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Reviewing the Role of Stakeholders in Operational Research: Opportunities for Group Model Building

V. de Gooyert, E.A.J.A. Rouwette, H.L. van Kranenburg
Institute for Management Research, Radboud University Nijmegen
P.O. Box 9108, 6500 HK, Nijmegen, The Netherlands
Telephone: +31 (24) 361 55 78, Facsimile: +31 (24) 361 19 33
E-mail: v.de.gooyert@fm.ru.nl

Abstract

Stakeholders have always received much attention in system dynamics, especially in the group model building tradition, which emphasizes the deep involvement of a client group in building a system dynamics model. In organizations, stakeholders are gaining more and more attention by managers who try to balance the interests of various stakeholders. This trend is reflected in management literature where much advancement is made in what is known as stakeholder theory. In stakeholder theory it is stated that the implementation of its principles is one of its biggest problems because tools that facilitate balancing the interests of stakeholders are supposedly lacking. Operational research on the other hand aims to advance these exact tools. Apparently, there is a large gap between management literature and operational research, including system dynamics and group model building. To assess how group model building and other operational research methods help to implement stakeholder theory, we provide a systematic review of 140 operational research applications on the topic 'stakeholders'. Content analysis of these articles shows the potential of group model building specifically, as this is a method that facilitates improving the rational, organizational process, and transactional level of an organization's stakeholder management capability.

Keywords: stakeholder theory; operational research; systematic review; group model building

Word count (references and the appendix excluded): 4,954

Introduction

Stakeholders have always received much attention in system dynamics (Forrester, 1961; Richardson and Pugh III, 1981; Sterman, 2000), especially in the group model building tradition, which emphasizes the deep involvement of a client group in building a system dynamics model (Andersen and Richardson, 1997; Rouwette et al., 2011; Vennix, 1996, 1999). Elias et al. (2000) reviewed system dynamics applications (Forrester, 1961; Gardiner and Ford, 1980; Hsiao, 1998; Maani and Cavana, 2000; Vennix, 1996) to show that stakeholders form an important part of the methodology, "although not always explicitly" (p. 178). Other operational research methods also acknowledge the importance of stakeholders.

More and more organizations try to balance the interests of various stakeholders, which in stakeholder theory are defined as “groups or individuals who can affect or are affected by the achievement of an organization’s mission” (Freeman, 1984; Parmar et al., 2010). These organizations are different from traditional organizations that merely focus on the interest of stockholders, by maximizing profits in the short term (Friedman, 1970; Jensen, 2002; Sundaram and Inkpen, 2004). Organizations trying to balance the interests of various stakeholders may address amongst others employees, customers, suppliers, and the community as a whole. *Stakeholder theory* is a tradition in management literature that tries to expand our knowledge on the challenges these organizations face (Donaldson and Preston, 1995; Laplume et al., 2008). In this domain, hundreds of articles have been making considerable advances in theorizing why organizations should take stakeholders into account (Phillips et al., 2003), which stakeholders should be taken into account (Mitchell et al., 1997), and what effects organizations may expect as a result (Jones, 1995).

The *implementation* of stakeholder theory has been found to be one of its biggest problems (Laplume et al., 2008). Kaler (2006) argues that, while organizations may seek to balance the interests of different stakeholders, this is too analytically complex to be carried out in practice. The tools that enable organizations to find the right balance are supposedly lacking. Wolfe and Putler (2002) point out that achieving this balance becomes even more complex if stakeholder groups themselves are heterogeneous. Margolis and Walsh (2003) argue that, compared to a traditional firm, managers in a stakeholder firm face additional tasks, including answering stakeholder issues themselves, or controlling, monitoring, and disciplining the stakeholder engagement of others. Operational research is a scientific tradition that is specifically aimed at developing tools to aid problem solving or decision-making. Management literature is focused on *expanding knowledge*, which in the case of stakeholder theory involves knowledge about the problems that organizations encounter when trying to balance the interests of different stakeholders. Operational research on the other hand always has a strong component of *problem solving* or *decision support*, to an increasing extent including problems or decisions in which stakeholders have an important role. Apparently there is a large gap between the management literature domain and the domain of operational research, of which the latter aims to develop the tools that the first indicates are lacking.

Our study consists of a review of the role that stakeholders have been playing in applications of operational research. Our reasons to conduct this study are twofold. As indicated, stakeholders play an important but sometimes implicit role in operational research (Elias et al., 2000). By analyzing commonalities and differences between various operational research applications on the topic ‘stakeholders’, including system dynamics and group model building, we aim to make the role of stakeholders explicit and facilitate the development of the field in this respect. The second reason for conducting our study is the observed gap between management literature and operational research. We review how developments in operational research relate to challenges that organization face as identified in management literature. By analyzing patterns in applications of operational research we identify four traditions in which operational research has been helping organizations to balance the interests of various

stakeholders: ‘optimization’, ‘insights in trade-offs’, ‘understanding the problem’, and ‘managing the boundaries’. We show how system dynamics and group model building belong to the tradition of ‘understanding the problem’. In stakeholder theory, Freeman (1984) distinguishes between a rational, an organizational process, and an interaction level of an organization’s stakeholder management capability. By relating these three levels from stakeholder theory with the various traditions in operational research, we show how the two domains are linked. Based on our analysis, we stress the potential of group model building for helping with the challenges of stakeholder theory, as this is a method that facilitates improving all three levels of an organization’s stakeholder management capability.

With this study we aim to contribute to closing the gap between two domains that are historically far apart: management literature focusing on *problems* that organizations deal with and operational research focusing on advancing *solutions*.

Background: stakeholder theory and operational research

In order to make a link between stakeholder theory and operational research, we first describe what stakeholder theory is, what advances have been made in the conceptualization of stakeholders, what reasons have been found for adopting stakeholder theory’s principles, and what advances have been made in conceptualizing an organization’s stakeholder management capability. Since the seminal work of Freeman (1984), stakeholder theory has grown beyond a single theory into a ‘research tradition’ (Trevino and Weaver, 1999) that encompasses a rich ‘genre of theories’ (Freeman, 1994), emphasizing *stakeholders*. A widely used definition of stakeholders is “groups and individuals who can affect, or are affected by, the achievement of an organization’s mission” (Freeman, 1984, p. 52). By putting emphasis on stakeholders, this genre sets itself apart from those that hold *stockholders* as the only stakeholders that business managers should take into account (Friedman, 1970). The field of stakeholder theory has progressed enormously in the last couple of decades and has branched out into a variety of disciplines including business ethics, strategic management, finance, accounting, marketing, and management (Parmar et al., 2010).

Since the origin of stakeholder theory, many answers have been given to the question which stakeholders should be taken into account (Mitchell et al., 1997). One major distinction that has been made is between the narrow and the wide sense of stakeholders (Freeman and Reed, 1983, p. 91). A stakeholder in the narrow sense is any identifiable group or individual on which the organization is dependent for its continued survival (i.e. employees, customer segments, certain suppliers, key government agencies, shareowners, particular financial institutions, as well as others are all stakeholders in the narrow sense of the term). A stakeholder in the wide sense is any identifiable group or individual who can affect the achievement of an organization’s objectives or who is affected by the achievement of an organization’s objectives (i.e. public interest groups, protest groups, government agencies, trade associations, competitors, unions, as well as employees, customer segments, shareowners, and others).

Organizations may have different reasons to adopt the goal of balancing various stakeholders’ interests: because it is in the interest of the organization or because they see taking stakeholders into account as having a value of its own. Jones summarizes the

reasons why organizations that adopt stakeholder theory “will have a competitive advantage over firms that do not” (1995, p. 422): these firms will reduce amongst others “agency costs, transactions cost, and costs associated with team production”, and more specifically “monitoring costs, bonding costs, search costs, warranty costs, and residual losses” (Jones, 1995, p. 422). Other organizations may see stakeholders as having an intrinsic value and they see taking stakeholders into account as their moral obligation. This is reflected in ‘the normative cores of stakeholder theory’ as stressed by Donaldson and Preston (1995). Phillips et al. (2003) show that these normative cores include the common good (Argandoña, 1998), feminist ethics (Burton and Dunn, 1996; Wicks et al., 1994), risk (Clarkson, 1994), integrative social contracts theory (Donaldson and Dunfee, 1999), property rights (Donaldson and Preston, 1995), Kantianism (Evan and Freeman, 1988), the doctrine of fair contracts (Freeman, 1994), and the principle of stakeholder fairness (Phillips, 1997, 2003).

Freeman (1984) considers an organization to possess stakeholder management capabilities when it is able to combine three levels of analysis, inspired by Allison’s analysis of decision making (1971). On the *rational* level, organizations must be able to identify all relevant stakeholders and their stakes, resulting in correct stakeholder maps. On the *organizational process* level, organizations must have routines in place to take these stakes into account in their operating procedures. These routines aim to translate the stakeholder map into specific strategic decisions. On the *transactional* level, organizations must bargain to balance the interests of stakeholders to achieve the organization’s purpose. An organization’s stakeholder management capability depends on its ability to allocate resources to interactions with stakeholders.

Operational research is a scientific tradition that is specifically aimed at developing tools to aid problem solving or decision-making, to an increasing extent including problems or decisions in which stakeholders have an important role. This is especially true for group model building, which emphasizes the deep involvement of a client group in building a system dynamics model (Andersen and Richardson, 1997; Rouwette et al., 2011; Vennix, 1996, 1999).

When looking at the topic of the respective fields, management literature and operational research seem to complement each other. To show the difference between the two we use the topology of Donaldson and Preston (1995). After reviewing stakeholder theory, Donaldson and Preston (1995) show how management literature is focusing on expanding knowledge of how organizations balance the interests of various stakeholders (descriptive), what the impact is of ‘taking stakeholders into account’ on ‘firm performance’ (instrumental), and what the arguments are for the statement that stakeholders should be taken into account (normative). What they deem the most elemental, however, is that stakeholder theory should be *managerial* because in the end managers have to make an actual decision that somehow balances the interests of various stakeholders (Donaldson and Preston, 1995). The irony is not lost on us that this *managerial* aspect of stakeholder theory that Donaldson and Preston (1995) consider to be lost out of sight in *management* literature, can be found in operational research which is managerial in the sense that it focuses on the development of tools that can be deployed to actually implement the idea that interests of stakeholders should be balanced.

Management literature	Operational research
<i>Descriptive:</i> How do organizations balance the interests of various stakeholders?	<i>Managerial:</i> What tools can be deployed to balance the interests of various stakeholders? What are the effects of deploying those tools?
<i>Instrumental:</i> What is the impact of ‘taking stakeholders into account’ on ‘firm performance’?	
<i>Normative:</i> What are the arguments for taking stakeholders into account?	

Table 1: ‘The stakeholder’ in management literature and operational research (adapted from Donaldson and Preston, 1995)

To study how management literature and operational research are linked, and what opportunities there are for group model building, we now turn to our systematic review of operational research applications on the topic ‘stakeholder’. We identify four operational research traditions. By relating the three stakeholder management capability levels from stakeholder theory to the traditions in operational research, we show how the two domains are linked.

Method for literature review

Laplume et al. (2008) provided a review of stakeholder theory based on content analysis of articles in management journals. We try to stay close to their method, but instead of reviewing stakeholder theory articles in management journals we review applications referring to the topic ‘stakeholder’ as reported in operational research journals. We apply a method similar to Laplume et al. (2008) and present our results in a similar fashion to be able to provide comparable insights in the progress of stakeholder theory and the progress of operational research regarding stakeholders.

We confined our sampling to leading journals on applications of operational research. We included journals that belong to the *Journal Citation Reports - Science edition 2011* subject category ‘operations research & management science’, yielding 77 journals. To obtain a manageable number of journals, we narrowed the selection to those journals that have an impact factor of 0.800 or higher, confining the selection to 41 journals. We excluded all journals that focus on a particular domain (e.g. *Transportation Science*, *Safety Science*), as well as journals that focus on conceptual contributions (e.g. *Mathematical Programming*, *Journal of Global Optimization*). This resulted in the final selection of eleven journals: *Annals of Operations Research*, *Computers & Operations Research*, *Decision Support Systems*, *European Journal of Operational Research*, *Expert Systems with Applications*, *Interfaces*, *Journal of the Operational Research Society*, *Management Science*, *Omega*, *Operations Research*, and *OR Spectrum*.

A search in *Web of Knowledge* for articles in these journals, published up to 2012, with the word ‘stakeholder’ appearing in the title, abstract, or keywords (author keywords as well as ‘keywords plus’), yielded 171 articles. We then repeated the search using the same criteria with *ScienceDirect*, resulting in four additional articles. A third search with *EBSCOHost* did not result in additional articles. We excluded all articles that did not describe a real-world or hypothetical application of operational research such as

literature reviews, descriptive research articles and conceptual articles. This resulted in a final selection of 140 articles, see table 1 below.

	AOR	COR	DSS	EJOR	ESA	I	JORS	MS	O	OR	ORS	Total
Year												
1991						1				1		2
1992			1									1
1993												0
1994			1			1		1	1			4
1995			1	1			1					3
1996												0
1997				1		1	1					3
1998				1			1					2
1999						1	3			1		5
2000		1					2					3
2001				6								6
2002			1			1		1				3
2003								1				1
2004				3		1	1			1		6
2005			1		1	1	3		1			7
2006			1	4			1					6
2007	1	1	1			3	5	1				12
2008			1	2	1		3	1	4			12
2009				5	5	1	1		1			13
2010			2	2	3	1	2	1	1			12
2011			2	2	7	1	4			1	1	18
2012			2	4	7	3	4		1			21
Total	1	2	14	31	24	16	32	6	9	4	1	140

Table 2: Articles with topic ‘stakeholder’ in operational research journals

Legend: AOR = Annals of Operations Research; COR = Computers & Operations Research; DSS = Decision Support Systems; EJOR = European Journal of Operational Research; ESA = Expert Systems with Applications; I = Interfaces; JORS = Journal of the Operational Research Society; MS = Management Science; O = Omega; OR = Operations Research; and ORS = OR Spectrum.

Similar to Laplume et al. (2008), we used content analysis (Krippendorff, 2004; Weber, 1990) to facilitate a structured and systematic analysis of the large volume of textual data. The coding was conducted iteratively, thereby inducting a coding scheme from the data. Different meetings were held with multiple researchers to reflect on the coding scheme, thereby improving the validity and reliability.

‘The stakeholder’ in management literature and in operational research

When looking at the emergence of the stakeholder topic in applications of operational research, the similarity to the progress of stakeholder theory stands out. Although Freeman published his seminal work in 1984, leading management journals started publishing articles on stakeholder theory in the early nineties, steadily increasing since then. The stakeholder topic in operational research also emerges in the early nineties, and while taking somewhat more time to develop mass, also steadily increases during the decades afterwards, see figure 1.

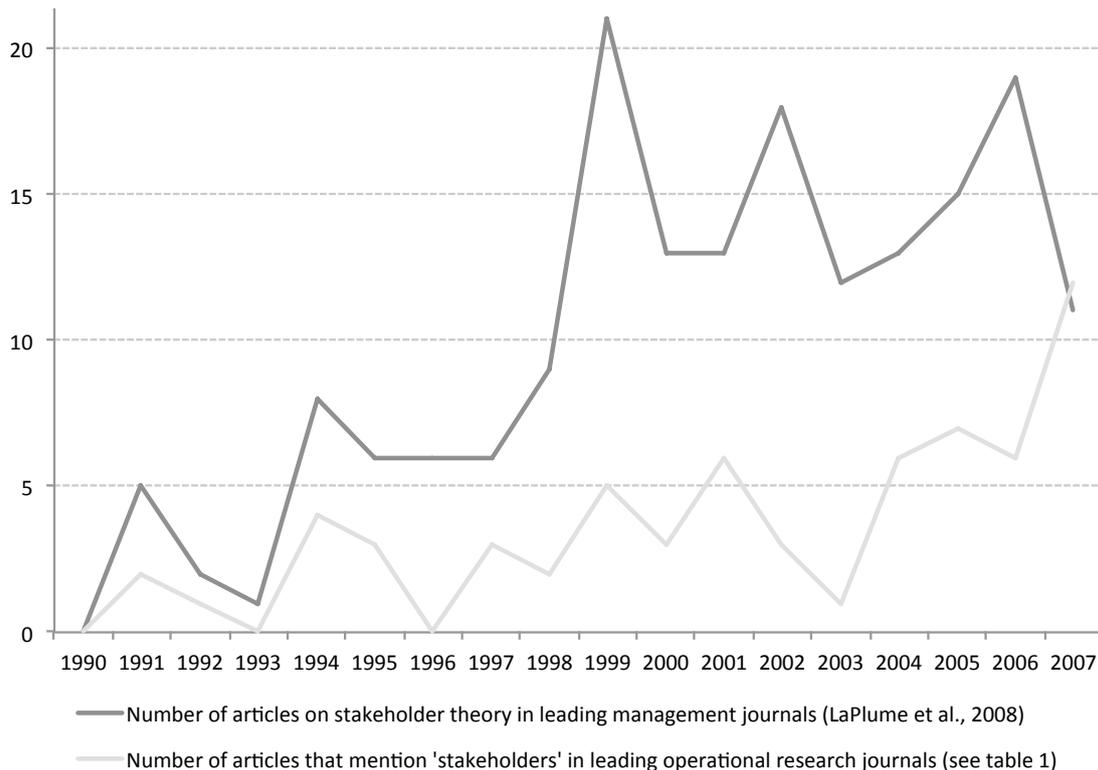


Figure 1: Comparable trends in management literature and operational research

We already discussed one indication of the gap between management literature and operational research, namely the statement in management literature that tools for implementing stakeholder theory are lacking (Kaler, 2006). Another indication stemming from our review is the lack of references to stakeholder theory from the applications of operational research: just three of the 140 applications of operational research refer to Freeman (1984) or mention stakeholder theory (Sarkis, 1998; Turcanu et al., 2006; Macharis et al., 2012). This confirms that the gap between management literature and operational research is large and works in two ways. By analyzing the specific relations between the advances in operational research and management literature, we aim to contribute to bringing the two domains closer together.

Major traditions in operational research

After several iterations of coding the 140 applications of operational research, we concluded that there are four different traditions in which operational research has been helping organizations that want to balance the interests of various stakeholders: ‘optimization’, ‘insights in trade-offs’, ‘understanding the problem’, and ‘managing the boundaries’. While many applications help in more than one way, most applications have a distinctive focus and can be clearly associated with one of the four traditions. The four traditions are described in more detail below.

Optimization

One way in which operational research tries to help organizations that want to balance the interests of various stakeholders is by ‘optimization’. These applications define goals and constraints by sets of mathematical relationships and provide a single best solution to a given problem. Typical methods used are goal programming, mixed-

integer linear programming, and neural networks. The methods are typically focused on quantitative aspects of problems. These applications are typically expert based: the researchers may ask stakeholders about the characteristics of the problem, but after that they often develop the application on their own. Application domains vary widely, including amongst others new product development (Bordley and Kirkwood, 2004), workforce scheduling (Belien et al., 2012), and road pricing (Teodorović and Edara, 2007). These applications typically regard stakeholders as the ones that have an interest in the outcome of the model, or as those that determine the goal functions or constraints that have to be considered in the mathematical relationships, or as sources of uncertainties that form a difficulty that has to be met by the method.

Insights in trade-offs

The largest tradition is formed by the applications that try to help by providing insights in trade-offs. While the first tradition provides a single solution, this second tradition focuses on *comparisons* of different alternatives on different criteria. These comparisons provide insights in how improvements in obtaining one goal may hinder obtaining another goal. Typical methods used are multi-criteria decision analysis (MCDA), analytical hierarchy process (AHP), analytical network process (ANP), data envelopment analysis (DEA), and ‘fuzzy’ variations of these methods. These fuzzy variations include a step in which verbal statements such as Likert items are translated into numbers (e.g. Chiou et al., 2005; Chou et al., 2006; Secme et al., 2009). The applications in this tradition typically start from the idea that ‘you cannot have it all’, and facilitate ‘how to divide the pie’ between different stakeholders holding different objectives. Typically these stakeholders participate in carrying out the operational research application, for instance the weighting of different criteria is elicited by asking stakeholders to make pairwise comparisons. Application domains vary widely, including amongst others portfolio management of R&D projects (Phillips and Bana e Costa, 2007), regional sustainable development (Cai et al., 2009), and health care delivery (Saaty, 1994). Stakeholders participate in various ways, including for example the identification of alternatives, the identification of criteria, the scoring of alternatives, and weighting the criteria.

Understanding the problem

The third way in which operational research has been helping is by increasing the understanding of the problems at hand. The first two traditions take as their point of departure that the researchers possess enough knowledge of the problem to be able to translate it into mathematical relations and numeric scores of alternatives. This third tradition does not assume that all relevant knowledge is available, takes one step back, and focuses on learning more about the problem. One goal of this approach is that by obtaining a better understanding of the problem, the researchers are able to facilitate ‘dividing the pie’, but they are also able to ‘make the pie bigger’. Methods include discrete event simulation (DES) and system dynamics (SD) simulation including group model building (GMB). The role of stakeholders varies in this tradition, from merely being the client of the model output to participating in workshops in which the model conceptualization is carried out as in group model building (GMB). Increased understanding is often nurtured by a structured process of analyzing the problem, for example identifying all relevant stocks and flows and their causal relationships (SD and GMB) or identifying all relevant events, accompanying changes in states of the system,

and relations between the events (DES). The resulting conceptual models are often graphically represented to facilitate discussion about which elements are relevant and which are not. Some applications continue by translating the conceptual model into mathematical relationships fit for quantitative analyses, while others focus on a qualitative understanding of the problem. Application domains again vary widely, including amongst others health care delivery (Lehany et al., 1999), risk assessment of oil operations (Merrick et al., 2002), and airline logistics (Den Hengst, De Vreede, and Maghnouji, 2007).

Managing the boundaries

The fourth tradition has been helping by managing the boundaries of problems. This tradition acknowledges that different viewpoints to an issue at hand need to be incorporated to be able to structure the problem, or because incorporating (minority) viewpoints is desirable based on ethical arguments. Methods typically include critical systems thinking (CST), soft systems methodology (SSM), and community operational research (COR). Almost all applications are based on intensive participative processes, and often result in an increased qualitative understanding of the problem. This understanding then may be summarized in what is called a ‘rich picture’, a picture with different elements and their relations fitted to the problem. Application domains vary widely, including amongst others housing services for older people (Midgley et al., 1998), energy efficiency (Neves et al., 2009), and fitness-to-drive arrangements (Hindle and Franco, 2009). Figure 2 below shows the progress of the four traditions over time.

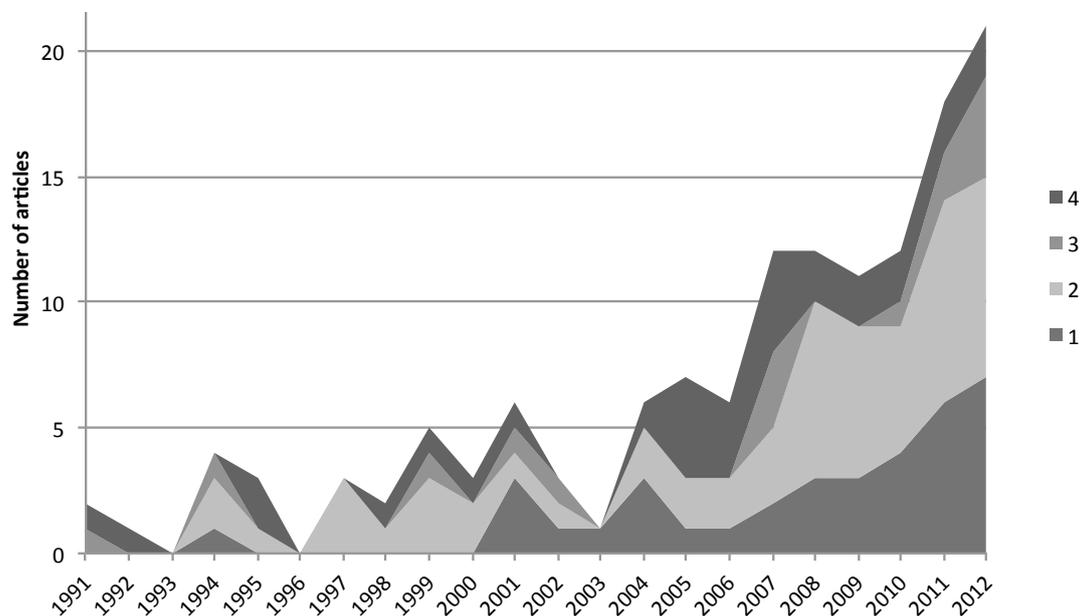


Figure 2: Progression of four ‘stakeholder traditions’ in operational research

Note that the differences in the role of stakeholders in these four traditions are substantial. Stakeholders may be merely regarded as sources of uncertainty that have to be dealt with in ‘optimization’, while in ‘managing the boundaries’ viewpoints of stakeholders may be incorporated for no other reason than the intrinsic value of the stakeholder. Also note how these different roles that stakeholders have in operational

research align with different lines of reasoning in stakeholder theory. As described earlier in this paper, stakeholder theory distinguishes between a narrow and a wide identification of stakeholders (Freeman and Reed, 1983) and between instrumental (Jones, 1995) and moral (Phillips et al., 2003) arguments for adopting the goal of balancing the interests of various stakeholders. While ‘optimization’ seems to be based on a narrow definition of stakeholders and instrumental arguments of taking them into account, ‘managing the boundaries’ seems to be based on a wide definition of stakeholders and moral arguments of taking them into account. The other two traditions ‘insights in trade-offs’ and ‘understanding the problem’ show to exist in different variations based on either narrow or wide definitions of stakeholders and on instrumental and/ or moral arguments of taking them into account.

The relation between stakeholder theory and operational research

Earlier in this paper we showed that Freeman (1984) considers an organization to possess stakeholder management capabilities when it is able to combine three levels: an organization should have a correct stakeholder map (*rational level*), routines to take stakeholders into account (*organizational process level*), and it should have effective interactions with stakeholders (*transactional level*). Following this argument, operational research is only able to increase an organization’s stakeholder management capability if it manages to facilitate improving one or more of the rational, organizational process, and transactional levels. When considering the 140 applications of operational research in this review, it stands out that they aim to increase an organization’s stakeholder management capability on different levels. These relations follow the pattern of the four identified traditions, see figure 3 below.

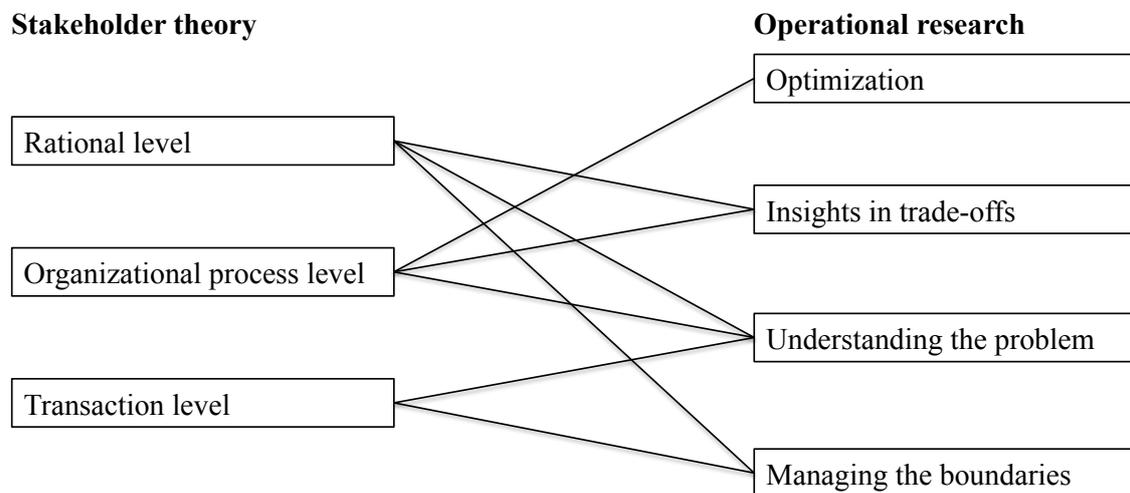


Figure 3: Relations between stakeholder theory and operational research

The first tradition, ‘optimization’, assumes that much of the problem is already known and that aspects of the problem can be translated into mathematical relationships. ‘Optimization’ is not about getting a clearer view of an organization’s stakeholder map, but is about translating knowledge about stakeholders into strategic decisions. Experts use a mathematical model to provide a single solution that may have implications for several stakeholders. Because this tradition focuses on calculating specific strategic decisions, it overlaps with the organizational process level of Freeman’s stakeholder management capability model (1984). The stakeholder map is assumed to be known or

at least not the part of the problem on which this tradition focuses. Transactions with stakeholders are not focused on in this tradition.

The second tradition, ‘insights in trade-offs’, also involves translating information about a problem into specific strategic decisions, thereby overlapping with the organizational process level. But even more central to these applications is eliciting stakeholder preferences, by involving them for example in the identification of alternatives, the identification of criteria, the scoring of alternatives, and weighting of the criteria. This tradition aims to increase knowledge on the various stakeholders and what exactly their stakes are. In that sense, these applications help the organization to improve its stakeholder map, improving the rational level of its stakeholder management capability.

The third tradition, ‘understanding the problem’, is the only tradition that encompasses elements of all three levels of stakeholder management capability. A stakeholder analysis is often part of the first stages of getting to understand the problem, potentially improving the rational level of an organization’s stakeholder management capability. Stakeholders in this tradition are often participating in workshops aimed at increasing the knowledge about a problem. These workshops focus on interactions between an organization and its stakeholders, thereby improving the transactional level of an organization’s stakeholder management capability. The model that is the result of the workshops in the end is used to identify specific strategic decisions, thereby improving the operational process level.

The fourth tradition, ‘managing the boundaries’, is mainly focused on the rational and the transactional level. This tradition seeks to incorporate many viewpoints in structuring a problem. Workshops that aim to facilitate developing a better understanding of these viewpoints may result in a better understanding of the stakeholder map of an organization, thereby improving the rational level of its stakeholder management capability. Even more central to the tradition, the workshops facilitate a multitude of interactions with stakeholders, thereby improving the transactional level.

We conclude that different traditions in operational research have different ways of helping organizations that seek to balance the interests of various stakeholders. Organizations that need to improve a particular level of their stakeholder management capability might want to look for operational research applications that focus on that level specifically. All levels are covered by the four traditions in operational research. Our conclusion is therefore that the statement that no analytical tools are available for implementing stakeholder theory (Kaler, 2006), is not supported by our review.

Opportunities for group model building

We started our study with the idea that group model building would be specifically useful to balance the interests of various stakeholders, since it gives stakeholders such an important role. We now come back to this idea, having compared group model building to other operational research methods. Based on our review, we indeed conclude that of all the different methods applied in operational research, especially group model building has a large potential for helping organizations that seek to balance the interests of various stakeholders. While other approaches cover just one or two of

Freeman's three levels of stakeholder management capability (1984), group model building has the potential to improve all three of them. The modeling sessions are typically sequences of pre-defined small pieces of group processes called 'scripts' that have different end results such as a stakeholder analysis (Andersen and Richardson, 1997, p. 108). These scripts may be adapted to support a narrow or a wide identification of stakeholders, and instrumental and/ or moral reasons to take them into account, depending on an organization's desire. Group model building projects typically include a script concerning a thorough analysis of the stakeholder setting, potentially improving an organization's stakeholder map. The projects are focused on eliciting the mental models of various stakeholders, facilitating smooth interaction between an organization and its stakeholders. A divergent script using for example Nominal Group Technique may be used to ensure that the viewpoints of all stakeholders are considered. Because of the participation of stakeholders in defining and structuring the problem, these stakeholders increase their commitment to solutions identified along the way. Building on the increased understanding of the problem, the projects end with recommendations for specific strategic decisions that strike a balance between the interests of various stakeholders.

Group model building is often applied to messy problems (Vennix, 1999), where there are considerable differences in opinions on what the problem exactly is and what outcomes are the most desirable. These messy problems typically include many stakeholders, whose interests vary widely. Group model building is aimed at facilitating high quality communication between stakeholders, generating insights in the problem at hand, obtaining consensus between stakeholders as well as lasting commitment to the decisions that are identified (Rouwette et al., 2011). Stakeholders are at the core of group model building. Therefore, it seems fruitful to make a connection between group model building literature, reporting about the progress of finding *solutions* for problems in stakeholder settings, and stakeholder theory in management literature, reporting about the *problems* that organizations encounter when trying to balance the interests of various stakeholders. This connection, however, is practically absent. By providing a review of various applications of operational research on the topic 'stakeholders', we showed how group model building differs from other applications. By linking the applications of operational research to stakeholder theory, we showed how group model building facilitates the improvement of an organization's stakeholder management capability. Our review may facilitate making the role of stakeholders in group model building more explicit in future research. By doing so we aim to contribute to closing the gap between management literature and operational research.

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