Development and validation of a managerial decision making self-efficacy questionnaire

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Orientation: Self-efficacy beliefs, given their task-specific nature, are likely to influence managers' perceived decision-making competence depending on fluctuations in their nature and strength as non-ability contributors.

Research purpose: The present research describes the conceptualisation, design and measurement of managerial decision-making self-efficacy.

Motivation for the study: The absence of a domain-specific measure of the decision-making self-efficacy of managers was the motivation for the development of the Managerial Decision-making Self-efficacy Questionnaire (MDMSEQ).

Research approach, design and method: A cross-sectional study was conducted on a non-probability convenience sample of managers from various organisations in South Africa. Statistical analysis focused on the construct validity and reliability of items through exploratory and confirmatory factor analysis to test the factorial validity of the measure.

Main findings: The research offers confirmatory validation of the factorial structure of the MDMSEQ. The results of two studies involving 455 (Study 1, *n* = 193; Study 2, *n* = 292) experienced managers evidenced a multidimensional structure and demonstrated respectable subscale internal consistencies. Findings also demonstrated that the MDMSEQ shared little common variance with confidence and problem-solving self-efficacy beliefs. In addition, several model fit indices suggested a reasonable to good model fit for the measurement model.

Practical/managerial implications: The findings have implications for practical applications in employment selection and development with regard to managerial decision-making. Absence of the assessment of self-efficacy beliefs may introduce systematic, non-performance related variance into managerial decision-making outcomes in spite of abilities that managers possess.

Contribution/value-add: Research on the volition-undermining effect of self-efficacy beliefs has been remarkably prominent, but despite this there are few appropriate measures that can be applied to managers as decision makers in organisations.

Introduction

Decision-making is arguably the most critical component of a manager's work. Flawed decision-making processes emanate from intelligent, responsible managers despite available information and good intentions (see Certo, Connelly & Tihanyi, 2008; Lovallo & Kahneman, 2003). Although stable levels of cognitive ability and personality traits are useful in selecting better performing managers, the ability to regulate such behaviour and attention represents a set of abilities relatively untapped in the realm of personnel selection (Beal, Weiss, Barros & MacDermid, 2005).

Acting for their organisations, managers undertake the decision process in a context of competing goals and objectives, together with information overload. These conditions may exceed individual managers' cognitive capability (i.e. their attentional resources), making them vulnerable to the volitional deployment of cognitive effort when they are extended to deal with such demands (Ganster, 2005; Payne & Bettman, 2007). Absence of a strong motivational influence (such as self-regulation via self-efficacy beliefs) reduces the volitional selection of cognitively effortful information search, deliberation and rational social influence in decision making (see O'Connor & Arnold, 2001; Wood, Atkins & Tabernero, 2000).

The absence of a domain-specific measure of the decision-making self-efficacy of managers was the motivation for the development of the Managerial Decision-making Self-efficacy Questionnaire (MDMSEQ). Self-efficacy beliefs have been prominent in psychological research over the past two decades (see, Burns & Christiansen, 2011; Judge, Jackson, Shaw, Scott & Rich, 2007). Defined

as beliefs in one's capabilities to organise and execute the courses of action required to produce given attainments (Bandura, 1997, p. 3), self-efficacy beliefs represent an individual-in-context appraisal. These beliefs influence how a challenge is cognitively evaluated and determine how much effort individuals will expend and how long they will persevere when confronting obstacles. In addition, self-efficacy beliefs influence individuals' thought patterns and emotional reactions and determine how resilient they will be in the face of adverse situations.

In spite of such prominence, self-efficacy beliefs have received limited attention as a potential determinant in managerial decision-making (Hiller & Hambrick, 2005; Zacarro, 2001). Yet extant research has confirmed the influence of self-efficacy on performance in complex decision-making tasks (e.g. Arenas, Tabernero & Briones, 2006; Sullivan, O'Connor & Burris, 2003).

The construct domain of self-efficacy measures should be contextualised in relation to the area of functioning an individual faces, thus calling for a taxonomy and content of a particular domain in order to measure how individuals function in the face of different types of dissuading conditions (Bandura, 2006). This issue has been largely unheeded in self-efficacy research, resulting in self-efficacy assessments that reflect global or generalised competence, bearing little resemblance to the specific performance on tasks that individuals must face.

The present authors concur with Bandura (2009) that 'making a decision does not ensure that individuals will mobilise the effort to execute the decided course of action successfully and stick to it in the face of difficulties' (p. 181). Consequently, self-efficacy beliefs may influence managers' perceived decision making competence to: mobilise motivation (effort and perseverance), exert rational and attentional resources (analytic and problem-solving skills), exercise independence in social influence (to gain compliance, enlist cooperation and acquire resources), control disruptive and aversive cognitions and implement courses of action in order to make accurate decisions. No current measure exists in the literature that meets this definition of managerial decision-making self-efficacy beliefs.

Construct domain and development of the MDMSEQ

Decision-making is more than the mere expression of knowledge and skills, and proficiency is not simply a mechanical expression of pre-formed skills. Managerial decision-making requires a number of distinct information cues that need to be processed (see, for example, Payne & Bettman, 2007; Wood et al., 2000) in parallel with the flexible orchestration of social abilities to enable managers to choose which actions to take and implement (see, for example, Elbanna & Child, 2007; Hough & White, 2003).

The conceptual framework for this research views managerial decision-making as a process in which managers are required to diagnose the situation, decide when a decision must be made, search for solutions, evaluate their consequences, select an alternative, influence others, implement action and deal with numerous obstacles, setbacks and adverse conditions. This implies the unbiased collection of information relevant to the decision and the reliance on analysis of this information to evaluate alternatives in making decisions (Bazerman, 2006; Brousseau, Driver, Hourihan & Larsson, 2006; Driver, Brousseau & Hunsaker, 1998).

Managers are rewarded when they demonstrate rationality in line with economic arguments of cost or risk in order to maximise the accuracy of their decisions (i.e. conformity to a rational decision). Such a motivation to perform accurately is often associated with a systematic-comprehensive decision process with an emphasis on being rational in making decisions (Certo et al., 2008; Elbanna, 2006; Elbanna & Child, 2007; Hough & White, 2003).

However, managers do not operate as autonomous agents but are accountable to multiple constituencies (Beach & Connolly, 2005; Ferris et al., 2007) and, unlike individual decision-making, managers make decisions as an agent for their organisation. They deal with decisions in contexts that are very different to those faced by individual decision makers since they rely on social encounters to gather and analyse relevant information for rational decision-making. They are faced with elaborate and complex social patterns of sociopolitical influence in order to deal with unpredictable social encounters (such as the formulation of and response to requests). Such encounters require them to use rational persuasive arguments, defend their decisions and reasoning to peers, subordinates or superiors, in order to exercise influence and obtain cooperation and resources for decisions (Bandura, 2009; Beach & Connolly, 2005; Zaccaro, 2001). Consequently, decisions result from an incremental context-dependent process that reflects an amalgam of preferences of those who hold most power, rather than what is good for an organisation.

The dual explanation of how decisions are made in organisations (i.e. a systematic-comprehensive and an incremental-sociopolitical process), however, involves more than applying a set of individual abilities and effort and attentional resources. Accountability for their decisions requires managers to apply a decision process through the productive use of capabilities, enlistment of effort and regulation of their affect in facing consequences that carry perturbing self-evaluative implications that undermine attentional resources (Beal et al., 2005) that impair good use of their decision-making skills (Bandura, 2009). In keeping with social cognitive theory, individuals are able to exercise control over their effort and affect; this control is influenced by their self-efficacy beliefs.

Specification of the construct domain

A conceptual treatment of managerial decision-making self-efficacy beliefs based on agentic control of affect, cognition and behaviour may offer explanatory and predictive power

to perform specific decision-making tasks at a specific level of performance, as well as the belief in the likelihood of successful performance.

Self-efficacy beliefs reflect an individual's expectations about future performance in specific contexts that are based, in part, on judgments of current capabilities directed toward a specific domain of activity (e.g. managerial decision-making). As such, self-efficacy beliefs are based on an affirmation and the strength of beliefs of a capability to produce given levels of attainment in a specific task (see, for example, Burns & Christiansen, 2011).

The MDMSEQ is based on a multidimensional taxonomy of managerial decision-making. Janis and Mann (1977) were amongst the first to offer a systematic treatment of the role of non-cognitive factors such as emotion, motivation and affect in the decision process. Based on studies of vigilance in reaching quality decisions that were subsequently implemented successfully, they described five sequential and progressive stages in arriving at a decision. They proposed a process consisting of: appraising the challenge, surveying alternatives, weighing alternatives, deliberating about commitment and adhering despite negative feedback and opposition. These stages apply to all consequential decisions.

The theoretical foundation for the design of questionnaire items in the present research depicts self-efficacy beliefs as specific and situational competence at specific levels of performance in order to mobilise motivation (effort and perseverance) and apply attentional resources to control disruptive thoughts and aversive affect in information seeking and inferential processes, and exercise social influence in order to make decisions in the best interest for the organisation. These are described more fully below.

Thought and affect control efficacy

Bandura (2009) states that self-efficacy beliefs play a pivotal role in the self-regulation of affective states by creating attentional biases in how events are construed and cognitively appraised to control intrusive thoughts that support effective courses of action in order to transform the environment in ways that alter its affective potential. Sarason, Pierce and Sarason (1996) provide evidence that anxiety presents a significant problem of intrusive, interfering thoughts which diminish attentional resources that could be devoted to the efficient execution of tasks. Such cognitive thoughts interfere with the allocation of sufficient attention to the task and this gives rise to volitional inaction and disengagement from intentions (see, for example, Beal *et al.*, 2005).

Cognitive interference thus has a volitional effect that encourages managers to avoid the opportunities afforded by a decision and it makes them less likely to make a decision and more likely to maximise positive affect by avoiding decisions (see, for instance, Baumeister, DeWall & Zhang, 2007; Luce, Payne & Bettman, 2001).

Analytical and inferential efficacy

Managerial decision-making relies on a systematic-comprehensive process of information search relevant to the decision as well as deliberation to evaluate alternatives in order to decide on a course of action. This gives rise to the volitional selection of cognitively effortful attempts to meet the criteria of rational judgment and choice. Wood *et al.* (2000) refer to *search efficacy* beliefs' capability to effectively utilise available sources of information and *deliberative processing efficacy* as beliefs about one's capacity to evaluate, process and integrate relevant information. Such exploratory search and inferential efficacy beliefs mediate effortful and extensive information gathering and deliberation of information that are associated with a more rational, systematic-comprehensive decision process that meets the best interests of the organisation (i.e. conformity with rationality).

Social influence efficacy

Managers are required to actively produce actions congruent with constituent demands. In addition, they must exercise rational and supportive modes of social influence for information acquisition and the political problem of influencing divergent interests in order to facilitate and execute decisions. Socially efficacious individuals are less likely to yield to the influence of others and are confident in exercising social and political influence in social encounters (i.e. direct and covert persuasion and social coercion modes of influence) (see, for example, Sullivan *et al.*, 2003). This involves the effortful application of verbal resources to explore, gather and analyse relevant information for rational deliberation and persuasion in order to advance, influence and gain compliance in a manner that promotes rationality in decisions (see, for example, Ferris *et al.*, 2007).

The foregoing discussion reflects the critical capability subscales that should be included in any representative, content valid measure of managerial decision-making self-efficacy beliefs.

Research objectives and hypotheses

In spite of the centrality of self-beliefs in efficacy in general work performance there is a conspicuous absence of a measure of managerial decision-making self-efficacy beliefs. In the preceding discussion self-efficacy beliefs have been conceptualised as specific and situational capabilities to: mobilise motivation (exert effort and perseverance to employ attentional resources) in order to control disruptive and aversive cognitions in applying analytical and inferential skills, and to exercise rational social influence in order to implement courses of action in managerial decision-making.

Considering the aforementioned psychological mechanisms and the manner in which they structurally combine in determining the level of managerial decision-making, self-efficacy beliefs gave rise to the overarching research question as to whether the explanatory structural model provides a valid description of these psychological mechanisms that

underpin variance in managerial decision-making self-efficacy beliefs.

Development of the MDMSEQ

MDMSEQ item pool

The content for the item pool was obtained from a systematic review and conceptual analysis of the literature on managerial decision-making, thus maximising content validity to contextualise the construct domain (see, Bazerman, 2006; Zaccaro, 2001).

Guided by these conceptual frameworks and empirical generalisations, the design of the items conceptualised managers' decision-making skills as behavioural actions regulated by efficacy-activated processes. This is illustrated in Table 1.

Formulated as estimates of how effort and ability combine and the type of affect a manager will experience in response to decision demands, the self-efficacy items determine whether managers make good or poor use of their decision-making skills (Bandura, 2009). Consequently, less than adequate self-efficacy beliefs inherently decrease the attentional focus in ways that impair persistent application of effort, as well as how well managers are able to balance their affect and deliberative analysis in decision-making. It is argued that such self-referent motivational and affective influences and self-doubt about one's ability contribute to suboptimal decision task strategies such as less effort, ill-focused information search, faulty recall of relevant information, inadequate identification and evaluation of alternatives, and failure to exercise rational modes of social influence that account for hastily concluded solutions. All these suboptimal strategies undermine the effective use of competencies managers possess.

A total of 30 items were generated to assess managerial decision-making self-efficacy beliefs. There were nine items representing the initiating activity and 12 items representing the design phase, both of which corresponded to acquiring and deliberating with information in a systematic manner (a systematic-comprehensive process). The choice phase contained nine items and reflected exercising effortful rational social influence in order to counteract the social and political pressures that detract from rational decisions. Bandura's (2006) guidelines for response format in the construction of items were followed for the MDMSEQ. Each item was framed to specifically reflect behaviours over which

managers can exercise some control, as well as how well they can perform these tasks *regularly* in the face of discouraging conditions as expressed in terms of level of perseverance, exertion, accuracy, threat or self-regulation.

In completing the MDMSEQ, perceived self-efficacy beliefs are measured against levels of decision-making capabilities on a 100-point scale, ranging in 10-unit intervals from 0 ('Cannot do'), through intermediate degrees of assurance of 50 ('Moderately certain can do'), to complete assurance of 100 ('Highly certain can do'). The items tapping the same domain of efficacy were added and converted to a mean self-efficacy subscale score.

EXAMPLE

Please rate in each of the blanks in the column how certain you are that you can get yourself to perform in these activities *regularly*.

Rate your degree of confidence by recording a number from 0 to 100 using the scale given below:

0	10	20	30	40	50	60	70	80	90	100

Cannot do at all   Moderately can do   Certain can do

1. Think clearly and keep all the relevant factors and information in mind	
2. Remain confident to make sound judgments and the right choices	
3. Use a methodical thinking process in my decisions.	

An investigation of comparative response format by Pajares, Hartley and Valiante (2001) report that after a factor and reliability analysis that a self-efficacy scale with a 0–100 response format was psychometrically stronger than when compared to a traditional Likert format. The fine-grained discrimination of the 0–100 scale provided an assessment of self-efficacy beliefs that was not only (1) more strongly related to the performance indexes with which it was compared, but also (2) predictive of achievement in a regression model, whereas the less discriminating scale using the Likert format was not. 'People usually avoid the extreme positions on a scale so one with only a few steps may, in actual use, shrink to one or two points. Including too few steps loses differentiating information because people who use the same response category may differ if intermediate steps were included' (Bandura, 2006, p. 312).

TABLE 1: Decision-making and self-efficacy beliefs.

Janis and Mann's (1977) conflict model of the decision-making process.	Self-efficacy beliefs (Bandura, 1997) as task or domain-specific appraisals to perform a specific task at a specific level of performance.
(1) An initiating activity (appraising the challenge, framing or structuring the problem, selecting situations requiring decisions),	(1) Diagnosing task demands,
(2) a design phase (searching for potential solutions, surveying alternatives, seeking and weighing alternatives) and	(2) applying analytic problem-solving strategies,
(3) making a choice (deliberating about and accepting one alternative from the available alternatives, influencing others, adhering to the decision despite negative feedback and opposition).	(3) constructing and evaluating alternative courses of action,
	(4) setting proximal goals to guide one's efforts,
	(5) creating self-incentives to sustain engagement in taxing activities and
	(6) managing emotions and debilitating intrusive thoughts.

Furthermore, the non-reactivity of self-efficacy beliefs assessments is not a great concern. Numerous tests for reactive effects of self-assessment have been conducted (Bandura, 1997). Findings show that individuals' level of motivation, affective reactions and performance attainments are the same regardless of whether they do or do not make prior efficacy judgments. Nor are efficacy judgments influenced by a responding bias to appear socially desirable, regardless of the domain of activity.

Research method
Research approach

The MDMSEQ was examined in two studies. Study 1 investigated the underlying factor structure and the item homogeneity within each of the domain-relevant self-efficacy scales with the use of exploratory factor analysis (EFA) to determine the multidimensionality internal consistency of the scale and subscales, as well as the convergent validity of the MDMSEQ. Study 2 employed conventional confirmatory factor analysis (CFA) in order to verify the psychometric quality of the measurement model and the magnitude of the relations between subscale factors as latent variables.

Study 1: Factorial validity
Participants and procedure

The data collection for this research was incorporated into the standard assessment procedures that the practice employs. The questionnaire was administered as part of a private assessment practice to 193 managers who all agreed to participate in the study. These managers were nominated by organisations' in-house human resources professionals for independent assessment in relation to managerial positions. The decision to undertake the present research rested on a considered judgment about how best to contribute to psychological science and human welfare. On the basis of this consideration, the researchers carried out the investigation with respect and concern for the dignity and welfare of the individuals who participated, taking cognisance of statutory and professional standards that govern the conduct of research with human participants. The researchers provided information to each individual to help them understand the study, as well as to inform them as to what they would be asked to respond to during the assessment, the risks and benefits and their rights as study subjects. It was also pointed out that the MDMSEQ measure to be used during the managerial assessment will be clearly marked 'for research purposes only'. Assurance was given in this regard that the findings would not be used for the purpose of the assessment they had been nominated for. Individuals, consequently, participated in the research voluntarily and with informed consent, thus providing an opportunity for a nonprobability, purposive sample.

Participants had at least five years' experience in management and were employed in middle to senior management positions across a number of organisations in the private sector. The mean age of the sample was 38.9 years (SD = 7.5) and 79% had a graduate or postgraduate qualification. Both genders were represented (males accounted for 70% of the sample, which is in keeping with employment practice trends). African black participants accounted for 15% of the sample.

The managerial levels of the sample were recorded based on Prinsloo's (1992) Cognitive Task Assessor in order to measure level of work according to an adapted version of the Stratified Systems Theory (Jacques, 1996). The Cognitive Task Assessor requires individuals to distribute a total of six points amongst descriptions that they think apply most to their present position. These points could be distributed amongst several options, all options or, in extreme instances, a single option. Scores are grouped into four managerial levels. A maximum score of 144 describes the most complex job level (level 4), a score of 100 level 3, a score of 64 level 2 and a score of 16 level 1. The mean score for the present sample was 71.4 with a SD of 19.6. The representation of managers across managerial levels was 8.8% (level 4), 51.8% (level 3) and 36.3% (level 2). There were no level 1 cases and the data for six cases (3.1%) was missing. This distribution suggests that close to 60% of the sample occupied high middle to senior management positions.

Dimensionality and factorial validity

In order to investigate the underlying factor structure, item homogeneity within each of the domain-relevant self-efficacy scales was investigated with EFA to determine the multidimensionality of the MDMSEQ. SPSS for Windows (version 21.0) was used to reduce the data into a set of weighted linear combinations using the principal axis method and oblique, direct oblimin factor rotation. Oblique factor rotation is generally more desirable than orthogonal rotation at an early stage of scale development because of the fewer constraints it imposes (Hair, Black, Babin, Anderson & Tatham, 2006) and is thus most appropriate when the a priori theory indicates that the obtained factors or dimensions are likely to be correlated. The items with the highest loadings on each construct were used to assist in identifying understandable and interpretable factor structures associated with each of the scales under consideration.

The communalities in Table 2 (noted as h^2) were acceptable (low communalities for a particular item between 0.0 and 0.4 may be problematic to include as it may struggle to load significantly on any factor). After visual inspection of the scree-plot for points of inflection and an examination of the eigenvalues, a four-factor solution was selected. The scree plot suggested that no more than four factors should be extracted (see Figure 1). The four-factor solution satisfied the Kaiser-Guttman criterion of retaining the factors with eigenvalues exceeding 1.0.

Loading of items on factors and percent of variance are shown (see Table 2). Items are ordered and grouped by size of loading to facilitate interpretation. There were few high cross-loadings on factors. Items were retained that provided the best representation to aid clear interpretation.
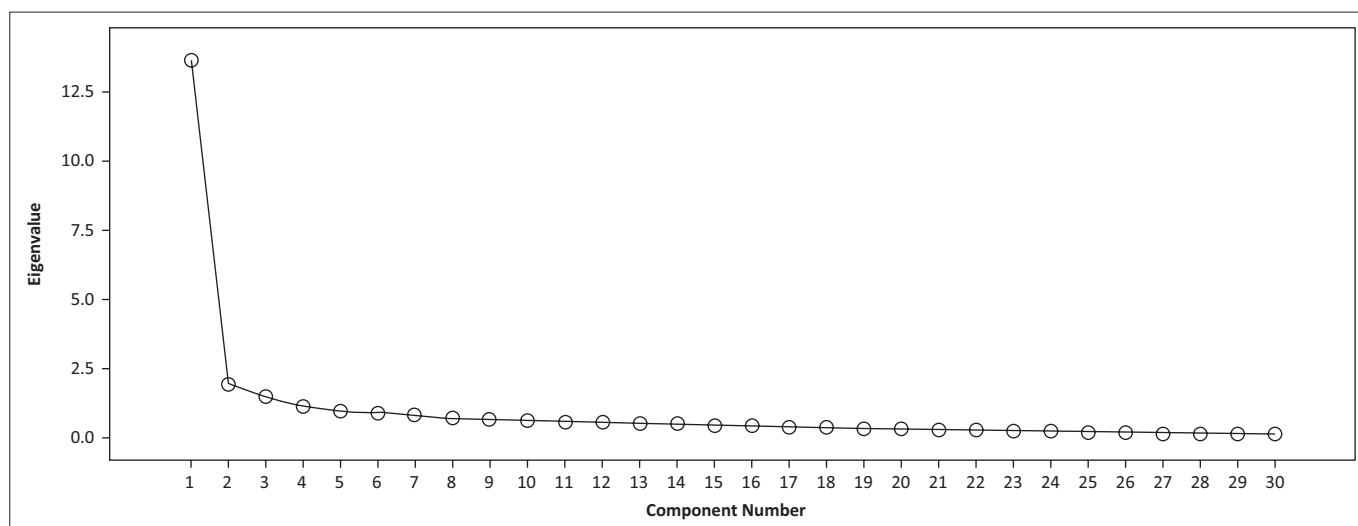
FIGURE 1: Scree plot and extracted eigenvalues suggested a four-factor solution.

TABLE 2: MDMSEQ: standard regression coefficients obtained via EFA (Oblimin rotation with Kaiser normalisation) (n = 193).

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Communalities (h^2)
6. Remain confident to make sound judgments and the right choices	**0.827**	-0.476	-	0.499	0.728
7. Know what to do next in decision-making	**0.8**	-0.487	-	0.428	0.659
8. Feel that I am making the right decisions	**0.798**	-0.51	-0.406	-	0.653
16. Influence decisions with certainty that they will work	**0.747**	-0.404	-0.458	-	0.603
17. Readily commit to my decisions	**0.734**	-0.414	-	0.485	0.589
15. Trust my own judgment and express my opinions firmly	**0.702**	-0.434	-0.528	-	0.582
9. Make difficult decisions under time pressure	**0.67**	-0.548	-	-	0.505
2. Control my level of attention and concentration when time pressure mounts	**0.655**	-0.593	-	-	0.519
1.Think clearly and keep all the relevant factors in mind	**0.624**	-0.591	-	-	0.541
19. Search for new information and alternatives		**-0.806**	-	-	0.660
21. Narrow down a list of alternatives that appear as effective options	0.612	**-0.794**	-	-	0.681
12. Discover a range of alternative or several solutions	0.422	**-0.78**	-	-	0.637
22. Manipulate quantitative data to identify trends, problems and their causes	0.411	**-0.761**	-	0.423	0.613
10. Use a methodical thinking process in my decisions		**-0.76**	-	0.424	0.619
20. Obtain information by seeing what needs to be known	0.715	**-0.744**	-	-	0.710
13. Weigh negative and positive consequences of each alternative option	0.536	**-0.735**	-	-	0.567
18. Appraise a business decision problem situation quickly	0.581	**-0.707**	-0.476	-	0.605
23. Choose the best alternative given the situation	0.596	**-0.705**	-	0.45	0.598
27. Secure resources to implement my decisions	0.575	**-0.692**	-0.554	-	0.630
11. Analyse and interpret numerical or quantitative data accurately	0.41	**-0.662**	-	-	0.473
25. Make decisions that contain risks and potentially unfavourable consequences	-	-	**-0.785**	-	0.631
28. Convince others of my decision choice even when opposition mounts	0.592	-0.427	**-0.78**	-	0.711
29. Influence decisions regardless of the amount of control I have over organisational constraints	0.532	-0.473	**-0.698**	-	0.602
24. Persevere in my persuasive attempts to convince others of my decision choice	0.641	-0.535	**-0.695**	-	0.672
26. Make a decision and persevere with actions to make them pay off	0.559	-0.542	**-0.691**	-	0.626
3. Limit negative thoughts entering my mind	0.406	-	-	**0.791**	0.643
5. Contain my self-doubts about my ability to deal with adverse consequences	0.655	-	-	**0.686**	0.665
14. Refrain from changing my mind to the least objectionable alternative	-	-0.467	-	**0.655**	0.502
30. Refrain from putting off difficult decisions	-	-0.439	-0.442	**0.642**	0.536
4. Refrain from worry about my decision choices and consequences	0.614	-0.435	-	**0.626**	0.560
Eigenvalues	13.706	1.965	1.484	1.165	-
% of variance	45.685	6.551	4.946	3.885	-

Extraction method: Principal component analysis.
Rotation method: Oblimin with Kaiser normalisation.

This was achieved by investigating item analysis and item-to-total correlations. All item-total correlations were 0.40 or greater, which resulted in no items being eliminated from the MDMSEQ (Nunnally & Bernstein, 1994).

Fabrigar, Wegener, MacCallum and Strahan (1999) recommend using relevant theory and multiple methods in factor retention decisions in order to balance the need for parsimony with that of plausibility. The Kaiser-Meyer-Oklin

TABLE 3: Zero-order intercorrelations, factorial dimensionality and internal consistency of MDMSEQ subscales.

MDMSEQ subscales	1	2	3	4
1. Affect control efficacy	-	-	-	-
2. Analytical and inferential efficacy	0.76**	-	-	-
3. Social influence efficacy	0.68**	0.63**	-	-
5. Thought control efficacy	0.71**	0.65**	0.59**	-
Eigenvalue	13.706	1.965	1.484	1.165
Percentage of variance explained	45.7	6.5	5.0	3.8
Cumulative percentage of variance explained	45.7	52.2	57.2	61.1
Coefficient alpha reliability estimates	0.9	0.92	0.85	0.8

**, $p < 0.01$, two-tailed.

value (Kaiser, 1970, 1974) was 0.94, which exceeded the recommended value of 0.60 (Hair *et al.*, 2006). In addition, the Barlett's test of sphericity (Bartlett, 1954) reached statistical significance, thus supporting the factorability of the correlation matrix.

The four-factor solution with items tapping the same managerial decision-making self-efficacy belief domains confirmed the multidimensionality of self-efficacy beliefs as measured by the MDMSEQ. Eigenvalues ranged from 1.165 to 13.706, with 61.07% of the total variance explained.

The factor explaining most of the variance was labelled as Affect Control Efficacy (ACE) (45.7% of the variance in the original scale, with nine items). Factor 2, labelled Analytical and Inferential Efficacy (AIE), accounted for 6.5% of the variance with 11 items. Social Influence Efficacy (SIE) (Factor 3) accounted for 5.0% of variance with five items. Factor 4, labelled Thought Control Efficacy (TCE), included five items and accounted for 3.8% of the variance (see Table 3).

Reliability and factor correlations

The coefficients of internal consistency indices (Cronbach's alpha) revealed reliability estimates of 0.90 for the Affect Control subscale. The Analytical and Inferential Efficacy subscale revealed an alpha of 0.92 and the Social Influence Efficacy subscale an alpha of 0.85. The five-item Thought Control Efficacy subscale revealed the lowest alpha of 0.80. The relatively high internal consistencies across subscales were above the 0.70 level recommended by Nunnally and Bernstein (1994). Further, in research with new measures an alpha of 0.60 is deemed acceptable according to Hair *et al.* (2006).

The reliability of the full 30-item scale was also calculated and revealed an internal reliability of 0.87. The full scale reliability was encouraging and comparable to another South African domain-specific self-efficacy beliefs scale, the Entrepreneurial Self-Efficacy Scale (Urban, 2006), which reported an alpha coefficient of 0.89. Table 2 reports the zero-order factor intercorrelations and internal consistency of the MDMSEQ subscales, which range in magnitude from 0.59 to 0.76. All zero-order coefficients exceeded the minimum of 0.30 recommended by Kline (1986).

TABLE 4: Correlation of MDMSEQ with similar measures.

MDMSEQ subscales	15 FQ+ factor O	PSSE
1. Affect control efficacy	-0.34**	0.32**
2. Analytical and inferential efficacy	-0.24**	0.24**
3. Social influence efficacy	-0.29**	0.29**
4. Thought control efficacy	-0.43**	0.25*

MDMSEQ, Managerial Decision-making Self-efficacy Questionnaire; PSSE, Problem Solving Self-efficacy Scale.
*, $p < 0.05$, one-tailed.
**, $p < 0.01$, one-tailed.

Construct validity

The aim of construct validation is to embed a purported measure of a construct in a nomological network to establish its relation to other variables with which it should theoretically be associated positively, negatively or practically not at all, and in a manner that is as free as possible from construct-irrelevant variance (Messick, 1995).

Other than information on its factorial validity, evidence related to how the MDMSEQ correlates with existing measures of self-efficacy would add to the information available on the construct being tapped. To the extent that the measure assesses conceptually similar constructs, the finding of strong correlations amongst similar measures should be interpreted as evidence for a lack of discriminant validity. On the other hand, to the extent that conceptually related constructs correlate with the measure, evidence is then provided for the convergent validity of the construct. Accordingly, to determine the convergent validity of the MDMSEQ it should be related positively and significantly with related constructs such as confidence and problem-solving self-efficacy. However, these relationships should not be too high in magnitude as to suggest construct redundancy.

The MDMSEQ's convergent validity was investigated by comparing it to the personality trait of confidence and the Problem Solving Self-efficacy Inventory (PSI-PSSE; Maydeu-Olivares & D'Zurilla, 1997). The 15FQ+ (Tyler, 2002) provides a comprehensive assessment of trait-based personality factors and the Factor O scale taps self-confidence (i.e. apprehensive, insecure, self-doubting). This scale was correlated with each of the four MDMSEQ subscales by calculating zero-order Pearson correlation coefficients. The results are reported in Table 4 where the findings demonstrated that the scores of the MDMSEQ subscales shared little common variance with the Factor O scale (trait confidence) (i.e. between 5% and 19% of the common variance explained). This suggests that managerial decision-making self-efficacy beliefs are indeed empirically distinct from confidence as a personality trait construct as suggested by extant research (see, for example, Chen, Gully, Whiteman & Kilcullen, 2000).

Moyo and Theron (2011), however, caution that the 15FQ+ measurement model parameter estimates were worrying. They report findings to suggest that the items generally do not reflect the latent personality dimensions with a great degree of precision. They present evidence to conclude that

there is little support for the design assumption that all items comprising Factor O subscale reflect one indivisible underlying theme.

Meiring, Van de Vijver and Rothmann (2006) also conclude that although item bias was not a major problem in an adapted version of the measure, only marginal increases were found in terms of the internal consistencies when compared to the original version and, moreover, for the black groups problematic reliability levels continued to limit the usefulness of the questionnaire.

Scores on the MDMSEQ and the Problem Solving Self-efficacy Scale (PSSE) of the PSI-PSSE were also correlated to further explore convergent validity. Although the PSSE subscale and the MDMSEQ both tap individual self-efficacy beliefs the constructs differ in their scope. The PSSE was designed to operationalise beliefs in problem-solving skills, effectiveness or competence and, consequently, represents a restricted view of self-efficacy beliefs in its application to managerial decision-making. In contrast, the MDMSEQ taps into multiplicative constellations of decision-making activities. Low, significant correlations are reported in Table 4 for the MDMSEQ and the PSSE. Whilst there was support for the convergent validity of the MDMSEQ, its subscales' shared variance was between 5% to 10% with the PSI-PSSE, suggesting that the MDMSEQ measures different aspects of self-efficacy.

Whilst there are no absolute cut-off points for what constitutes discriminant or convergent validity, there is general agreement that convergent validity exists when correlations are fairly high, for example, greater than 0.60 (Trochim, 2006). Although the present findings represented a less stringent test of discriminant validity, some researchers use a correlation of 0.85 as a rule-of-thumb cut-off point since correlations above this level signal definitional overlap of constructs.

Study 2: Factor structure confirmation and construct validity

The second study was a CFA to verify the psychometric quality of the measurement model and the magnitude of the relations between factors as latent variables. This second study defined the relations between the MDMSEQ latent variables (i.e. unobserved constructs) and their respective indicators in order to provide the link between the measurement and the underlying construct it was designed to measure. In addition, the investigation was used to assess the contribution and reliability of each indicator measure in the estimation of the relationships between the latent factors. Consequently, the CFA model specifies the pattern by which each measure loads on a particular latent factor (see Figure 2).

Participants and procedure

The questionnaire was continued with managers who all agreed to participate in the study as was described in
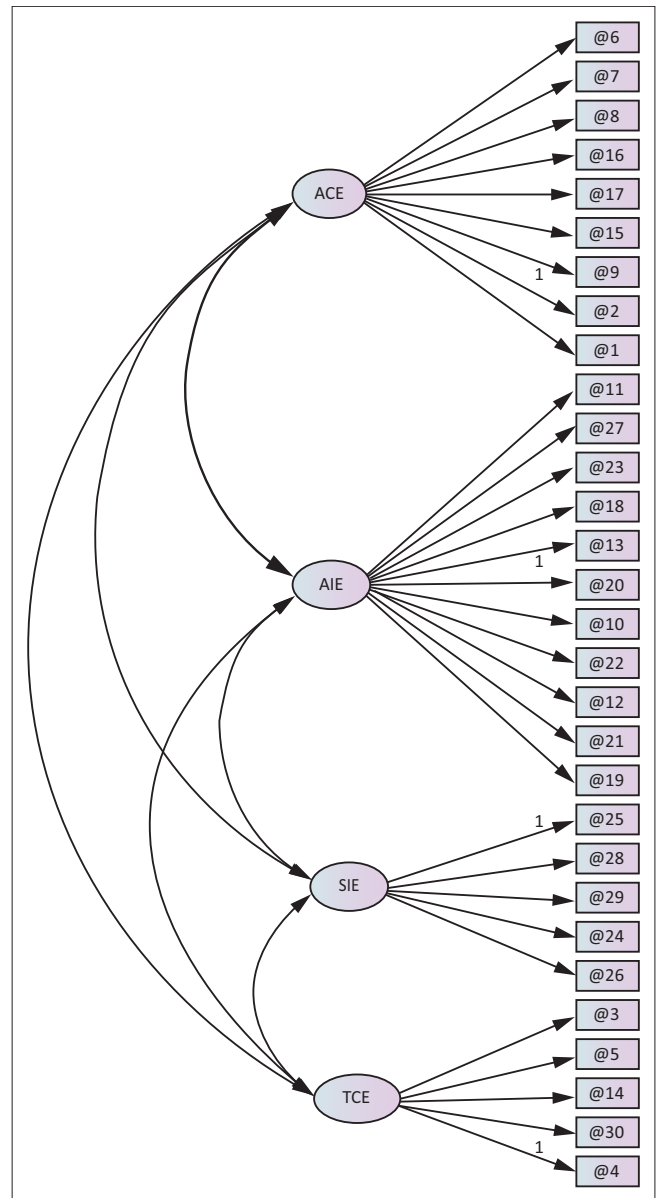
ACE, affect control efficacy; AIE, analytical and inferential efficacy; SIE, social influence efficacy; TCE, thought control efficacy.

FIGURE 2: Hypothesised confirmatory factor analysis model.

Study 1. The same ethical considerations as pointed out for Study 1 were applied. This afforded an opportunity for a second sample of 262 managers for Study 2. The mean age of the sample was 39.6 years (*SD* = 7.2) and 64.8% had a graduate or postgraduate qualification. Both genders were represented (men accounted for 70% of the sample). African black participants accounted for 37% of the sample. The mean score for the present sample was 65.8 with a *SD* of 20.9. The representation of managers across managerial levels was 4.7% level 4, 33.3% level 3 and 35.6% level 2. There were no level 1 cases and in 69 cases (26.4%) data on job level was missing. This distribution suggests that close to 70% of the sample occupied high middle management positions.

There was no MDMSEQ missing data in the sample of managers. The assumptions of multivariate normality and

linearity were evaluated using AMOS 17.0 for Windows (Arbuckle, 2008). Multivariate kurtosis was investigated with the normalised estimate of Mardia's (1970, 1974) kappa and there was evidence of kurtosis. This means that the data failed to meet the assumption of multivariate normality which necessitated a choice for robust maximum likelihood (RML) estimation to fit the measurement model (Bentler, 2006). Tabachnick and Fidell (2001) recommend EQS as the statistical package (Bentler, 2006) and the data analysis program of choice when data are non-normal since it is also the only program that offers the Satorra and Bentler (1994) scaled χ^2 (SB-χ^2) test statistic. After specifying the measurement model as illustrated in Figure 2, the goodness-of-fit for the measurement model and the specific evidence of construct validity were evaluated using AMOS 17.0 for Windows (Arbuckle, 2008) and EQS 6.1 (Bentler, 2006).

Fit statistics and alternative models

As no single measure of fit can provide a conclusive verdict on model fit (Byrne, 2006), the present authors used a spectrum of indices to test the four subscales of the MDMSEQ. The guidelines recommended by Hair *et al.* (2006) were used in order to determine the acceptability of fit for the measurement model.

Several recommended measures of overall goodness of fit were used including the comparative fit index (CFI), the normed fit index (NFI), the Tucker-Lewis index (TLI) or non-normed fit index (NNFI), Bollen's IFI, the root mean square error of approximation (RMSEA), the standardised root mean square residual (SRMR) and the ratio of chi-square relative to the degrees of freedom (χ^2/df) (e.g. Hu & Bentler, 1999). Values of 0.90 or higher are desirable and presumed to result in an acceptable model fit to the data for the CFI, NFI, NNFI and the IFI (e.g. Bentler, 2006; Hair *et al.*, 2006). The appropriate level for the RMSEA should be close to 0.06 and a cutoff value close to 0.08 for the SRMR. In addition, these authors suggest values of less than 5 for the χ^2/df ratio to indicate an acceptable model fit.

Finally, the expected cross-validation index (ECVI) was used as a means to assess the likelihood that the measurement model could be cross-validated across similar sized samples from the same population. In order to assess a model's ECVI the model needs to be compared against the ECVI values of other models. The model with the smallest ECVI value is chosen as representing the greatest potential for replication (Byrne, 2001). The measurement model fit measures appear in Table 5.

Arbuckle (2008) recommends the ratio for the χ^2/df as an indicator of fit between the hypothesised model and the sample data and suggests a range of 2 to 1 or 3 to 1 as representing an acceptable fit. A ratio of less than 2 represents an inadequate fit. Other authors suggest that values of less than 5 indicate acceptable model fit. The present χ^2/df ratio was 2.9 and, on the basis of the ratio χ^2/df, the measurement model fit the data well.

TABLE 5: Overall structural model fit measures: Robust maximum likelihood.

Fit statistics	Model
Absolute fit statistics	
χ^2/df	2.90
Satorra-Bentler scaled chi-square (χ^2) of estimated model	820.28
Degrees of freedom	399
Significance level	0.00
Standardised RMR	0.06
Root mean square error of approximation (RMSEA)	0.06
90 Percent confidence interval for RMSEA	0.057, 0.070
Incremental and parsimony fit statistics	
Bentler-Bonett normed fit index (NFI)	0.75
Bentler-Bonett non-normed fit index (NNFI)	0.84
Comparative fit index (CFI)	0.85
Bollen's (IFI) fit index	0.85

The chi-square fit index was examined for absolute model testing (i.e. whether the model can predict what is actually observed). A significant chi-square fit index indicates that the model is empirically invalid. The findings revealed a significant *p*-value for the chi-square statistic (χ^2). Consequently, on this index the measurement model did not fit the observed correlations. Nevertheless, various authors (e.g. Arbuckle, 2008; Hair *et al.*, 2006) have noted that kurtosis in the data makes χ^2 particularly troublesome in evaluating the goodness-of-fit of a model. Thus, the Satorra-Bentler scaled χ^2 was employed in order to accommodate the absence of normality. On this index a non-significant *p*-value for SB-χ^2 was also obtained. However, it is not practical to assume that data must fit the proposed model perfectly since any model is an approximation of reality. Moreover, χ^2 is influenced by sample size, that is, as the sample increases so does the value of χ^2.

The SRMR reflects a badness-of-fit measure and is especially useful in detecting misspecification (Bentler, 2006). As pointed out earlier good-fitting models have small SRMR and values of 0.08 or less are desired. An arbitrary cut-off of between 0.05 and 0.08 is suggested for SRMR (Hair *et al.*, 2006; Tabachnick & Fidell, 2001). The measurement model reflected a SRMR of 0.06. As this SRMR value is relatively small it suggests the model fits the data well regardless of what other measures of fit imply.

The RMSEA was 0.06. Byrne (2001) notes that the RMSEA has only recently been recognised as one of the more informative criteria in covariance structure modelling. The RMSEA takes into account the error of approximation in the population and asks the question of how well the model, with unknown but optimally chosen parameter values, fits the population covariance matrix if it were available. Values less than 0.05 indicate a good fit. As the RMSEA is sensitive to model misspecification, it yields appropriate conclusions regarding model quality and it is possible to build confidence intervals around RMSEA values (Bentler, 2006). The 90% confidence interval for RMSEA was 0.05 to 0.07. This narrow confidence interval for the measurement model argued for a reasonable fit of the conceptual model to the empirical data.

Incremental fit measures adjust the measures of fit to provide a comparison between models with differing numbers of estimated coefficients, the purpose being to determine the amount of fit achieved by each estimated coefficient. More complex models are expected to fit the data better, so fit measures must be relative to model complexity before comparisons between models can be made. To provide alternative perspectives on model fit, the authors deployed a number of different goodness-of-fit measures. The CFI and IFI were 0.85, the NNFI was 0.84, but the NFI was 0.75. Like other fit indices, relatively high values represent relatively better fit to compare one model to another.

Finally, the ECVI was used as a means to assess the likelihood that the measurement model could be cross-validated across similar sized samples from the same population. Because ECVI coefficients can take on any value, the estimated model ECVI value of 4.945 was compared to the saturated model (ECVI = 3.563). Given the lower ECVI value for the model, compared to the saturated model, it was concluded that the model was reasonable in representing an approximation to the population.

Measurement model validity

Using the theoretical framework and EFA, the four theorised factors served as latent constructs and the items retained from Study 1 served as indicators for each latent construct.

The squared multiple correlations reflect item reliability and thus show the proportion of variance of an indicator that is explained by its underlying construct variable (with the balance due to measurement error). High multiple squared correlation values denote high reliability, whereas low values are associated with measurement error (Byrne, 2001; Hair *et al.*, 2006).

Loading estimates that are significant provide a useful start in assessing the convergent validity of the measurement model. The items, together with their loadings on their primary factors, are shown in Figure 3.

For high convergent validity, high loadings on a factor indicate that they converge on some common point. Although factor loadings were all statistically significant this may still be fairly weak in strength. Hair *et al.* (2006) assert that standardised loading estimates should be 0.5 or higher, and ideally 0.7 or higher. Upon closer inspection some problematic low loadings on AIE were noted. This suggested that more of the variance in indicators was due to error variance than explained variance. Because no other indicators had low loadings it was however decided that it was not necessary to delete any for the model to be re-estimated.

The four factors were qualitatively distinct but inter-related (i.e. correlated) constructs. Discriminant validity implies that the latent variables should behave in a manner that does not imply that two or more different latent variables correlate perfectly and therefore, by implication, suggest essentially a single construct. The correlations between latent variables were not excessively high as to serve as evidence that the measures do discriminate between the distinct constructs.

Composite reliability

The multi-factor internal consistency, rho (ρ), calculated using EQS (Bentler, 2006), revealed a value of 0.95. The MDMSEQ composite reliability was encouraging and comparable to other self-efficacy belief scales. For instance, Bandura's (1989) Multidimensional Scales of Perceived Self-efficacy reliability ranged from 0.70 to 0.87 (Miller, Coombs, & Fuqua, 1999). In addition, the General Self-efficacy Scale (Sherer *et al.*, 1982) has reliability estimates ranging from 0.76 to 0.89 (Imam, 2007) and Chen, Gully and Eden's (2001) New General Self-efficacy Scale demonstrated reliability coefficients that range from 0.86 to 0.90. Burns and Christiansen (2011) report internal consistency estimates of their general work domain-specific efficacy scales as ranging from 0.74 to 0.87 with an average alpha of 0.82. In addition, Urban's (2006) South African Entrepreneurial Self-efficacy Scale reflected a composite alpha of 0.89.

Discussion

Bandura (1999) argues that psychology should move toward more domain-specific cognitive structures instead of relying on all-purpose measures of personal attributes in its efforts to explain how personal factors contribute to psychosocial functioning. Conceptual and empirical evidence provide for a reasoned assertion to suggest that it is unrealistic to expect global decontextualised measures cast in non-conditional generalities to have explanatory and predictive power to account for individual differences in the quality of managerial decision making (Bandura, 1997). In such omnibus conglomerate traits the items are decontextualised by deleting information about the situations with which people are dealing and the more general the items the more respondents have to try to guess what the unspecified situational particulars might be.

In order to examine managerial decision-making self-efficacy beliefs the preliminary step in Study 1 was to review existing taxonomies of common managerial decision-making activities where self-efficacy beliefs are likely to impact on volitional allocation of attentional resources that, in turn, impact on the rationality and quality of decision-making outcomes.

Evidence for factorial validity

The multidimensionality of the MDMSEQ was established in Study 1. Exploratory factor analysis confirmed the homogeneity of the original 30-item scale and identified understandable and interpretable parsimonious factor structures associated with each of the latent variables under consideration in keeping with the literature and extant empirical research. The authors confirmed a four-dimensional
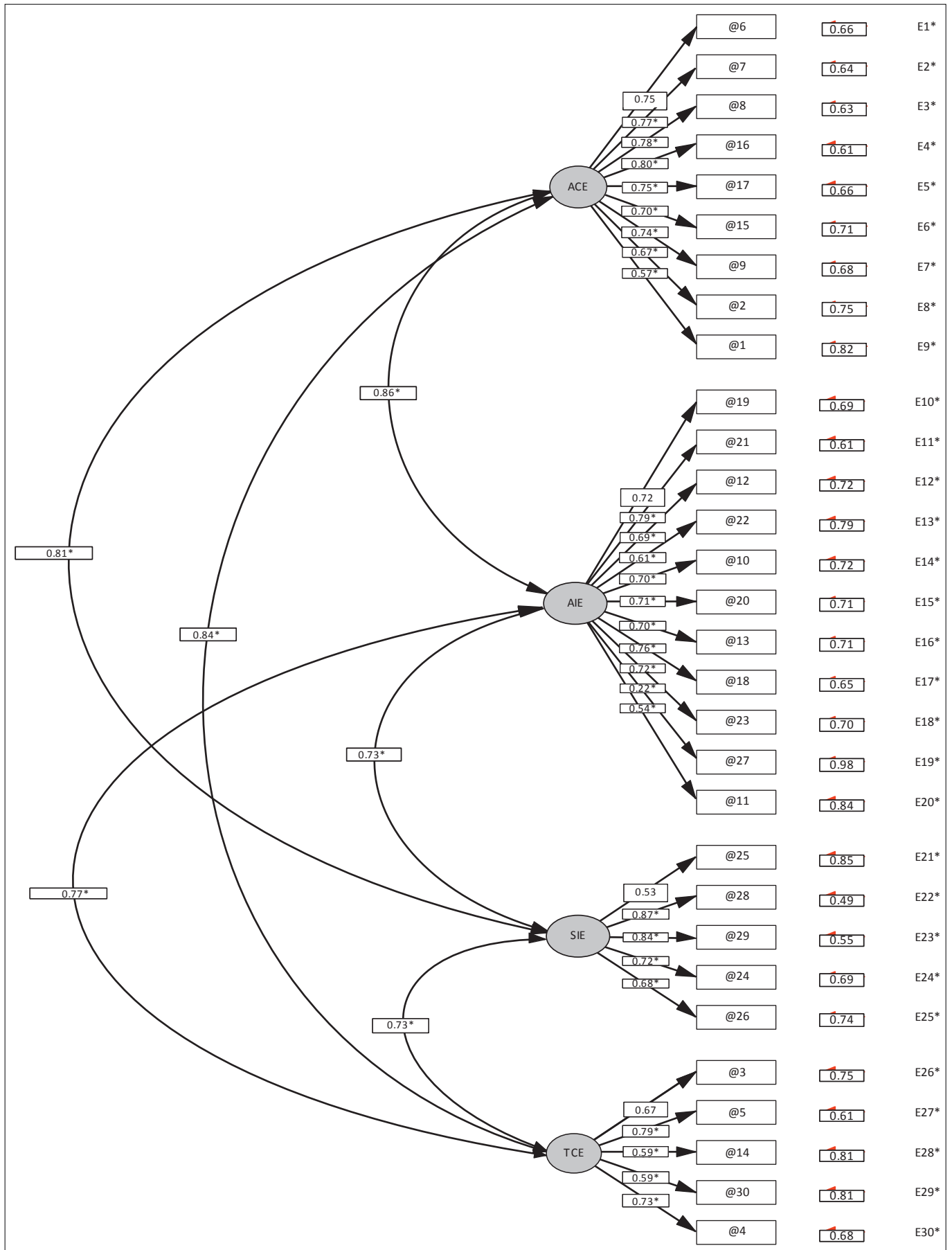
ACE, affect control efficacy; AIE, analytical and inferential efficacy; SIE, social influence efficacy; TCE, thought control Efficacy.

FIGURE 3: Factor standardised loadings and measurement errors of the indicators.

construct, comprising thought and affect control, social influence and analytical and inferential efficacy beliefs.

Evidence for convergent validity

Study 1 also focused on convergent validity and supported two fundamental conceptual constructs related to managerial decision-making self-efficacy beliefs. It was argued that the MDMSEQ, as a set of capabilities, guide and shape behaviour at least in part through attentional effort and regulation of affect. The domain-linked knowledge structures, self-conceptions and competencies in the MDMSEQ, consequently, are thus conceptually distinct from confidence as a relatively stable and enduring personality trait that focuses more on the characteristic responses that individuals make to broad environmental demands than on context-specific and task-specific performance. The evidence confirmed that the MDMSEQ shared little common variance with confidence as a contextually enduring trait disposition.

Secondly, although the MDMSEQ is related to problem-solving self-efficacy beliefs, it remains independent and distinct from problem-solving beliefs. The latter beliefs reflect the ability to assess a present and desired state of affairs and of finding ways to move from the former to the latter state (see, for a review, Maydeu-Olivares & D'Zurilla, 1997). These beliefs are not tied to specific situations or behaviour, but generalise to a variety of situations. Decision-making self-efficacy beliefs, however, are specific levels of performance in order to: mobilise motivation (effort and perseverance), exert rational and attentional resources (analytic and problem-solving skills), exercise independence in social influence (to gain compliance, enlist cooperation and acquire resources), control disruptive and aversive cognitions, and implement courses of action in order to make accurate decisions. For both conceptual issues the common variances suggested that the MDMSEQ is not simply synonymous with confidence and problem-solving efficacy beliefs which would have suggested construct redundancy.

Evidence of measurement model fit

The overall model fit, the significant factor loadings, the high composite reliability, the substantial proportion of variance in most indicators accounted for by the four factors, as well as the empirical independence of the factors, support the proposed psychometric character of the MDMSEQ.

Confirmatory factor analysis provided evidence of construct validity based on tests of significance and assessment of the measurement model fit. The results supported the four-dimensionality of the MDMSEQ structure on a second validation sample. The measurement model fitted the data moderately well. The general nomological validity demonstrated that the latent variables were related to one another. The discriminability between the latent variables, and the extent to which each latent variable was truly distinct from other latent variables, demonstrated that latent variables were related to one another in a manner

that supported conceptual relations in managerial decision making self-efficacy.

Limitations and recommendations for future research

Although the MDMSEQ is conceptually more consistent with managerial decision-making self-efficacy beliefs than with confidence and problem-solving efficacy as generalised, context-independent constructs, there remains the issue of content deficiency or the degree to which the domain of managerial decision-making self-efficacy beliefs was sufficiently sampled. This can only be determined by comparing the content of the items to the definition of the construct and judging whether the items sufficiently sample the domain as defined.

The fact that the selection of latent variables of the MDMSEQ was made on an a priori basis represents a limitation since managerial decision-making constitutes a complex process expressing itself in an array of interdependent behavioural actions and driven by an intricate nomological network of situational and person-centred latent variables. The extent to which the identity of such other latent variables is known, as well as the manner in which they combine to affect the various subscale dimensions, suggests there is a possibility of an alternative model that may contain a number of additional latent variables and paths nested within a more elaborate model.

This might suggest adaptation of the measurement instrument as, for example, broadening the domain specification and adding items to reflect country or context-specific items. For instance, several studies have concluded that country, contextual and decision-specific characteristics, team decision-making disposition and manager tenure play a central role in relation to decision-making (Elbanna & Child, 2007; Papadakis, 2006; Papadakis & Barwise, 2002).

Establishing the validity of a measurement instrument is a key process in the development of good instrumentation. Benson (1998) offers three stages of construct validation: (1) substantive, (2) structural and (3) external. In the substantive stage, constructs are theorised and defined. In the structural stage, relationships amongst variables purported to measure the construct are sought. The external stage incorporates the construct's relation to other constructs, that is, establishes its relation to other variables with which it should theoretically be associated positively, negatively or practically not at all (i.e. creating the nomological network; see Cronbach & Meehl, 1955). Exploring a theory's nomological net indicates whether the operational definitions adequately represent the theory, and how well the real-world paper-and-pencil measure is grounded in its hypothetical world.

The present evidence suggests respectable psychometric properties for the MDMSEQ. In accordance with the conceptual literature, the MDMSEQ demonstrated the potential to capture the multidimensional nature of decision-

making self-efficacy beliefs relevant to managerial decision-making. Further exploration of the construct validity (by way of the factorial and convergent validity of the MDMSEQ subscales) suggests that the constructs measured were in keeping with the literature and empirical research. Moreover, the reliability estimates confirmed a degree of trust in the indicators' properties in providing an uncontaminated measure of the defined constructs.

External domain studies are needed to consider how predictive the MDMSEQ and its subscales are of managerial decision outcomes and how constellations of individual variable factors (for example, cognitive ability level and emotion-based traits) as antecedents interact with self-efficacy beliefs to regulate effort and affect in predicted ways (see, for example, Judge *et al.*, 2007). The MDMSEQ presents a plausible model to account for individual differences that influence the engagement and allocation of attentional resources that give rise to the selection of cognitively effortful information search, deliberation and rational social influence in managerial decision-making processes.

Other than a theoretical contribution, the study aids in both heuristic and applied utility. Managers are notoriously unwilling to submit themselves to scholarly investigation (Hambrick, 2007) and relatively little is known about the measurement of motivational and volitional effects of self-efficacy in managerial decision-making (Hiller & Hambrick, 2005; Zacarro, 2001). The MDMSEQ appears to be a reliable measure of the volitional undermining effects of managerial decision-making self-efficacy beliefs as operationalised in terms of the four dimensions defined in this study.

The standards for educational and psychological testing (American Psychological Association, 2004) recommend test-taking effort be collected, reported and used in interpretation of test scores. Similarly, in the Guidelines on Test Use, the International Test Commission (ITC, 2001) calls for test users to 'consider other qualities which may have artificially lowered or raised results when interpreting scores' (p. 21, Guideline 2.7.7). Test-taking effort is one such quality and thus should be examined and reported.

With the foregoing in mind, different individuals with similar skills or the same person under different circumstances may perform poorly, adequately or extraordinarily, depending on fluctuations in their beliefs about their competence (Bandura, 1997). Consequently, how managers behave can often be better predicted by the beliefs they hold about their capabilities than by what they are actually capable of demonstrating, for their self-efficacy perceptions help determine what they do with the knowledge and skills they have. Assessment findings must thus be interpreted as a composite and interactive result between effort applied (self-beliefs in competence) and ability. This may help explain why managers' assessment behaviours are sometimes disjoined from their actual capabilities and why their behaviour may differ widely even when they have similar knowledge and skills.

One advantage of self-efficacy beliefs is that they are relatively malleable contextually situated patterns that are relatively easy to change (Chen *et al.*, 2000). Given appropriate cognitive ability, successful performance is often as much a matter of beliefs in capability (Bandura, 1997) and when individuals believe that their competence is dynamic, malleable and able to be developed (an incremental theory), they tend to focus less on fixed ability and traits, and appreciate outcomes and actions in terms of more specific behavioural or psychological mediators (Dweck & Molden, 2005). Changes in self-efficacy beliefs and performance show self-corrections where individuals defer to actual performance as a stronger predictor of confidence for future performance (McNatt & Judge, 2004).

Consequently, the potential utility of the MDMSEQ may help practitioners predict pre-training motivation, tailor specific coaching or training programmes in order to help managers to regulate their attention and affect as temporal processes that impact on the quality of managerial decision-making.

Notwithstanding these potential findings, the present study only provided an initial step towards extending research on the MDMSEQ. Although the present authors were afforded the opportunity to estimate the plausibility of a model of relations in the MDMSEQ, the data were obtained from a restricted managerial population whilst attempting to estimate the parameters of an unrestricted managerial population. Consequently, the findings may be due to sample range restriction. Thus the evidence, although suggestive, may imply that the solutions are optimal for this specific sample, suggesting that the measurement model should be replicated for a broader population of managers. The scale was purposefully developed and initial validity evidence using a racially diverse sample of South African managers is promising. However, additional validity evidence for the scores is clearly needed.

Measurement invariance is rarely tested in organisational research (Vandenberg & Lance, 2000) and the establishment of measurement invariance across groups is thus a logical prerequisite to conducting substantive cross-group comparisons (e.g. tests of group mean differences, invariance of structural parameter estimates) for future research.

Future research should replicate the MDMSEQ's construct structure by demonstrating configural invariance to determine whether the construct shares its meaning across samples. Such configural invariance constitutes the most basic test of measurement equivalence by an examination of the configuration of relationships between items and the specified latent variables across samples. In addition, a much stronger case can be made if item loadings are of the same magnitude across samples (Vandenberg & Lance, 2000). This would suggest that managers of different samples (for instance, gender, race, educational and job level) calibrate the measure and thus interpret the construct in the same way. Such metric invariance could confirm

that the measurement model is identical to that tested for configural invariance with the added constraint of factor loadings across samples.

Acknowledgements

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