



## Recent evidence on the effectiveness of group model building



Rodney J Scott<sup>a,\*</sup>, Robert Y Cavana<sup>b</sup>, Donald Cameron<sup>c</sup>

<sup>a</sup>The University of Queensland, Brisbane, QLD 4072, Australia

<sup>b</sup>Victoria University of Wellington, Wellington 6140, New Zealand

<sup>c</sup>The University of Queensland, Brisbane, QLD 4072, Australia

### ARTICLE INFO

#### Article history:

Received 12 July 2014

Accepted 30 June 2015

Available online 8 July 2015

#### Keywords:

Behavioural OR

Group model building

System dynamics

Evidence

Literature review

### ABSTRACT

Group model building (GMB) is a participatory approach to using system dynamics in group decision-making and problem structuring. This paper considers the published quantitative evidence base for GMB since the earlier literature review by Rouwette et al. (2002), to consider the level of understanding on three basic questions: what does it achieve, when should it be applied, and how should it be applied or improved? There have now been at least 45 such studies since 1987, utilising controlled experiments, field experiments, pretest/posttest, and observational research designs. There is evidence of GMB achieving a range of outcomes, particularly with regard to the behaviour of participants and their learning through the process. There is some evidence that GMB is more effective at supporting communication and consensus than traditional facilitation, however GMB has not been compared to other problem structuring methods. GMB has been successfully applied in a range of contexts, but there is little evidence on which to select between different GMB tools, or to understand when certain tools may be more appropriate. There is improving evidence on how GMB works, but this has not yet been translated into changing practice. Overall the evidence base for GMB has continued to improve, supporting its use for improving communication and agreement between participants in group decision processes. This paper argues that future research in group model building would benefit from three main shifts: from single cases to multiple cases; from controlled settings to applied settings; and by augmenting survey results with more objective measures.

© 2015 Elsevier B.V. and Association of European Operational Research Societies (EURO) within the International Federation of Operational Research Societies (IFORS). All rights reserved.

### 1. Introduction

Participative and behavioural aspects of OR are important and underexplored (Hamalainen, Luoma, & Saarinen, 2013). One area with an emerging evidence-base is group model building (“GMB”, Vennix, 1996), a participatory approach to the development of system dynamics models. Recent GMB literature has given more prominence to participant behaviour and interpersonal dynamics, to explore how GMB supports persuasion (Rouwette, Korzilius, Vennix, & Jacobs, 2011a), trust (Black & Andersen, 2012), and agreement (Rouwette, 2011).

The importance of involving the client in the modelling process has been acknowledged since the conception of system dynamics (Forrester, 1961). Practitioners observed that recommendations developed through system dynamics were not automatically adopted by the client (Greenberger, Crenson, & Crissey, 1976), and experimented with involving the client in the modelling pro-

cess. This became known as “group model building” (Vennix, 1996). The term has been criticised as cosy, narrow and parochial (Andersen, Vennix, Richardson, & Rouwette, 2007), in that it fails to mention that the models in question are always system dynamics models. Authors have proposed that GMB should be considered as a sub-set of problem structuring methods (Andersen et al., 2007; Rouwette, Vennix, & Felling, 2009) or group decision support systems (Vennix, Andersen, Richardson, & Rohrbaugh, 1992). Nonetheless, the term and its limitation to system dynamics methods has been used in many publications (e.g. Akkermans & Vennix, 1997; Andersen & Richardson, 1997; Andersen, Richardson, & Vennix, 1997, 2007; Luna-Reyes et al., 2006; Richardson, 2013; Richardson & Andersen, 1995; Richardson, Andersen, Rohrbaugh, & Steinhurst, 1992; Rouwette & Vennix, 2006, 2011; Rouwette et al., 2009; Rouwette, Vennix, & Thijssen, 2000, 2002, 2011a, 2011b; Vennix, 1996, 1999; Vennix & Rouwette, 2000; Vennix, Scheper, & Willems, 1993, 1996; Zagonel, 2002, 2004). Maintaining this narrow definition allows this paper to build directly on an earlier literature review (Rouwette, Vennix, & Mullekom, 2002).

Despite over 100 publications on GMB methods (see Section 3), relatively few have described attempts at quantitative analysis. This

\* Corresponding author. Tel.: +64 27 6127 402.

E-mail addresses: [rodney.scott@gmail.com](mailto:rodney.scott@gmail.com) (R.J. Scott), [bob.cavana@vuw.ac.nz](mailto:bob.cavana@vuw.ac.nz) (R.Y. Cavana), [donald.cameron@uq.edu.au](mailto:donald.cameron@uq.edu.au) (D. Cameron).

paper collates the available evidence on group model building, including studies of how it is used, what it achieves, and why. This information is used to reflect on the quantitative evidence base for GMB, to synthesise the conclusions, to consider how this addresses fundamental research questions, and to identify key opportunities for the future. The analysis is arranged around three themes: what group model building achieves; when it should be applied; and how it should be applied or improved. This is likely to be of interest to GMB practitioners in understanding the state of empirical evidence for their craft, and for GMB researchers in identifying further research opportunities. The study is also likely to be of interest to the broader OR community, as many of the research challenges (particularly balancing experimental control with external validity) are likely to be applicable to other participative and behavioural approaches.

This paper is arranged in four sections after this introduction. Section 2 summarises early research on GMB, as articulated by Rouwette et al. (2002). The methodology for augmenting and updating the literature review by Rouwette et al. (2002) is then explained in Section 3. Literature is presented and analysed in Section 4 to describe the quantitative evidence base for GMB. And finally in Section 5, there is a discussion of the implications of the research findings, and an exploration of research gaps and future research opportunities.

## 2. Early research on group model building

The first empirical study was conducted in 1988, and in the following 13 years, there were 19 studies on GMB that collected quantitative evidence regarding its use. In 2002, Rouwette et al. reviewed 107 GMB studies, including the 19 that attempted some sort of quantitative assessment. The studies that included quantitative evidence were published between 1987 and 2000. The review considered five aspects of the studies: the source of the data; what data were collected; how they were collected; when they were collected; and what was found. The different studies related to a range of intervention contexts and tools, described in different and incomplete ways. The evaluations consisted of post-workshop surveys or pretest/posttest questionnaires, and mostly relied on participants' own views of what the workshops had achieved. Of those using a pretest/posttest design, three used a single case study and two a field experiment. The authors expressed caution about biases introduced by measurement methods, and recommended direct comparison of different measurement methods to determine if they were associated with different results (Rouwette et al., 2002).

The conclusions of this review were relatively modest: GMB literature included a number of small-scale evaluations that demonstrated that participants believe GMB contributes to improved communication quality, insight, consensus and commitment to conclusions. The reasons for this success were unclear, as was the relative effectiveness of GMB versus other techniques (Rouwette et al., 2002).

Three papers at around this time contained recommendations on a research programme for the future of GMB. Andersen et al. (1997) proposed that more rigorous and consistent recording of the intervention context and tools was required, as well as evaluation of several explanatory hypotheses: systems thinking, group structure, chunking, gifted practitioner, group communication, or Hawthorn effect. While noting the barriers to effective research design, they recommended experiments to complement survey results, and the use of common survey methods to allow results from many studies to be aggregated. They also proposed: the inclusion of measurement methods that do not rely on participants reporting their own cognitive processes; that studies measure either mental models or their changes but not both in the same subjects; that some study of the enduring effects (if any) of GMB is conducted; and that mixed methods are used to improve the robustness of results. Coyle (2000) proposed an exploration into the wise balance between qualitative and

**Table 1**  
Selection criteria.

Criteria	Definition
Quantitative evidence	Numerical or statistical data reported in the results of the study
System dynamics tools	One of more of the following tools used as part of the group process: behaviour over time graph, causal loop diagram, stock and flow model, simulation model
Focus on client participation or group interaction	A decision process involving more than one person, with reference to interaction between the participants in the creation or interpretation of the system dynamics tool

quantitative GMB, through the development of a metric for measuring the presumed added understanding and confidence from quantitative modelling. Finally, Rouwette et al. (2002) echoed the earlier call from Andersen et al. (1997) to thoroughly record case research in a standardised format, while also calling for more reporting of unsuccessful case studies.

## 3. Methodology

These calls for more research into how GMB is conducted, what it achieves, and why, set the scene for several important quantitative studies over the coming decade, as well as a number of smaller pilot studies. This paper reviews this research, in order to reflect on the current quantitative evidence base regarding GMB.

### 3.1. Paper selection

A literature search was conducted to identify relevant evidence for GMB. This included past issues of five journals from 2001 to 2014 (European Journal of Operational Research, Journal of the Operational Research Society, Group Decision and Negotiation, System Dynamics Review, System Research and Behavioral Sciences), and past proceedings of two international conferences (Meeting of the International Society of Systems Sciences, and International Conference of the System Dynamics Society). Papers were selected that included quantitative evidence relating to GMB. The references cited in these papers were subsequently analysed to reveal additional research.

This method introduces several possible biases. First, it is possible that empirical GMB studies have been published elsewhere than the publications examined, and not subsequently referenced by empirical GMB studies within those publications examined. Secondly, it is possible that some papers were missed due to human error, where it was not immediately apparent that the paper related to GMB. Third, not all research is published, for a number of reasons including: ambivalence, commercial sensitivity, or a reluctance to publish findings from unsuccessful cases. It is not possible to measure these possible biases, and therefore caution must be taken in assuming that this paper describes all empirical research on GMB.

Papers were selected on the basis of three criteria: quantitative evidence, system dynamics tools, and a focus on client participation or group interaction (see Table 1).

Several studies were excluded that evaluated participant learning through use of system dynamics methods but that did not feature significant group interaction (e.g. Capelo & Dias, 2009; Cavaleri, Raphael, & Filletti, 2002; Gary & Wood, 2007, 2011; Hopper & Stave, 2008; Jensen, 2005; Kopainsky, Alessi, Pedercini, & Davidsson, 2009, 2010a, 2010b, 2011a, 2011b, 2012; Kopainsky & Saldarriaga, 2012; Kopainsky & Sawicka, 2011; Langley & Morecroft, 2004; Maani & Maharaj, 2003; Moxnes, 2004; Mulder, Lazonder, & de Jong, 2011; Plate, 2010; Stouten, Heeme, Gellynck, & Polet, 2012; Yasarcan, 2009). Conversely, several papers were included that described individual work on system dynamics tools alternated with group feedback

Download English Version:

<https://daneshyari.com/en/article/6896014>

Download Persian Version:

<https://daneshyari.com/article/6896014>

[Daneshyari.com](https://daneshyari.com)