Environmental Impact Assessment Review 57 (2016) 187–194

Contents lists available at ScienceDirect

Environmental Impact Assessment Review

journal homepage: www.elsevier.com/locate/eiar

A game theory perspective on environmental assessment: What games are played and what does this tell us about decision making rationality and legitimacy?

Alan Bond [a,d,*], Jenny Pope [b,d], Angus Morrison-Saunders [c,d], Francois Retief [d]

[a] School of Environmental Sciences, University of East Anglia, United Kingdom
[b] Integral Sustainability, Australia
[c] Murdoch University, Australia
[d] Research Unit for Environmental Sciences and Management, North-West University, South Africa

ARTICLE INFO

Article history:
Received 9 August 2015
Received in revised form 21 January 2016
Accepted 22 January 2016
Available online xxxx

Keywords:
Game theory
Environmental assessment
Legitimacy
Instrumental rationality
Deliberative rationality
Decision making

ABSTRACT

Game theory provides a useful theoretical framework to examine the decision process operating in the context of environmental assessment, and to examine the rationality and legitimacy of decision-making subject to Environmental Assessment (EA). The research uses a case study of the Environmental Impact Assessment and Sustainability Appraisal processes undertaken in England. To these are applied an analytical framework, based on the concept of decision windows to identify the decisions to be assessed. The conditions for legitimacy are defined, based on game theory, in relation to the timing of decision information, the behaviour type (competitive, reciprocal, equity) exhibited by the decision maker, and the level of public engagement; as, together, these control the type of rationality which can be brought to bear on the decision. Instrumental rationality is based on self-interest of individuals, whereas deliberative rationality seeks broader consensus and is more likely to underpin legitimate decisions. The results indicate that the Sustainability Appraisal process, conducted at plan level, is better than EIA, conducted at project level, but still fails to provide conditions that facilitate legitimacy. Game theory also suggests that Sustainability Appraisal is likely to deliver 'least worst' outcomes rather than best outcomes when the goals of the assessment process are considered; this may explain the propensity of such 'least worst' decisions in practise. On the basis of what can be learned from applying this game theory perspective, it is suggested that environmental assessment processes need to be redesigned and better integrated into decision making in order to guarantee the legitimacy of the decisions made.

1. Linking rationality and legitimacy of EA with game theory

Environmental Assessment (EA) was established based on a technical-rational model which argues that better information will lead to better decisions. This follows the logic that decision-makers display 'instrumental rationality' which in the context of EA means taking the decision, based on the evidence available, which best delivers the goals of EA. However, the goals of environmental assessment are considered to have changed over time from environmental advocacy to sustainable development (Morrison-Saunders and Fischer, 2006; Morrison-Saunders and Therivel, 2006), and there are contested meanings of sustainable development (Bond and Morrison-Saunders, 2011). This calls into question the extent to which instrumental rationality is possible, or desirable.

Another issue with decision makers displaying instrumental rationality is the argument that it allows powerful stakeholders to influence outcomes to meet their own ends. The theory is that through the application of instrumental rationality 'knowledge speaks to power' (Pope et al., 2013). But Cashmore and Axelsson (2013) argue that knowledge does not necessarily speak to power as power can control the knowledge made available to decision makers (Cashmore et al., 2008).

Owens et al. (2004, p.1947) argue that the contested decision-making (e.g. where the definition of sustainable development is contested, or the outcomes inequitable) creates decision legitimacy problems: "*this brings us to another failure of the technical-rational model*: *appraisal based on contested judgments or frames loses legitimacy and becomes practically inadequate for delivering reasonably consensual policy outputs*". Appelstrand (2002, p.285), writing about forestry policy, describes this problem of technical-rational decision-making failing to cope with contested values as a "legitimisation crisis". Suchman (1995, p.574) synthesises understanding from wider literature to define legitimacy as "*a generalised perception or assumption that the actions of an entity are desirable*, *proper*, *or appropriate within some socially constructed system of norms*, *values*, *beliefs*, *and definitions*". As such, legitimacy in the context of EA contains elements of goal framing (i.e. a

* Corresponding author at: School of Environmental Sciences, University of East Anglia, United Kingdom.

http://dx.doi.org/10.1016/j.eiar.2016.01.002
0195-9255/

common understanding of sustainability is needed) and of equity (i.e. the outcomes of the decision need to favour all stakeholders equally). We therefore define a legitimate EA process as one which all stakeholders agree is fair and which delivers an acceptable outcome for all parties. This is in line with the definition of Adger et al. (2005, p.83) that legitimacy means "the extent to which decisions are acceptable to participants and non-participants".

Therefore, to avoid the possibility of EA being manipulated for the instrumental ends of the powerful, Owens and Cowell (2002) argue that 'deliberative rationality' needs to be exercised. This involves a broad cross section of society agreeing the normative expectations (of sustainable development) that they could all live with (Gauthier, 2013). In addition, more inclusive participation is better able to deliver equity in decision making (see, for example, Kakonge, 1996; O'Faircheallaigh, 2010; Petts, 2003; Shepherd and Bowler, 1997; Sinclair and Fitzpatrick, 2002; Wiklund, 2011). It is widely recognised that the timing of the participation is crucial in order to facilitate deliberation, with early participation, as encompassed in the Arhus Convention (UNECE, 1998) being an essential precondition of a legitimate process (Agterbosch and Breukers, 2008).

Deliberative rationality relies on broad participation of stakeholders, including members of the public. It is not to be confused with the type of deliberation that might take place in a decision-making committee that typifies many democratic systems. In these committees, a group (of elected representatives) make a decision which Kugler et al. (2012) argue simply reinforces the application of instrumental rationality. Kugler et al. (2012, p.473) provide some hypotheses for why this might be the case, including "*the social support of shared self-interest (or, greed) hypothesis argues that groups are greedier than individuals because group members provide each other with support for acting in a selfish, in-group-oriented way*"; and "*the identifiability hypothesis, which proposes that in interindividual interactions players assume that they are identifiable and thus can be held accountable … in intergroup interactions responsibility for a choice is by its very nature obscured*". Thus, deliberative rationality is not necessarily delivered by a decision-making committee.

Game theory has been defined as "*the study of mathematical models of conflict and cooperation between intelligent rational decision-makers*" (Myerson, 1991, p.1), and it assumes that rational decisions based on self-interest (i.e. exhibiting instrumental rationality) are made by players in a game where there are individual decision-makers (Poundstone, 1992). Different decision contexts can be modelled using different games (including cooperative games that allow for deliberation (Colman, 1995)), and these different games provide insights into the timing of information provision, the levels of engagement (i.e. extent of participation of stakeholders and so the extent to which deliberative rationality can be facilitated and legitimacy achieved), and the extent to which equity (also a prerequisite for legitimacy) is delivered. Where the decision context matches one of the games that is modelled through game theory, the outcomes in terms of decision rationality and legitimacy can potentially be predicted. As such, game theory can be applied to EA cases in order to investigate the rationality and legitimacy of the decision-making that takes place.

Thus, it is clear that the technical-rational model of decision making subject to Environmental Assessment (EA) (at all levels: projects, plans, policies) is subject to criticism, and that the contested nature of the goals and outcomes of EA has led to a 'legitimisation crisis'. We argue that there is a need both to apply deliberative rationality in decision making to agree the goals of EA, and to focus more on the equity of outcomes, to facilitate greater legitimacy. Based on this context, in this paper we aim to examine the rationality and legitimacy of decision-making subject to project-level Environmental Impact Assessment (EIA), and to plan-level Sustainability Appraisal (SA) in England through the lens of game theory.

Applying game theory to EA decision contexts is a novel means of investigating and evaluating practise from the viewpoint of rationality and legitimacy. The next section of the paper introduces game theory, although it is necessarily brief as the literature on this topic is vast and we introduce the concepts without recourse to the mathematical proofs that underlie the usual application of the theories. This section introduces the games which will be matched against the EA processes. The third section explains our methodology for evaluating the rationality and legitimacy of English EIA and SA by setting out the analytical framework we have employed, and justifying the selection of case studies. The fourth section applies the method to the case study and discusses the implications of the results. Finally, conclusions are provided to clarify our learning in the context of the aim of the paper.

2. Overview of game theory literature

In game theory, the basic concept is that there are two or more decision makers (called 'players'), each of which has a choice of ways of acting (Colman, 1995). In mathematical applications of game theory, it also has to be possible to quantify the preferences for decision outcome of each player in order to analyse the different possible outcomes. Different decision-making contexts are represented by different games which are played by players who are making rational decisions typically based on self-interest, i.e. displaying instrumental rationality (Schubik, 1982). The types of games are determined by the types (and number) of players and the types of decisions that have to be made. The development of game theory is credited to John von Neumann (Poundstone, 1992). The derivation of game theory was apparently based on observations of poker players, but Poundstone (1992) explains the basis for the theory through childhood games. He refers to cake division whereby to avoid two children fighting over which gets the biggest piece of cake, one child gets to cut the cake whilst the other then chooses which piece to eat (the *cake slicing* game). The argument is that the best strategy for the first child is to anticipate the second child will choose the largest piece, as a result the first child will likely seek to cut the cake evenly in order to get the optimum outcome. This is known as the 'minimax' principle whereby the cake cutter will maximum the minimum he/she will get. One of the bases of game theory is therefore the self-interest of players (Poundstone, 1992).

In the above description, the behaviour is reciprocal in that each player's decision has an effect on the outcome for the other. But the example is not typical. In the cake example both children can see the cake and the outcome is transparent, which is a key determinant of legitimacy in decision making (Jasanoff, 1997) and a basic principle for environmental assessment (International Association for Impact Assessment and Institute of Environmental Assessment, 1999). In reality the outcome is often more complex. Poundstone (1992) points to the frequent application of game theory to *zero-sum* games – i.e. those like poker where one player wins all the money that has been bet by all the individual players in the game, but all the other player have lost money. In a game of poker – all players exhibit self-interest, but only one player's self-interest is satisfied, everyone else loses and presumably feels aggrieved as a result.

Another game is known as the *prisoner's dilemma*. In this case of two game players, neither knows what the other will do. Each has two possible choices and so there are just four potential outcomes (Schubik, 1982). It is known as the prisoner's dilemma because it is best explained by reference to two prisoners, interrogated separately, whose gaol sentences are dependent on whether they cooperate with the authorities or not, and also on whether the other prisoner does the same. By way of example, the sentences may be as follows:

- If one prisoner cooperates with the authorities and implicates the other prisoner, and the other prisoner says nothing, the cooperating prisoner will go free and the other prisoner will get a ten year sentence.
- If both prisoners choose not to cooperate with the authorities, both will go to prison for two years each.