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Measuring organisational performance using a mix of OR methods

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ABSTRACT

Performance measurement has become an increasingly important issue in recent years. In spite of the remarkable progress that has been achieved in this area of research, many performance measurement initiatives fall short of their potential in supporting decision-making. This paper argues that adopting a multi-method approach to assessing performance has the potential to result in more comprehensive and effective performance measurement systems. To support this assertion, the paper discusses the development of a performance measurement system for a Business Tax Department, which combined the use of several operational research (OR) techniques including qualitative system dynamics, data envelopment analysis and multiple criteria decision analysis. The use of these OR techniques was influential in developing and implementing the performance measurement system and has the potential to be transferred to other contexts.

1. Introduction

Performance measurement has been of interest to both researchers and practitioners for many years, as a result of which several performance measurement frameworks have been proposed and their use extensively documented. The Balanced Scorecard (Kaplan and Norton, 1992) and Data Envelopment Analysis (Charnes et al., 1978) are among the better known frameworks. Although most publications report successful implementation of the adopted methodology, several authors (e.g. Meekings, 1995; McCunn, 1998; Schneiderman, 1999; Neely and Bourne, 2000; Bourne et al., 2002; Van Camp and Braet, 2016) have also highlighted that many performance measurement initiatives have fallen short of their potential to support decision-making. Factors cited as contributing to failure in the implementation of performance measurement systems, include contextual, processual and content issues (Bourne et al., 2002). Several authors have suggested the integration of different methods as a means of addressing some of these issues and enabling more comprehensive and effective performance measurement systems (e.g. Tsang et al., 1999; Howland and Rowse, 2006; Wang, 2006; García-Valderrama et al., 2009; Ferreira et al., 2011; Amado et al., 2012).

The Operational Research/Management Science (OR/MS) literature encompasses several methodologies which have proved very valuable in promoting organisational learning and in guiding decision makers to a more effective and efficient use of information (see, for example, Mingers and Rosenhead, 2004). We support the view expressed by several OR/MS academics (e.g. Dyson, 2000; Francis and Holloway, 2002; Smith and Goddard, 2002; Ackermann et al., 2005) that such techniques have the potential to enhance the design and implementation of organisational performance measurement systems. However, despite these claims, there are few published accounts of the use in practice and insights gained from adopting a multi-method approach to performance measurement and improvement.

This paper aims to contribute to existing literature in two ways. First and foremost it contributes to the literature on performance measurement practice through an in depth discussion of a multi-method approach to the development of a performance measurement system for the United Kingdom (UK) former Business Services and Taxes (BST) department of Her Majesty's (HM) Customs and Excise to assist in identifying best practice among 7 regions. The case study illustrates the integrated use of several OR/MS techniques, specifically: oval mapping, qualitative system dynamics (SD), data envelopment analysis (DEA) and multiple criteria decision analysis (MCDA). Secondly, through this case study and a review of the literature on performance measurement practice, it contributes to the growing OR/MS literature on mixing methods.

The paper is structured as follows. In the first part, drawing on the OR/MS literature relating to the mixing of OR/MS methods in practice, a review of multi-method approaches to performance measurement is provided. The second part of the paper presents the case study in detail. The third part concludes the paper with a discussion of the benefits derived from the integration of methods for performance measurement and management.

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2. Mixing OR methods to enhance the performance measurement process

Mixing OR/MS methods to gain a deeper understanding of complex problems has been of interest to both researchers and practitioners for many years, and its benefits are well documented in the literature (e.g. Mingers and Brocklesby, 1997; Jackson, 1999; Mingers, 2000; Mingers, 2003; Howick and Ackermann, 2011; Henao and Franco, 2016). As discussed by Munro and Mingers (2002, 2004), a mixed methods approach has been used in many contexts and has taken multiple forms. A number of authors (e.g. Bennett, 1985; Schultz and Hatch, 1996; Mingers and Brocklesby, 1997; Pollack, 2009; Morgan et al., 2017) have discussed different ways in which different approaches, which can be viewed at the level of methods, methodologies or paradigms, might be combined in a practical intervention.

The different ways of mixing reflect both the temporal nature of the combination and the nature and extent of the integration. From a temporal perspective different approaches might be used in parallel or sequentially, in either case potentially multiply (Pollack, 2009). Integration can take many forms, ranging from no practical integration of methods, simply a comparison of outcomes (Bennett, 1985) through to the creation of a new approach achieved by partitioning and combining elements of distinct methods (Mingers and Brocklesby, 1997). Strategies for integration lying on a spectrum between these two extremes include: complementarity which integrates through one-directional or mutual re-inforcement (Schultz and Hatch, 1996); the enrichment (Bennett, 1985) or enhancement (Mingers and Brocklesby, 1997) of one approach by incorporating elements of another or the embedding of one approach within another (Pidd, 2012); and interplay between two approaches which permits both connections and contrasts (Schultz and Hatch, 1996).

At the same time that integration can take multiple forms, it can also address a multitude of problems in different areas. Organisational performance measurement, the focus of the current research, is one of the areas where a mixed methods approach has been proposed (e.g. Santos et al., 2002; Ferreira et al., 2011; Amado et al., 2012). Two different lines of research and practice can be identified. The first explores the combined use of different OR/MS methodologies which were not primarily conceived to assess organisational performance but which can be used to develop standalone performance measurement systems. The second explores the combined use of well established OR performance assessment frameworks, such as DEA, with other OR/MS techniques in order to develop more effective evaluation systems.

Regarding the first line of research, one of the pioneering works on the use of multiple OR techniques to assist the development and implementation of performance measurement systems is that of Suwignjo et al. (2000). They propose the use of cognitive maps and cause and effect diagrams to identify factors affecting performance and explicitly represent their relationships followed by the use of the Analytic Hierarchy Process (AHP) to help managers quantify the relative effects of these factors on organisational performance.

Ferreira et al. (2011, 2012, 2014a, 2014b), also discuss the use of cognitive mapping and of MCDA to support the development of multidimensional performance evaluation systems, and to deal explicitly with the trade-offs between the different dimensions of performance and interests of different stakeholders. However, rather than using the AHP they propose the Measuring Attractiveness by a Categorical-Based Evaluation Technique (MACBETH).

Other studies using MCDA as part of a multi-method approach aimed at assessing organisational performance include Yurdakul and Íç (2005), Ertuğrul and Karakaşoğlu (2009), Seçme et al. (2009), Sun (2010) and Joshi et al. (2011). All these studies propose the development of organisational performance measurement models based on the combined use of the AHP and TOPSIS (Technique for Order Performance by Similarity to Ideal Solution) methods, either in their original or fuzzy versions. The AHP is used to determine the relative importance (weights) of the different performance indicators and dimensions, and the TOPSIS method to determine the performance scores and rank the units under assessment. Joshi et al. (2011), however, extend the previous works by proposing the use of the Delphi method to identify, synthesise and prioritise the key performance factors and sub-factors prior to the use of the AHP.

Santos et al. (2002, 2008) have also contributed to this area of research by discussing how the use of SD and MCDA, independently and in an integrated manner, can enhance the process of performance measurement and management. The main departure of their work from others relates to the proposal of the use of SD modelling to assist decision makers identify an appropriate set of performance measures, and the integrated use of these two OR methodologies to analyse the performance results and test improvement alternatives. In doing so, they extend the use of OR/MS techniques from the design and measurement stages to the analysis and improvement stages, closing the performance measurement loop.

The second line of research has focused mostly on the integrated use of DEA with other OR/MS methodologies in order to increase the comprehensiveness and effectiveness of the performance measurement process. In this regard, the DEA technique has been combined with both soft and hard OR methodologies.

Casu et al. (2005), for instance, discuss the use of a computer-supported group support system (focusing on the Journey Making methodology) to determine the boundaries of the unit of assessment and the input-output variables to use in the DEA analysis. Another study discussing the use of soft OR to assist the specification of DEA models is that of Mingers et al. (2009), which proposes the use of soft systems methodology (SSM) to assist the identification of the inputs and outputs to use when comparing decision making units (DMUs). In both cases the OR techniques were used prior to the DEA analysis. However, this is not always the case. For instance, Greasley (2005) discusses the extent to which discrete-event simulation can be used prior to or after the DEA analysis. According to this author, simulation can be used to generate data for the DEA analysis in line with what was also proposed by McMullen and Frazier (1998). However, Greasley (2005) also emphasises that once the DEA analysis has identified the best and worst performers, simulation can be used to offer practical guidance towards performance improvement. This can be achieved by using simulation to explore the feasibility and efficiency of variations in the operating practices of the best performers or to assist the transfer of best practice from the benchmarks to the poorer performers.

The use of other OR/MS techniques to complement DEA and assist decision makers interpret and use the assessment results has become more common in recent years. For instance, the use of Decision Trees to assist decision and policy makers discover reasons behind efficient and inefficient DMUs, assess the impact of certain factors on the efficiency levels, and prioritise improvement initiatives, has been proposed by several researchers in the past decade (e.g. Wu, 2006; Wu et al., 2006; Seol et al., 2007, 2008; Samoilenko and Osei-Bryson, 2008; Emrouznejad and Anouze, 2010; Lee, 2010; Sharma and Yu, 2010).

Multicriteria decision analysis methods have also been combined with DEA on several occasions. The relationship between these two methodologies has long been discussed (e.g. Belton, 1992; Doyle and Green, 1993; Stewart, 1996; Athanassopoulos and Podinovski, 1997; Joro et al., 1998; Bouyssou, 1999, Sarkis, 2000) and their similarities have resulted in synergistic developments in both methods as pointed out by Wallenius et al. (2008), and illustrated by André et al. (2010). For example, MCDA methods can be used to find non-radial targets for the DMUs (Korhonen and Syrjänen, 2004) and to incorporate decision makers' preferences into DEA (e.g. Halme et al., 1999; Gouveia et al., 2008; Almeida and Dias, 2012). On the other hand, when information regarding the decision makers' preferences is limited or ambiguous, DEA can provide necessary information to allow multicriteria analyses to be performed (e.g. Mavrotas and Triffilis, 2006). Other studies exploring the combination of MCDA and DEA to develop business