is valued (head of the Upper Green River Valley Coalition).

Drilling could be a tourist attraction in itself, if visitors are interested in taking tours of the drilling sites. A drilling museum recently opened in Big Piney (head of the Chamber of Commerce).

Overview of economic performance

Our interviews revealed that energy development has benefited the Pinedale School District in terms of increased funding. In addition to an annual operating budget of US$6 million, the Pinedale School System receives monies based on assessments on the energy companies. The school system also receives monies from tax valuations that are based in large part on energy revenues. With funds retained by the school district in 2001–2002 from the assessed valuations on natural gas developments, all regular employees of the district received a 12% bonus. The school district is not allowed to carry over funds; therefore, the school district invests all monies in infrastructure (e.g. additions to the high school), programmes (e.g. well-funded science programme) or salaries. Consequently, the Pinedale school superintendent (and one of the science teachers) claim that the school district has well-funded programmes and well-paid teachers. The board of trustees implemented a compensation package, which included a raise of 18.58%, on average, in hopes of retaining high-quality staff in the school district. The energy companies also fund scholarships for the graduating students to attend college.

Energy development also benefits Sublette County through property taxes. Interviewees reported that the assessed valuation for Sublette County increased from 1995/1996 to 2004/2005 primarily because of the increase in natural gas prices and production. Property taxes benefit local and statewide schools, healthcare and governmental agencies. It was also reported to us that the energy industry provides the highest-paying jobs in the area.

While it appears that the concern of increased criminal activity during the active drilling period may have merit, we are unable to rule out alternative causes such as an increase in tourists, as a result of seasonal effects, or an increase in the number of officers employed. For example, we located national data on theft incidents and discovered a similar pattern, although not of the same magnitude, in which 52.9% of theft incidents occurred in the summer months and 47.1% of theft incidents occurred in the winter months corresponding to the moratorium period. Note also that the crime data is maintained monthly so we used the periods that corresponded most closely to the moratorium, which is in effect from 15 November to 30 April of each year.

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Some interviewees were concerned that increased drilling could negatively affect tourism because of the effect drilling has on the natural beauty of the area. Sublette County is a gateway to the Tetons and Yellowstone National Parks and is a place of great scenic beauty. Tourism in Sublette County has been growing steadily and is important to the area in terms of creating earnings and jobs. Many believe that increased drilling will be an eyesore that will cause tourists to stop visiting the area. However, the head of the Sublette County Chamber of Commerce, Eric Sechrist, believes that drilling rigs could become a tourist attraction. He has approached one of the local energy companies with a proposal that they fund a visitor centre and, in turn, could have a display on the oil and gas industry and its role in the local area. In addition, Sechrist is hopeful that local companies could even begin offering tours of drilling rigs.

The WGF is partially funded through sales of hunting licences. Each year the WGF determines population objectives based on an assessment of what the habitat can support. An estimate is made of the population and hunting licences are issued for the difference. A concern is that increased drilling activity will decrease animal populations and thus revenue from the sale of hunting licences will also decrease.

Finally, there are indirect economic effects on residents of the city of Pinedale. The energy companies have spurred development and growth, real estate prices have increased and an employee at EnCana Oil and Gas believes that ‘many people that are not employed by the oil and gas industry cannot afford to live here anymore’. The BLM field manager also noted that, while Sublette County has enormous wealth, the town of Pinedale does not possess the same amount of wealth since energy assessments and taxes bypass the city and are paid directly to the County. Therefore, the City of Pinedale does not have the financial resources necessary to support the growth in population and desperately needs to invest in infrastructure, such as sewer systems and roads. While the mayor of Pinedale echoed these sentiments and noted that the water and sewer systems are 50 years old, she believes, however, that ‘the benefits of drilling far outweigh the costs’.

Economic performance measures
We identified five primary areas in which a change in policy on energy development could have economic ramifications: education, Sublette County wealth, tourism, hunting licence revenue and average pay. There are several objective measures decision-makers can use to assess the effects of energy development on these areas.

The amount of energy assessment, amount of scholarship funding by energy companies, average teacher salary levels, the assessed valuation of the Pinedale School District and the price in dollars per Mcf (1,000 cubic feet) are five measures that provide decision-makers with potential information on how energy development can impact education. In 2003, the school system received an additional US$4 million in assessed funds. Energy firms awarded over US$250,000 in scholarships to the high school graduating class of approximately 50 students. We verified that the Pinedale School District does pay the highest teacher salaries in the state of Wyoming. Coinciding with the increase in natural gas prices (from US$2.5/Mcf in 1996 to US$4.1/Mcf in 2003) and in the number of working rigs (24 in 1996 to 54 in 2003), the assessed valuation for the Pinedale School District has increased from US$140.8 million in 1995/1996 to US$1,655.5 million in 2004/2005. In sum, the measures indicate that the energy development has benefited the Pinedale educational system in terms of increased funding.

Four objective measures provide information on tourism. These measures include the growth rate in visitor spending in Sublette County, dollars of earnings generated by the median sales price of houses in Sublette County more than doubled from 1994 to 2003 to US$158,000. However, that is comparable to the median price nationally of existing homes and well below the median national price of new houses, which is approximately US$190,000.
visitor spending in Sublette County, the number of jobs created from visitor spending in Sublette County and the dollars spent on lodging in Sublette County. All of these measures showed that tourism spending is on the increase. In 2003, tourists spent US$30.6 million, which helped employ 520 people in related tourism businesses. It is interesting to note, though, that during the period 1997–2003, as energy development has steadily grown, tourism has also steadily grown. For example, tourism spending has grown almost 60% during the period.

Price per licence and the number of hunting licences issued provide decision-makers with information on the detail behind the revenue from hunting licences. These two performance measures provide information on whether a change in revenue is due to a change in price or a change in the number of licences issued. During 1999–2003 as energy development increased, revenue from hunting licences also increased from US$16.3 million to US$19.3 million.

Percentage of assessed Sublette County property tax valuation derived from the oil and gas industry provides decision-makers with information on the economic impact the energy industry has on the county. The assessed valuation for Sublette County has risen from US$216.4 million in 1995/1996 to US$2,039.1 million in 2004/2005 primarily because of the increase in natural gas prices and production. Over 85% of the assessed value is derived from the energy industry. For 2003 the oil and gas industry paid 91.6% of the property tax in Sublette County. Finally, we verified that the energy industry does provide high-paying jobs, which we substantiated with a performance measure, average salary in dollars by industry. In 2003, the average annual salary for a job in the oil and gas industry was US$69,000, far above the next highest average annual salary of US$42,000 in the transportation and utilities industries.

**Recommendation and implications for managers**

Organisations often have difficulty integrating stakeholder preferences into management decisions. When we arrived in Pinedale, the stakeholders all complained of inadequate and inaccurate information on sustainability performance. Decisions were clearly limited by the lack of information—both the quality and quantity. In our early discussions, it was reported to us that animals were dying because of the drilling. But there was little evidence to support this. How many died, what the animal population was before or after the drilling, and the causes of any decrease were all speculative. There was a bit of anecdotal evidence that some animals died on the highway, but whether this had increased or whether it was a result of the drilling was unknown. This lack of information inhibited the decision-making of all of the stakeholders. Though they did have very different interests and different priorities, the various stakeholders shown on Figure 1 needed better information for decision-making purposes.

As their performance measurement systems currently stood, none of the decision-makers had the information needed to adequately represent his or her stakeholder interests. Our fieldwork confirmed that the government representative could not meet the public and voter needs, the corporations could not meet shareholder needs, and the activist groups could not adequately represent environmental needs; they were each attempting to make decisions and represent their stakeholders without the necessary information. The method in this paper provides a systematic approach for identifying a comprehensive set of stakeholders and measuring sustainability performance. Sustainability issues are particularly challenging in this regard since they typically have long time horizons, are particularly difficult to measure, and are inherently high in uncertainty. Thus, their assessment and integration into decision-making is typically
not done. We provide guidance on how to identify stakeholders (through our tables of the network analysis) and how to measure sustainability performance (through the archival data that we gathered and the interviews that we conducted). Corporations, government representatives and environmentalists, for example, each have a different set of constituents and probably place different value on the information provided. But, each now has a standard set of information to work from. In this section, we discuss recommendations for how managers can use this information in the decision-making process.

Recap of stakeholder identification

The first step is to fully identify all stakeholders. Figure 1 shows the results of a process using network theory in which we continued to identify stakeholders until no more strong or weak identifications were made during the interview process. This is a critical step for any organisation as measurement of sustainability performance will only be as complete as the stakeholder identification. It was only through the secondary, weak form of stakeholder identifications that we were able to determine social, economic and environmental sustainability performance that extended beyond the first trade-off identified: that of development and wildlife. For example, we learned that a social performance outcome is the 5,334 archaeological sites located by the energy companies during their development activities and an economic performance outcome is the high teacher salaries that the Pinedale community enjoys.

Performance measures

In this section we discuss how managers can use the sustainability performance measures identified in Table 1 to facilitate decision-making. Managers often fail to use a comprehensive set of performance measures owing to worries that they may lack reliability or validity; however, a comprehensive set of performance measures helps reduce pre-decision uncertainty and facilitate decision-making (Galbraith 1973; Ittner and Larcker 2003). Thus one of the purposes of this study is to provide information that can help inform decision-making; the purpose is not to resolve the conflict of energy development. Through the interviews and development of the sustainability performance measures we were able to gain assurance that there is indeed a conflict. Prior to the development of these measures, no stakeholder had persuasive evidence of this. However, after compiling the performance measures and evaluating the archival data it is clear that energy development does affect animal populations in the Pinedale area. But what also is clear is that there are numerous other environmental, social and economic outcomes of energy development that decision-makers were not considering or had no information with which to include the outcome in their decision-framework. Thus the conflict was viewed narrowly and with emotions instead of broadly and with information.

To facilitate the discussion of sustainability performance measures in decision-making, we first assess their quality (see next section). Although a decision-maker may have quality measures, it is still necessary to determine whether the measure is relevant to the decision conflict under deliberation. We then turn our attention to the use of these performance measures in decision models, including the need for strategic alignment and assessment of the measure’s cause-and-effect associations. We end with a brief illustration of how these sustainability performance measures could be used in a decision model (see below).
Quality of performance measures

The measures identified in Table 1 vary in their objectivity, accuracy and understandability, or ease of interpretability. For example, precipitation and width of bottleneck are relatively easy to measure. Precipitation is an objective measure provided by an independent third party. It is collected in a systematic manner and reported consistently over time. Similarly, the width of the bottleneck is easy to verify since it physically exists, can be measured using standard measurement scales, and is observable to the eye. It also can be measured consistently over time; moreover, it can be documented with photographs making the change over time easy to see. On the other hand, performance measures such as the variance from animal population by animal type is more difficult to measure. This figure is derived from the WGF Annual Reports. While the planned population is not in question, the ‘true’ animal population is more difficult to measure. For example, for the ungulates, WGF employees estimate animal populations during their annual migration to and from their winter range.

After the decision-maker has assessed the performance measures and understands the quality of the information available, he or she must then assess how to best interpret the measure. There is no doubt that the use and interpretability of the information will vary across the decision conflict and across the decision-makers. For example, the optimum size of the animal population may be disputed. Energy developers may view the optimum animal population as one that is simply above the level at which it would be placed on an endangered species list while a conservationist group with a mission focused on saving the sage grouse may interpret animal population as ‘more is better’. Another example is that different decision-makers could have differing (and strong) opinions on whether tax revenue or tourism increases are necessarily improvements in social or economic performance.

In sum, we are not suggesting that all performance measures are ‘quality’ measures nor are we suggesting that all decision-makers (or stakeholders) will interpret the results of the performance measures similarly. Recall that this is consistent with existing literature that suggests that the decision context will influence decision-makers’ perceptions of information quality (Ballou et al. 2004). But, we do posit that these performance measures provide a foundation on which decision-makers can begin to make more informed decisions. They provide a base of information to which the decision-maker can then apply his or her specific expertise, skills and perspective.

Relevance of performance measures

The performance measures identified in Table 1 allowed us to reach agreement that: (1) energy development was harmful to wildlife; and (2) there were additional environmental, social and economic impacts that were ignored in the discussion. To move past this point, decision-makers must consider the relevance of each performance measure. In this study, the specific decision could be whether to lift the moratorium or whether to allow additional energy development on public lands. Depending on the decision, the specific performance measure may or may not be relevant, especially in its current state. For example, the issue of safety may be pertinent to the lifting of the moratorium but not to the decision of whether to develop more lands. Moreover, many of these measures provide information that corresponds to the current level of drilling activity. For example, consider the bottleneck. It is currently measured as a level that corresponds to the current level of energy development activity. While it is clear that this measure is objective and accurate, it is unclear how increasing drilling will affect the rate of decrease in the width of the bottleneck. The relevance of this measure is also unclear since it depends on the specific decision being deliberated. If the decision under deliberation is whether to allow additional drilling in the Trapper’s Point area, then the width of the bottleneck, or estimated impact to that width, becomes highly relevant. If, however, the decision under
deliberation is whether to allow year-round drilling on existing sites that are outside the Trapper’s Point area, then this measure is not likely to be relevant.

To be truly relevant to the decision it is likely that decision-makers will need to make estimates regarding the change in the measure that will correspond to the change in the level of drilling. For example, the economic measures provide information on how the current level of drilling affects the county’s wealth. Decision-makers will need to take this information and make estimates of the additional funding that will correspond to either increased development on public lands or the lifting of the moratorium that will result in estimated increases in drilling. In sum, the sustainability performance measures identified in Table 1 are informative for decision-making. That is, they provide information for decision-makers that will help reduce pre-decision uncertainty. However, that is not to say that they will not need massaging or manipulation before they become completely usable in each specific decision-context for each specific decision-maker.

Cause-and-effect relations
In order for performance measures to be truly effective they must accurately reflect causal linkages that capture the potential impacts for sustainability performance. This is a difficult task since it is often hard to substantiate causal relationships among variables. Decision-makers must hypothesise how each of the actions that could be taken will impact the environmental, social and economic performance. As actual performance measures are collected, these can be compared with the hypothesised performance relationships and modifications made to reflect additional information.

In creating cause-and-effect models, decision-makers will need to consider the various relations among the variables. Some variables, such as number of drilling rigs, clearly are part of the drilling process and directly impact performance. Other measures, such as precipitation, are not a part of the drilling process, but may impact performance; instead they are considered control variables. For example, consider the measure, ‘variance from plan objective by animal type’, which provides information on animal populations. This information is critical since animal population is an inflammatory issue in the conflict of whether oil and gas companies should be allowed to operate more rigs and develop more land in the Pinedale area. But decision-makers must be mindful to control for factors other than energy development that may have an effect on animal populations. For example, we are able to provide measures for two control variables that are also likely to affect animal populations: number of inches of rainfall and number of hunting licences issued. While these measures are not ‘caused’ by energy development, they do have an impact on animal populations. Thus, in order to isolate the effects of drilling on animal populations, decision-makers will need to control for precipitation and hunting. In sum, the effect of energy development on animal populations will be overstated (and represent a maximum ‘boundary’ effect) unless other factors such as precipitation and issuance of hunting licences are also taken into account.

When performance is reported further analysis thus may permit decision-makers to partial out and better specify the causes of sustainability performance. As the causal relationships are further specified and tested, modifications can be made to the causal links and decision models being used. On the first iteration of the measurement system, the primary impacts are likely identified and measured based on the hypothesised relationships. It would be unusual in most cases that an exhaustive list of all relationships and impacts would be identified. As additional data is collected and analysed, there is a better understanding of primary and secondary impacts (and the relationships between them) and additional measures are developed, some measures are refined and some are dropped. This becomes a continuous process to improve decision-making through a better set of collected information subject to the cost of the information being acquired.
Cause-and-effect relations can also be substantiated through interview data when longitudinal data is not available (as in this case) (Ittner and Larcker 2003).

The information system thus provides the ability for each of the decision-makers to use the information in ways that may fit their own implicit or explicit decision models. That is, poor decisions are often the result of inadequate information or the result of poor decision models even if the information is adequate (Sprinkle 2003). In Pinedale, the current information was mostly of both very low quantity and quality. Decisions were being made blindly. The improved information provides a clearer understanding of the impacts, the performance and how actions by various stakeholders could change future sustainability performance. However, even when the information quality is improved, the individual decision models may not change and the different stakeholders may want to use the information to support their predetermined positions. But having sustainability performance measures will facilitate a discussion and negotiation among the stakeholders that is more difficult without the information.

Illustration: Expansion of energy development

The purpose of this sub-section is to provide an illustration of how these performance measures could be used in a decision model related to a specific decision about whether to expand energy development. The proposed models are shown in Figure 2. Figure 2(a) shows the model that was being used when we first arrived at Pinedale. There was no relevant information and different stakeholders simply believed that expansion in energy development either would or would not have a negative impact on animal populations. The model in Figure 2(b) is one potential decision model developed based on the archival and interview data discussed earlier in the paper.

The decision model hypothesises that animal populations, the width of the bottleneck\(^{11}\) and the number of hunting licences issued will decrease if energy development is expanded. The model hypothesises that the total number of days new drilling rigs are in existence, the number of archaeological sites recorded, the amount of the energy assessment, amount of scholarship funding, assessed valuation of the Pinedale school district, and the percentage of Sublette County property tax valuation derived from oil and gas will be positively affected. Other factors that are not affected directly by energy development but must be controlled for include the number of inches of rainfall, and the price in dollars per Mcf. The model predicts that precipitation, the width of the bottleneck, the number of working rigs and the number of hunting licences will influence animal populations, while the price of oil will influence the school and property tax valuations. The objective of this model is to capture loss of habitat, decrease in animal populations and visual pollution, which will measure environmental performance; preservation of archaeological sites, which will capture social performance; and funding for education, revenue from hunting licences and Sublette County wealth, which will measure economic performance.

Figure 2(b) represents only an illustrative model. Decision-makers will have to estimate some of the effects in translating levels to changes in order to capture the increase in energy development. Decision-makers will need to continue to work to develop a better understanding of the model and try to refine the model through an iterative process (Ittner and Larcker 2003). Other aspects of the model will also have to be considered, including how to weight the various factors and make trade-offs, align qualitative information with strategic objectives, and integrate the remaining qualitative information gleaned from the interviews that was unable to be captured through performance measures and utilised in the illustrative model. Recall also that extant literature shows that the decision context influences decision-makers’ perceptions of the use and quality

\(^{11}\) Note that this assumes that the expansion would encroach on the Trapper’s Point area.
**Figure 2** ILLUSTRATIVE EXAMPLES: (a) ORIGINAL MODEL; (b) ILLUSTRATIVE MODEL

(a) Expansion in energy development → +/ns → Variance from plan for population objective by animal → Environmental performance

(b) Expansion in energy development

- # of inches of rainfall
- Variance from plan for population objective by animal
- Width of bottleneck
- # of days new drilling rigs are in existence
- # of working rigs
- # of archaeological sites recorded
- Amount of energy assessment
- Amount of scholarship funding
- Assessed valuation of Pinedale school district
- # of hunting licences issued
- % of Sublette City property tax valuation derived from O&G

| Expansion in energy development | Price in $ per Mcf |

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**ns**: not significant

Environmental performance (capture loss of habitat, decrease in animal population and visual pollution)

Social performance (capture preservation of archaeological sites)

Economic performance (capture funding for education, revenue source from hunting licences and Sublette County wealth)
of information (Ballou et al. 2004). Thus, while decision-makers across stakeholder groups will now at least have a common starting point, the interpretation of information will no doubt differ across stakeholders. Finally, decision-makers will need to complete the assessment by measuring stakeholders’ reactions to the model and estimating the economic ramifications to the county, to the corporation or to the environment.

**Conclusion**

Organisations must consider differing and multiple objectives emanating from diverse stakeholders. Some of these objectives relate to social and environmental impacts of organisational actions. Where once managers might have made a routine capital investment decision based on estimated cash flows including such traditional items as capital outlay, cost of capital, and reduced expenses or additional sales, managers now must consider social and environmental impacts of the decision as well. For example, a McKinsey survey reported that almost all 400 corporate executives surveyed agreed that they must be aware of pollution and other environmental effects stemming from corporate decisions (Berry and Rondinelli 1998). While research suggests that organisations need to evaluate diverse stakeholder interests, be aware of social and economic impacts, and integrate this into decision-making, there is little guidance on the underlying process. Furthermore, organisations including non-profit advocacy organisations and governmental agencies also struggle with these same types of decision.

The purpose of this article is to provide insights that are useful in decision-making. We do this by studying one conflict in its natural, rich context and illustrate how to identify a complete set of stakeholders and measure sustainability performance. We identify multiple diverse stakeholder groups. We present evidence of multiple sustainability performance measures, including social, environmental and economic indicators that could result from a sustainability action (i.e. the expansion of drilling activities). We then draw on the extensive case evidence to discuss recommendations and implications for managers on how the information can be used to inform decision-making.

Similar to most studies, this one has its limitations. We create a dataset that combines archival, interview and observations in order to provide evidence on multiple types of performance measure: social, environmental and financial. This research design enables us to capture the intricacies inherent in a natural setting while being able to triangulate results across research methods. However, the evidence provided is from a single conflict. Notwithstanding that fact, we believe that our findings and hence our conceptual discussion on how to use this information to facilitate decision-making is generalisable to other CSR and sustainability decisions, such as a decision to operate an oil rig off the coast of Africa, or a decision to outsource manufacturing facilities to a developing country. To the extent possible, we substantiate qualitative interview data with quantitative archival data and observations to assess social, environmental and economic performance. Owing to data limitations, however, we cannot accomplish this for all impacts and, for tractability, we do not include the entire universe of sustainability performance measures.

Finally, this article is the first step in illustrating how organisations can use information to inform decision-making in the CSR area. Future research that investigates how organisations then balance and weigh stakeholder reactions, trade off social vs. environmental vs. financial performance, and form their stakeholder reactions, will provide additional insights for this stream of literature. That is, this study focused on providing decision-makers with information in the form of performance measures. Future research could then investigate the workings of the decision models that
decision-makers plug these performance measures into in terms of trade-offs, weightings of various performance measures, use of qualitative information, interpretability of information and other judgements. Moreover, not all information lends itself to formal performance measurement systems and the ‘messier’ the data, the closer to the source should be the decision-making (Galbraith 1973). As this field study points out, decision-makers will have to grapple with how to best combine performance measures of varying quality with qualitative information available through interviews. It is critical to note that an option is not to forgo gathering the information, as was the case in Pinedale, but to gather the messy data, and try to make some sense of it. One possible suggestion is to implement lateral relations: that is, more team or group work at the source of the CSR decision (Galbraith 1973). Thus an interesting direction for further research would be to intertwine the CSR literature with the organisational design literature to determine whether the decision-rights are pushed down in the organisation with offsetting control in incentives.

Despite the limitations above, this study makes a significant contribution to the literature on managerial accounting practices. As stated above, when we began this project we questioned every stakeholder for measures supporting their position. While we heard many self-serving statements, none of them could document a coherent story or had developed feasible performance measures. Thus all of the relevant decision-makers and organisations had inadequate information and measures for effective decision-making. Prior literature has found that ‘both the provision of information for decision-facilitating purposes and the characteristics of that information have been found to improve individuals’ knowledge and ability to make better judgments and decisions’ (Sprinkle 2003: 304). Using a context in which integrated information systems are lacking, this article provides an illustration on how managers can identify stakeholders, collect information, measure performance and use that information to inform decision-making for CSR. In today’s business world, where decision-makers are expected to function as leaders even while facing fuzzy decisions and multiple stakeholders, having increased information on social, environmental and economic performance can enable that leader’s effectiveness (Maak and Pless 2006).

References


# Appendix: interviews

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<tr>
<th>Stakeholder group</th>
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<tr>
<td>Energy companies</td>
<td>▶ VP External Relations, Shell</td>
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<td></td>
<td>▶ Land Analyst, Shell</td>
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<td></td>
<td>▶ General Manager Pinedale Division, Questar</td>
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<td></td>
<td>▶ Division Operation Manager, EOG Resources</td>
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<td></td>
<td>▶ Permitting Agent, EnCana Oil and Gas (USA) Inc.</td>
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<td></td>
<td>▶ Bureau of Land Management Field Manager</td>
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<td></td>
<td>▶ Bureau of Land Management Archaeologist</td>
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<td></td>
<td>▶ Wyoming Game and Fish Department</td>
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<td></td>
<td>▶ Senator’s Regional Office, Jackson Hole, Wyoming</td>
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<td></td>
<td>▶ Wyoming Oil and Gas Commission</td>
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<td></td>
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<td>▶ County Planning and Zoning</td>
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<td></td>
<td>▶ Mayor, Pinedale, Wyoming</td>
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<td>Environmental and conservation</td>
<td>▶ Upper Green River Valley Coalition, Director</td>
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<td>groups</td>
<td>▶ Upper Green River Valley Land Trust</td>
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<td></td>
<td>▶ Wildlife Conservation Society</td>
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<tr>
<td>Other</td>
<td>▶ Superintendent of Pinedale School Systems</td>
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<td></td>
<td>▶ Local Rancher, Sublette County</td>
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<td>▶ Science Teacher, Pinedale, Wyoming</td>
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<td>▶ Tourists</td>
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<td>▶ Wagon Wheel Citizens Committee Members</td>
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