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MIXED METHODS APPROACH TO DEVELOP A COMPETITIVE INTELLIGENCE SURVEY FOR SOUTH AFRICAN CRICKET COACHES

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ABSTRACT

Sport coaches and business managers follow similar activities to collect, analyse and communicate data related to the opposition, known as competitive intelligence (CI), to gain a competitive advantage through strategic decision making. Little is known about the CI process that coaches follow. This study aimed to develop a CI survey for South African cricket coaches and to determine content and face validity of the items. The CI survey was developed using a mixed-methods approach that integrated at four points during a five-step process. Semi-structured interviews were conducted with high-level cricket coaches and support staff, followed by a constant comparative method of qualitative data analysis with Atlas.Ti™ software. Theory and data-driven interview codes and categories were quantitised. A cluster analysis concatenated the codes into five conceptual themes, each with sub-categories. These themes were used to create scales of the survey, whereas the categories were used to create items. Experts confirmed the content, face and preliminary factorial validity of newly developed scales and items of the CI survey. The newly developed CI survey for cricket coaches is unique within the sporting fraternity and holds promise for researchers to further explore this phenomenon within the social sciences field of enquiry.

***Keywords*:** Competitive intelligence; Mixed methods; Survey development.

INTRODUCTION

Competitive intelligence (CI) is a process within the business domain whereby practitioners collect, analyse and communicate specific competitor information to managers for strategic decision making (SCIP, 2012). Competitive intelligence is an important function within businesses as it allows organisations to gain and maintain their competitive advantage through strategic plans, decisions and operations (Calof & Wright, 2008). Likewise, in the sport domain, cricket coaches obtain CI through the collection and analysis of information on their competitors and the environment for decision making and countering of opponent strategy (Bhattacharjee & Saikia, 2014). In this regard, performance analysis (PA) of cricket matches and players has increased over the past decade as coaches aim to uncover key performance indicators and match

elements to assess tactical decisions and enhance performances (Petersen *et a*l., 2008; Sharma *et al*., 2012). Although the statistical and PA of cricket matches and players provide coaches with information for strategic decision making, coaches make use of an unstructured process *(*Groom *et al*., 2011). Researchers suggest that a domain-specific phenomenon can be transferred to another domain to determine the underlying principles and variables (Turocy, 2002).

Incidentally, numerous business CI process properties are identical to the properties of the process that coaches follow for CI creation within the sport domain (Hendrickson, 2012). However, coaches do not operate in a similar structured manner when collecting and analysing competitor information when compared to their business counterparts (Hendrickson, 2012; Wright *et al*., 2012a/b). A systematic approach to data collection and analysis will improve coaches' ability to adjust and devise a suitable counter-strategy, enhancing their competitiveness and chances of success (Nasri, 2011a, b). However, in order for coaches to enhance their CI practices, an investigation of their current CI activities, is needed. The creation of a scientifically and empirically developed survey will allow researchers to investigate SA cricket coaches' CI activities.

In the business domain, the systematic CI activities performed by companies have been investigated through the use of surveys (Saayman *et al*., 2008). Business CI surveys measure the following main constructs: planning and focus, data collection, analysis, communication, countering, organisational awareness and the CI process (Viviers *et al*., 2002; Weiss, 2002). Business CI survey-based research determined a variety of CI practices within different business sectors of South Africa (Viviers *et al*., 2002; Wright *et al*., 2002; Wright *et al*., 2009; Du Toit & Sewdass, 2014a). Additionally, CI survey-based research has identified CI challenges faced by South African pharmaceutical companies, explored CI within countries such as Brazil and Morocco, investigated the maturity level of the CI function within banking sectors, and proposed CI culture development strategies within South African businesses (Heppes & Du Toit, 2008; Fatti & Du Toit, 2013; Du Toit & Sewdass, 2014b).

Accordingly, the development of a CI survey for cricket coaches, using similar properties and constructs, will allow researchers in the sport and coaching fraternity to investigate the CI creation process within coaching practices. In this regard, the use of a mixed-method approach provides a stepwise and innovative approach to develop surveys within social sciences research (Gehlbach & Brinkworth, 2011).

PURPOSE OF RESEARCH

The purpose of this study was to develop a CI survey for South African cricket coaches and to determine the content and face validity of the items in the survey.

METHODOLOGY

Population and sampling

South African cricket coaches with more than five years of coaching experience at university, provincial, professional or national level, and/or who obtained a coaching qualification from the national governing body, as well as their immediate support staff, comprised the study population. These coaches and support staff were targeted since they are responsible for team

strategy development and usually, regardless of competitive level, engage in data collection and analysis of some sort (Cooper *et al.*, 2007). Ethical procedures for informed consent and participation, as stipulated by the Declaration of Helsinki (World Medical Association, 2013) and the Health Research Ethics Committee of the university where the research was conducted (Ethics number NWU-00185-15-A1), were adhered to during the sampling and research process. Purposeful sampling was deemed to be appropriate to gain insight into the specific occurrence of cricket coaches and support staffs' CI-related activities (Merriam, 1988). Coaches who consented to participate in the study were asked if support staff were involved with the team (assistant coaches, performance analysts or sport scientists). The support staff included in the study, had to have at least three years' experience or a tertiary qualification in the human movement science or sports analysis field. The use of snowball sampling added two assistant coaches and three analysts to the sample (Merriam, 1998).

Data collection

Face-to-face, Skype or telephonic interviews were conducted with the coaches and support staff according to their mode and location preferences, since numerous coaches were not in close proximity to the researcher. The researcher emailed the interview schedule to participants two days prior to the interview appointment so that interviewees could familiarise themselves with the questions. The researcher transcribed the voice recorded interviews verbatim and emailed it to participants for validation purposes. None of the participants objected to the authenticity and accuracy of the transcriptions which enhanced data validation (Creswell, 2003). Participants also completed a demographic information questionnaire regarding coaching experience, qualifications and teams coached.

A total of 16 males and one female participated in this study of whom 12 were head coaches, two assistant coaches and three analysts. Nine of the fourteen participant coaches had between ten and nineteen years of experience, three coaches between six to nine years, and two coaches more than twenty years of experience. Five participants had a level two, four participants a level three and five participants a level four coaching qualification, respectively. Two of the participants were involved at national, six at a franchise or domestic professional, four at provincial, two at premier and three at university level. One coach was involved with a female team; one with both women and men teams and the rest coached male cricket teams. Between the three analysts, two had between three to four years of experience on the university level and one more than ten years at international level.

Process overview and integration of mixed methods

A mixed methods approach that integrated at four points during a five-step process was used to achieve the aim of this study (Table 1).

The study followed the five-step process proposed by Gehlbach and Brinkworth (2011) to create a survey. The five steps included i) a literature review, ii) the use of focus group interviews, iii) synthesis of findings into a comprehensive list, iv) the development of items, and v) expert reviews before executing a pilot study (Gehlbach & Brinkworth, 2011). This approach relies on diverse techniques and, among other things, consultations with experts in the field to assist in item development and validity determination at the onset of survey creation (Gehlbach & Brinkworth, 2011). This study incorporated qualitative and quantitative data collection and analysis methods during the various steps which are explained hereafter.

***Table 1*. STUDY DESIGN STEPS AND MIXED METHODS INTEGRATION POINTS**

No	Steps	Sub-activities	Method	Mixed methods
1.	Literature review	Systematic literature review	Document collection and qualitative analysis	
2.	Interviews	Study sample Data collection Data analysis CCM Codebook Cohens' Kappa	Qualitative data analysis Quantitative verification of qualitative analysis process	Integration point 1
3.	Synthesis of literature and interview data	Quantifying data Quantitative analysis Cluster analysis Qualitative theme and category creation	Quantitative and qualitative data analysis	Integration point 2
4.	Development of items	Theme and category creation	Using quantitative cluster for a qualitative theme, category and item creation	Integration point 3
5.	Expert review	Expert panel Panel analysis Inter-rater agreement Factorial validity	Quantitative and qualitative item analysis Using quantitative and qualitative data to revise the instrument	Integration point 4
Revised instrument				

Literature review

In the first step of survey development, relevant literature was explored through a systematic literature review (SLR) of the business CI and sport-related performance analysis (PA) as well as coaching domains (Van den Berg *et al*., 2020). A search on identified keywords was conducted using the following databases: Academic Search Premier, EbscoHost™, Business Search Premier™, Scopus, MasterFILE Premier™, Regional Business News™, Emerald Insight™, SACat™, Web of Science™, and SAePublications™. The SLR identified substantial similarities and specific differences between the business CI and sport coaching domains as well as overarching constructs (Table 2).

The SLR also allowed researchers to examine pre-existing CI scales within the business domain, which aided in labelling themes and constructs together with definitions for development of sport-related CI items during later steps of the process (Burton & Mazerolle, 2011; Gehlbach & Brinkworth, 2011). The qualitative document analysis confirmed the transferability of the business CI domain-specific phenomenon to the sport coaching context and determined the underlying CI sports themes (Turocy, 2002). In this regard, Hendrickson (2012) indicated that the business and sport CI process themes for intelligence creation were identical (Table 2).

***Table 2*. CI AND SPORT COACHING THEMES IDENTIFIED FROM SLR WITH DEFINITIONS OF CONSTRUCTS**

No	Construct	Definition
1.	Data collection	The process of gathering key data on a variety of competitor and environmental aspects from numerous sources and in different formats by a specific person
2.	Data conversion	The activity of giving data meaning: a process of formal analysis
3.	Information communication	The process and method of conveying or transferring information between stakeholders
4.	Information countering	The process of decision making and strategic thinking, planning and action, following the process of data collection and conversion aimed at obtaining a competitive advantage
5.	CI process	The stepwise process incorporating data collection, conversion, communication and countering, as well as additional factors which influence a competitive advantage

Interviews

For the second step and exploratory qualitative data collection and analysis, researchers turned their attention to the population of interest, which is a deviation from most traditional survey construction processes (Gehlbach & Brinkworth, 2011). Researchers compiled open-ended questions from the SLR for semi-structured interviews with cricket coaches to obtain a broad scope and in-depth data on CI properties (Henning *et a*l., 2004; De Vos *et al*., 2005). Four questions related to data collection, conversion, communication and countering were generated, as well as two additional questions related to the CI culture and focus of key intelligence topics (KITs) that coaches deemed to be important (Weiss, 2002). These questions adhered to the SLR-identified constructs (step 1) as suggested by Turocy (2002).

Synthesis of literature and interview data

The third step in the survey development process endeavoured to merge literature and theory with empirical evidence to aid researchers in developing constructs and a comprehensive list of indicators for item development (Gehlbach & Brinkworth, 2011). In this regard, the empirical inductive created codes from the interviews were quantitised to enhance the qualitative analysis (Saldanha & O'Brien, 2013). The quantitative statistical method of clustering codes provides new meaning to codes which are grouped as categories. This was the second integration point of mixed methods and the quantitising of data, according to Saldanha and O'Brien (2013) are explained hereafter.

Qualitative data analysis

Codes for the interview data were created inductively using ATLAS.TI™ software. The researchers created a codebook to direct the coding process and by using the constant comparative method (CCM) for the qualitative content analysis process (Boeije, 2002; DeCuir-Gunby *et al*., 2011). A codebook contains codes, related definitions and an example of each code which directs the analysis process (DeCuir-Gunby *et al*., 2011). A code was defined as a

meaning unit, which can also be viewed as a separate entity of meaning (Côté *et al*., 1993). The researcher, together with a skilled colleague, created and revised data-driven codes within the context of the data, referring to the code definition and examples (DeCuir-Gunby *et al*., 2011). The SLR identified business CI and sport coaching constructs were used to categorise the inductive codes, which provided a framework for the data analysis.

At this point, a quantitative data analysis method was incorporated to establish the intra- and inter-rater content analysis reliability. The calculation of Cohen's Kappa, a change-corrected measure (Anderson *et al*., 2001), served as the first integration point for the use of mixed methods. The primary researcher coded two interviews on separate occasions more than a week apart and obtained a strong inter-rater reliability (Cohen's Kappa = 0.79). The inter-rater reliability for this study was found to be $\kappa = 0.78$ when a research colleague coded two interviews independently. The moderate inter-rater reliability achieved could be ascribed to the lower expertise on CI of the research colleague. However, since a reliability of between the 0.80 and 0.90 range is considered to be rich in analytical value, researchers proceeded with the content analysis (Campbell *et al*., 2013). Data saturation was unequivocally reached with 17 participants (Guest *et al*., 2006).

Quantitative data analysis

The inductive coded interview data were quantitised to achieve a numerical conversion of the qualitative data by dichotomising and counting qualitative codes (Saldanha & O'Brien, 2013). The statistical analysis of qualitative created codes counting holds valuable information for data exploration within mixed methods research (Collingridge, 2013). In this regard, a single-linkage, 1-Person correlation coefficient cluster analysis was performed with the quantitised data (Wilkinson *et al*., 2009). Results of the cluster analysis are presented as a dendrogram in Figure 1. The linkage distance for detecting different clusters was set at four which rendered five groups. The quantitatively clustered groups were then explored and labelled as categories and themes. The dendrogram clustered quantitative themes were titled according to conceptually concatenated categories which were created from cluster incidence similarities and their constituent value towards the overarching category as clustered within the dendrogram. The cluster incidence similarities were categorised by referring to the quotes of participants and fitted under each corresponding theme within the dendrogram structure (Gehlbach & Brinkworth, 2011). Researchers collaborated to create categories and themes by referring back to the five literature created themes and their definitions generated during step one, as well as the narratives by the participants. The newly labelled conceptual themes and categories which emerged from the dendrogram are provided in Table 3. The five themes indicating the CI process followed by cricket coaches are identified and labelled as: strategy design, review, information transmission, CI process dynamics and information parameters, each with their sub-categories.

The first theme, namely Strategy design, relates to aspects that contribute to the intended strategy developed by the coach and include the following categories: (i) coaching philosophy, (ii) CI culture, (iii) strategy assessment, (iv) planning, (v) environmental information, (vi) information on own strengths and weaknesses, (vii) quality analysis, (viii) strategy adjustment and (ix) knowledge implemented. The second theme, namely Review describes how the coach appraises information to confirm his strategy design and denotes categories of (i) video analysis, (ii) statistics, (iii) formal analysis, (iv) storing system, (v) KPI (Key Performance Indicators) and (vi) opponents' strategy assessment.

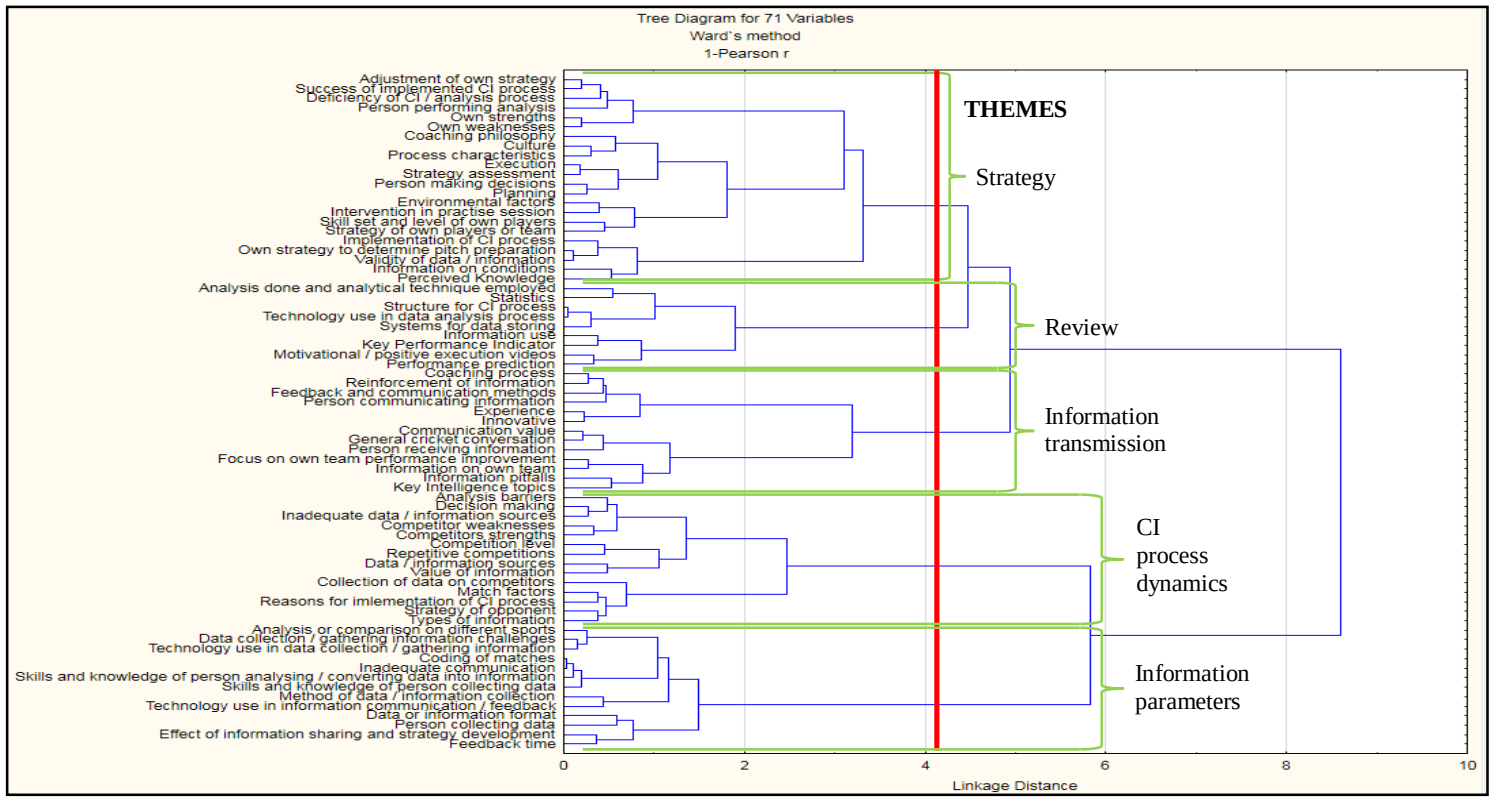

Figure 1. **DENDROGRAM OF SINGLE-LINKAGE, 1-PEARSON CORRELATION COEFFICIENT CLUSTER ANALYSES OF ALL QUANTITISED CODED INTERVIEW DATA INDICES WITH CONCEPTUALLY CONCATENATED THEMES**

Table 3. **CRICKET COACHES INTERVIEW DATA CI THEMES AND CATEGORIES CREATED FROM THE DENDROGRAM**

	Theme	Definition/description	Categories
1.	Strategy design (Peterson *et al.*, 2008b)	Aspects that contribute to the design of the teams' match strategy by the coach	Coaching philosophy CI culture Strategy assessment Planning Environmental information Information on own strengths and weaknesses Strategy adjustment Knowledge implemented
2.	Review (Franks & Miller, 1986)	The manner and method used by the coach to review information / look at info to confirm strategy design	Video analysis Statistics Formal analysis Storing system Key Performance Indicators (KPIs) and Opponents' strategy assessment
3.	Information transmission (Bampouras *et al.*, 2012)	The manner and method used by the coach to communicate information regarding the team strategy	Person communicating/receiving Its Type and focus Reinforcement Method and technology used
4.	CI process dynamics (Saayman *et al.*, 2008)	The forces or properties which could stimulate growth, development, or change within a system or process. Factors the coach has to manage to affect a successful CI process.	A systematic approach, Decision making and sources utilised
5.	Information parameters (Wright & Calof, 2006)	Limitations coaches perceive or experience which negatively influence the process of CI being implemented (Parameter: a limit or boundary which defines the scope of a particular process or activity)	Feedback Technology CI value Person and skills

The theme, Information transmission relates to the "how and what" of information which coaches communicate regarding their designed strategy and includes categories such as (i) person communicating, (ii) person receiving communication, (iii) KITs, (iv) type and focus, (v) reinforcement and (vi) method and technology used. Specific CI process dynamics as the fourth theme is characterised by forces which could stimulate the growth, development or change within the CI process of coaches and refer to factors which the coach has to manage effectively for successful CI implementation. These include (i) the systematic approach, (ii) decision making and (iii) sources utilised. The last theme, namely Information parameters refers to limitations that coaches experience or perceive which negatively influence the

successful implementation of a systematic CI process. Categories within this last theme are (i) feedback, (ii) technology, (iii) CI value and (iv) person and skills. The five themes rendered 28 categories, which were used to develop the items of the CI survey (Table 3).

Development of items

The process of categorising cluster constructs of the quantitised data within the newly labelled conceptual categories, allowed researchers to compile preliminary items (Gehlbach & Brinkworth, 2011). Through the synthesis of theory and empirical evidence, the final survey categories and subsequent items were created (Gehlbach & Brinkworth, 2011). The item numbers were reduced to 28 items to enhance the administration of the survey, ease of completion, and response rate by participants (McGartland Rubio *et al*., 2003; Gehlbach & Brinkworth, 2011). The themes that were presented in Table 3, delineate the main constructs of the survey and the categories under each theme were used to develop appropriate items (Turocy, 2002; Gehlbach & Brinkworth, 2011). Special attention was given to the wording of constructed questions by guarding against the use of ambiguous language, bias and double-barrel questions (Burton & Mazerolle, 2011; Gehlbach & Brinkworth, 2011). Best practices in item development were applied by avoiding the use of reverse-scored items and numeric labels as well as by using five response anchors of "strongly agree", "agree", "neutral", "disagree" and "strongly disagree" (Turocy, 2002; Gehlbach & Brinkworth, 2011).

Item generation resulted in 28 items corresponding to the categories within the five themes which were identified as the main scales of the survey. Additionally, each correlating concept and item was justified from literature, thereby re-utilising step three by synthesising literature into the qualitative and quantitative analysed data (Table 4). The literature description and justification supported the items that were created from the quantitised categories and conceptual concatenated constructs by substantiating it through literature within the scope of the survey's "strongly agree" to "strongly disagree" Likert scale. Therefore, Step four provided integration point number three for the mixed methods approach.

Expert review

Gehlbach and Brinkworth (2011) propose that experts should review survey items before pilot studies are initiated. In this regard, experts were used to determine the content and face validity of the newly developed survey items. Therefore, step five is the fourth integration point of the mixed methods approach of this study**.**

Validation

McGartland Rubio *et al.* (2003) developed a measure that allows researchers to operationalise a construct and test its validity during its conceptualisation. Consequently, this measure was used to determine the content validity which is the extent that items assess the same content or how well the content was sampled in the measure of the developed survey (McGartland Rubio *et al*., 2003). Content validity is characterised by face and logical validity, where face validity indicates that the measurement instrument or items appear to be valid, whereas logical validity uses a rigorous process during which an expert panel evaluates the content validity of the measurement instrument (McGartland Rubio *et al*., 2003). Therefore, this study used research specialists in the field of sports science and management to establish construct relevance as well as content validity (Turocy, 2002; Gehlbach & Brinkworth, 2011).

Table 4. **PROPOSED CONSTRUCTS, ITEMS, CONCEPTS MEASURED AND LITERATURE RATIONALE DESCRIPTION OF CI SURVEY ITEMS FOR CRICKET COACHES**

	Item	CI concept	Description and rationale
	A. Strategy design ***What are the factors/aspects that contribute to the design of the coaches' team match strategy***		
1.	My coaching philosophy is the guiding principle for my team strategy development	Coaching philosophy guide CI practice	If Strongly Agree (SA) = The elite coaches indicated that their coaching philosophies guide their coaching processes, which included the CI process (Wright *et al*., 2012a)
2.	A team culture is created whereby players and coaching staff consistently collect and analyse information on competitors in a formal and systematic manner	CI culture	If SA = the coach values information collection and analysis and fosters these activities within the team as part of their operational undertakings, and creates a CI culture for successful implementation (Wright & Calof, 2006)
3.	The execution of the team strategy is assessed after every match	Strategy execution assessment	If SA = the process of CI is completed and the coach analyses the execution and effectiveness of strategy used, which was derived through CI activities performed (Begg & Du Toit, 2007)
4.	Me as the coach, plan and decide on the team strategy to be followed	Person(s) planning and making decisions	If SA = The coach is ultimately responsible for decision making and strategy followed and is the person who should implement and drive the CI process (Du Toit & Sewdass, 2014)
5.	Environmental information (such as pitch and weather conditions) are gathered and analysed in a prescribed and structured manner before each match	Environmental information	If SA = environmental information is collected systematically through a standard process (Du Toit, 2003)
6.	I need continuous information on my players' strengths and weaknesses for strategic decision making	Internal/own team strengths and weaknesses used for strategy design	If SA = The focus of the coach for strategy development is on his own players' strengths and weaknesses. This correlates with business CI whereby internal information enhances organisations' CI capabilities. However, this is only one facet of strategy development (Saayman *et al*., 2008)
7.	High quality analysed information is used to determine the intervention training sessions before matches	Analysis of quality information	If SA = High-quality information is gained through skilled people (Gatsoris, 2012). Therefore, an analyst is used to obtain quality data (Bampouras *et al*., 2012)

	Item	CI concept	Description and rationale
8.	I adjust my team's strategy if new information is gained before matches	Strategy adjustment	If SA = The coach values the continuous collection and analysis of information and sees the advantages of risk-taking by adjusting the strategy (Gatsoris, 2012)
9.	I have enough knowledge of competitors and the environment to guide a structured information collection and competitor analysis	Perceived knowledge implemented	If SA = Coach has high levels of perceived knowledge on competitors and uses it to systematically evaluate and analyse information before and after each match. Elite coaches spend many hours reviewing PA information after matches to inform their strategy development for the next matches (Wright *et al*., 2012a)
B.	***Review How does the coach review information/look at information to confirm his strategy design?***		
10.	After every match, I would look at specific video footage and video analysis of that specific match	Video footage analysis	If SA = Elite coaches receive edited clips after matches and would spend additional time to complete their own PA (Wright *et al*., 2012a)
11.	I evaluate statistical data and information after each match	Sources and statistical information	If SA = Coach uses available statistics after a match to evaluate match specifics. Statistics are influential in cricket especially for determining critical factors for match strategy adjustments (Moore *et al*., 2012)
12.	At the onset of each season, we perform a SWOT analysis of opposition players	Formal analysis technique	If SA = Coach employs one of the most basic and used analytical techniques for opposition player analysis (Gatsoris, 2012; Dai *et al.*, 2011)
13.	I have an established, well-functioning system for storing and retrieving previously analysed competitor and environmental information	Data storing system	If SA = Coach uses a formal system for storing and retrieving data – this is in accordance to research by Lyons (2011) which indicates that coaches use cloud computing to store and manage data
15.	The competitor information collected and analysed is primarily used for opponent strategy assessment and prediction	Information utilised for opponent strategy assessment/performance prediction	If SA = The focus of the coaches' intelligence process is to assess and evaluate the opposition strategy, usually to counter it (Lames & McGarry, 2007). Coaches use information proactively to predict performance and counter the performance of opposition players (Hughes, 2005)

	Item	CI concept	Description and rationale
C.	***Information transmission***	***How and what information do coaches communicate regarding strategy***	
16.	As the coach, I am primarily responsible to communicate information on the opposition, environment and team strategy to my team	Person communicating strategy	If SA = The coach is the main person to communicate and share information and strategy. Research indicates that the majority of elite coaches (more than 86%) give feedback to the team or individuals after match analysis (Wright *et al*., 2012a)
17.	I tailor my communication method on competitor and environmental information to suit the preferences of my individual players	Value and method of quality communication	If SA = The coach uses different methods to communicate to players such as verbal and visual communication (i.e. video footage) so that players better understand, value and enjoy the information that is conveyed. Sports coaches experiment with information and communication technology (Lyons, 2011)
18.	I distribute competitor information to anyone in the team who is interested in it	Person receiving information	Reverse scoring with strongly disagrees as the highest value. If SA = Information is not shared openly and widely to the whole team but only to those who are interested. Coaches receive information from sports scientists or analysts and communicate it to all players themselves or allow an analyst to communicate information to players and team directly (Bampouras *et al.*, 2012), including all team members and not just those interested
19.	I communicate information on competitors and the environment to my players before each match	Information communication focus	If SA = The coach values specific competitor information and sees the need to communicate important aspects. (Bampouras *et al*., 2012)
20.	I emphasise selected competitor information to my own players	Reinforcement vs. Information overload	If SA = The coach selects specific competition information to continuously communicate to players. The coach also reinforces key aspects (Bampouras *et al*., 2012)
21.	My key intelligence needs are communicated to a person who performs the information collection and competitor analysis	KITs	If SA = The coach as intelligence user informs those who collect and analyse data, on what information is needed (Nasri, 2011). This is essential in CI process planning. Identified KITs direct the collection and analysis process (Fleisher & Wright, 2010)

	Item	CI concept	Description and rationale
D.	***CI process dynamics***	***The forces or properties which could stimulate growth, development, or change within a CI system or process. Factors the coach has to manage to effect a successful CI process***	
22.	Our coaching management team follows a systematic, continuous process to collect and analyse competitor strengths and weaknesses	A systematic process for competitor analysis	If SA = One of the main focuses of coaches and the CI process is to identify opposition strengths and weaknesses. Assigned personnel and a systematic approach is needed to continuously collect and analyse these strengths and weaknesses (Wright *et al*., 2012b).
23.	I access and utilise a number of sources (websites, video footage, coded video clips) to collect and analyse information on competitors and the environment	Sources of information	If SA = The coach has adequate sources available to use (Wright *et al*., 2012)
24.	I continuously utilise analysed and high-quality information to guide my decisions	Decision making based on intelligence	If SA = Decision making is done on intelligence (Michaeli & Simon, 2008)
E	***Data/Information parameters***	***Limitations coaches perceive or experience which negatively influence the process of CI being implemented (Parameter: a limit or boundary which defines the scope of a particular process or activity)***	
25.	We use highly sophisticated technology to code and analyse videos and data	Technology	If SA = Technology use for collection and analysis is adequate and available. Technology is used for PA and is accessible to coaches as a variety of products are available which coaches use more and more (Wright *et al*., 2012a; Baca, 2006).
26.	The person who performs competitor and environmental analysis for our team is skilled and trained in using technology-driven analysis techniques	Person and skills for collecting and analysing	If SA = The coach has a skilled person available to perform CI activities (Wright *et al*., 2012a). A skilled person is essential for the collection and analysis process to be valid and successful (O'Donoghue, 2006).
27.	Feedback on own performance and strategy execution is performed shortly after each match	Feedback time	If SA = Feedback time is influential and coaches express a need for timely feedback from the analyst to the team (Wright *et al*., 2012a). Timely feedback is also essential in strategic decision making (Tej Adidam *et al*., 2012).
28.	I value technology-driven competitor and environmental information above information gained from my own players	Value of technology-enhanced information	If SA = The coach values CI and therefore invest in systematic information gathering and analysis of competitors. The coach also values the objective and analytical information gained from objective video analysis and statistics (Moore *et al.*, 2012; Wright *et al*., 2012a)

The purpose of this step was also to obtain information on item clarity, representativeness, language use and other item-related concerns that research specialists highlighted (Burton & Mazerolle, 2011; Gehlbach & Brinkworth, 2011). Each item was evaluated on its ability to represent the content domain as described by a theoretical definition (McGartland Rubio *et al*., 2003). The clarity of an item was evaluated based on how clearly an item was worded (McGartland Rubio *et al*., 2003). Anchors of "1=Not at all representative/clear", "2=Major revisions", "3=Minor revisions" and "4=Very much representative/clear" were used to evaluate last-mentioned aspects of different items (McGartland Rubio *et al*., 2003).

The reliability or inter-rater agreement was also calculated from the responses (Table 5). Items were grouped together and experts were asked to indicate if the items fitted the subscale and therefore allowed the preliminary assessment of the factorial structure. Each item was individually measured according to these criteria and space was provided for paragraph type comments to be inserted after the quantitative evaluation of each item. By making use of Google forms, the expert panel quantitatively and qualitatively assessed the newly developed items.

Expert panel

Academic sport research experts were used to establish the construct relevance and validity of each item (Gehlbach & Brinkworth, 2011). The feedback from external university research peers with more than five years' experience in the fields of sports science and management, provided information on item clarity and construct complexities and aided to quantify the content validity of the scale (Gehlbach & Brinkworth, 2011). A total of five experts responded which is in line with the recommended number needed (Lynn, 1986; McGartland Rubio *et al*., 2003).

For the expert panel data analysis, three types of quantitative analyses were performed, namely an analysis to test the content validity of each measure, an analysis to test the factorial validity of each item and analysis to test inter-rater agreement (Table 5). Content validity was based on the representativeness of items and the content validity index (CVI) was calculated by counting the number of experts who rated the item as three or four (indicating "minor revisions" and "very much representative", respectively) and dividing that number by the total number of experts. This provided a value for each item as a proportion of the experts who deemed the content as valid (McGartland Rubio *et al*., 2003; Zamanzadeh *et al*., 2015) The CVI of each subscale was calculated by computing the average for the items per subscale, and the CVI of the instrument as the average of all the subscales. A CVI of 0.8 for a new measurement instrument is recommended (Davis, 1992) and all the subscales within the new survey, as well as the instrument as a whole, were above this standard which confirms the newly developed items' content validity (Table 5).

Inter-rater agreement

Inter-rater agreement (IRA) determines the extent to which the experts were reliable in their ratings and is calculated by regarding the representativeness and clarity values for each item (McGartland Rubio *et al*., 2003). The IRA per item was calculated by dividing the number of items considered to be hundred percent reliable by the total number of items (either in the subscale or the instrument as a whole) (Davis, 1992).

Table 5. **VALIDITY RATINGS OF SURVEY SUBSCALES BY EXPERT REVIEWERS**

Subscale and items	**Representa-tiveness CVI mean score**	**Clarity mean score**	**IRA Representa-tiveness score**	**IRA Clarity score**	**IRA Clarity score (2nd method)**	**Factorial Validity Index (FVI)**
Strategy design (Items 1-9)	0.96	0.93	0.78	0.67	1	0.96
Review (Items 10-15)	0.99	0.93	1	0.67	1	0.99
Information transmission (Items 16-21)	1	0.97	1	0.83	1	1
CI process dynamics (Items 22-24)	1	1	1	1	1	1
Information parameters (Items 25-28)	1	0.93	1	0.75	1	1
Mean for all items	0.99	0.95	0.96	0.82	1	0.99

The representativeness IRA was above the 0.8 value for the instrument as a whole and four out of the five subscales, with only the Strategy design subscale slightly below the 0.8 level. The clarity IRA was slightly below the 0.8 value on the Strategy design, Review and Information parameter subscales. However, a closer evaluation of the qualitative feedback from expert reviewers on these items within the three subscales indicated no major changes to items.

Minor changes to improve clarity were proposed by reviewers; e.g. "a team culture currently exists whereby..." instead of "a team culture is created whereby...". Experts had a hundred percent agreement on six out of the nine items within the Strategy design, four out of six items for the Review subscale and three out of the four items for the Information parameters subscale. When the less conservative approach is followed in calculating the clarity IRA, whereby the number of items with an IRA of at least 0.80 is divided by the total number of items (within the subscales and as a whole), the values were all equal to 1; indicating a high level of inter-rater agreement for clarity (McGartland Rubio *et al.*, 2003).

Factorial validity index

McGartland Rubio *et al*. (2003) proposed the calculation of a Factorial Validity Index (FVI) to determine the degree to which experts consider items to be associated with the respective subscales. The FVI for each item was calculated by dividing the number of experts, who associated the item with the subscale, by the total number of experts. The FVI value for each subscale was again calculated by averaging items within the subscale and for the instrument as a whole by averaging all the subscales (McGartland Rubio *et al*., 2003). Even though there is currently no criteria for an acceptable FVI, a value of 0.8 is proposed (McGartland Rubio *et al*., 2003). The subscales and instrument as a whole satisfy the recommended level, since all FVI values were above the suggested value.

Revision of the instrument

After the quantitative data analysis of the items of the newly developed CI survey for cricket coaches by the expert reviewers, researchers could turn their attention to the qualitative feedback of each item, to determine the scope of necessary revisions (McGartland Rubio *et al.*, 2003). Minor adjustments in word and language choices were necessary to improve the instrument (McGartland Rubio *et al*., 2003). The revised instrument is presented in Table 6 with the adjusted items indicated in italic text. Sixteen out of the twenty-eight items were adapted based on the quantitative and qualitative feedback received from the expert panel. This emphasises the valuable contribution of quantitative and qualitative methods to expertly validate content and face validity of newly developed survey items.

DISCUSSION

This study aimed to empirically develop a CI survey for cricket coaches using a mixed method approach. The findings substantiate the operationalising of the CI concept theoretically, empirically and as a measurement tool to be used in practice by cricket coaches. In this regard, the study rendered methodological and practical implications for the social sciences and in particular the cricket coaching domain.

Table 6. **REVISED ITEMS OF CI SURVEY FOR CRICKET COACHES**

No.	Subscale and items
A.	***Strategy design***
1	*My coaching philosophy guides the development of my team strategy*
2	*A team culture is created whereby players and coaching staff consistently collect and analyse information on competitors in a systematic manner*
3	The execution of the team strategy is assessed after every match
4	*As a coach, I primarily plan and decide on the team strategy to be followed for matches*
5	Environmental information (such as pitch and weather conditions) are gathered and analysed in a structured manner before each match
6	I need continuous information on my own team players' strengths and weaknesses for strategic decision making
7	High quality analysed information is used during planning and strategy design before matches
8	I adjust my teams' strategy if new information is gained before matches
9	*I have sufficient knowledge of competitors and the environment to direct a structured information collection and analysis*
B.	***Review***
10	*After every match, I look at specific video footage and analysis of that specific match*
11	*I evaluate statistical data after each match*
12	*At the onset of each season, a SWOT analysis of opposition players are performed*
13	I have an established, well-functioning system for storing and retrieving previously analysed competitor and environmental information
14	*The Key Performance Indicators (such as runs scored for batters and runs conceded for bowlers) that I evaluate to assess and develop new match strategies differ from one match to another*
15	The competitor information collected and analysed is primarily used for opponent strategy assessment
C.	***Information transmission***
16	As the coach, I am primarily responsible to communicate information on the opposition, environment and team strategy to my team
17	*I tailor my communication method regarding competitor and environmental information to suit the preferences of my individual players*
18	*I share information about our competitors and environment mainly collectively to the whole team*
19	*I communicate only vital information on competitors and the environment to my players before each match*
20	*I re-accentuate selected competitor information to individual players*
21	*I communicate my key intelligence needs to a person who collects and analyse the competitor and environmental information*

No.	Subscale and items
D.	***CI process dynamics***
22	Our coaching management team follows a systematic, continuous process to collect and analyse competitor strengths and weaknesses
23	I access and utilise a number of sources (websites, video footage, coded video clips) to collect and analyse information on competitors and the environment
24	I continuously utilise analysed and high-quality information to guide my decisions
E.	***Data / Information parameters***
25	*We use highly sophisticated technology to capture, code and analyse videos and data*
26	*The person who performs the analysis on competitors and the environment is skilled and trained in using technology-driven analysis techniques*
27	Feedback on own team performance and strategy execution is performed shortly after each match
28	*I value technology-derived competitor and environmental information as most influential on my coaching practice*

Methodological implications

From a literature knowledge pool and methodological perspective, the integration of mixed methods at four points during a five-step process of survey development provided a novel approach for researchers within social sciences. The quantitating of the qualitative interview data analysis allowed for a quantitative cluster analysis, substantiating an innovative approach to clarify and explain empirical results (Saldanha & O'Brien, 2013). In this regard, the quantitative cluster analysis provided a structure to explore the qualitative narratives and codes. Furthermore, the scientific mixed method approach that was applied in this study allowed researchers to gain a richer understanding of the CI process that South African cricket coaches follow. The categories and themes derived from the study also contributed to an expansion of the literature knowledge pool of cricket coaches' CI-related practices which correspond with theoretical foundations of the CI business domain.

In addition, the mixed method analysis of the newly developed survey items by an expert panel was valuable, not only for the validation of survey items, but also for the methodological contribution of systematic steps that can be followed to develop a survey through empirical findings (Gehlbach & Brinkworth, 2011). The mixed methods approach balanced the use of diverse techniques in developing a survey, instead of relying only on one form of analysis and paves the way for an integrated method for survey development in future.

Practical implications

The empirical findings of the study rendered specific themes and categories of cricket coaches' CI activities. The themes and categories indicate that five distinct aspects influence cricket coaches' CI creation process. In this regard, strategy design, review and information transmission are the key aspects, with CI process dynamics and data or information parameters as secondary aspects to direct coaches' CI processes. Each of these aspects consists of specific sub-categories (items created) which enable researchers and practitioners to better understand the processes that cricket coaches follow to gain a competitive advantage. Until now, this is an

area of research which has not delivered a lot of information (Groom *et al*., 2011). Therefore, the findings of this study may contribute to the current education courses that are presented to coaches in South Africa, since the findings provide detailed directives for coaches to measure, evaluate and direct their CI activities.

CONCLUSION

The integration of systematic, but diverse steps as part of a mixed methods approach, allowed researchers to develop a new CI survey for cricket coaches. Experts in the sports science and management research fields corroborated the newly developed constructs and items. The establishment of the content and factorial validity at the onset of the item and scale development increased the efficiency and effectiveness of the instrument item development. Therefore, this article illustrated how a mix of qualitative and quantitative analyses allowed researchers to develop a new and unique CI survey for cricket coaches. The survey will enable researchers and practitioners to gain a richer understanding of the under-researched CI phenomenon and specific CI-related practises within the cricket sport domain.

Findings of the study also shed light onto the dearth of knowledge regarding coaches' strategy design, review and information transmission processes, as well as indicated how coaches deal with CI process dynamics and address information parameters. The newly developed CI survey does not only allow researchers to investigate the competitive process that coaches follow but ultimately provide an opportunity for practitioners in the fields of coaching and sports analysis to enhance the CI creation process. A well-structured CI process will enable coaches and other practitioners, especially in the cricket fraternity, to plan, create and execute activities that allow them to gain a competitive edge over their opponents.

Despite the positive outcomes of this study, the newly developed CI survey was only scrutinised for content and face validity, with preliminary factorial validity evident. However, to assess the full degree of factorial validity, future studies should use a revised measure that allows for the assessment of additional psychometric properties through a factor analysis.

Conflict of interests

The author(s) declare no potential conflicts of interest concerning the research, authorship and/or publication of this article.

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