

Cricket coaching and batting in the 21st century through a 4IR lens: a narrative review

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ABSTRACT

The aim of this narrative review is to document an understanding of cricket coaching in the context of South Africa and recognise the importance of technology and innovation for cricket (and sports in general) in the context of the fourth industrial revolution. In addition, an understanding of the evolution of batting and factors contributing to successful batting as well as the links that exist between coaching manuals, coaching practice, skills and the individual player are outlined. Furthermore, tangible examples of technological and innovative applications that can be used to advance cricket coaching in the modern era are discussed.

INTRODUCTION

In the fourth industrial revolution (4IR), technology and innovation have propelled exciting evolutions within the sports fraternity.¹ All stakeholders ranging from coaches, players, sports scientists and biomechanists are in a position to better monitor, analyse, prepare and track performance. However, there is also a need for these stakeholders to adjust in an era galvanised by advanced technology as well as artificial intelligence (AI).²

Almost 20 years ago, it was stated that ‘innovation is the only insurance against irrelevance’.³ These words resonate till this day since sports performance can be managed and optimised seamlessly. In order for coaching in sport to be successful, it must not only be current and aligned to modern-day trends, but also be relevant. As a result, there is a greater need for sports coaches to garner modern-day skills and attributes that will allow them to apply their trade in a diversified industry of movement and exercise science.⁴

The field of sport and exercise science has made considerable waves in technological advances and innovative approaches.¹ The fact that physical activity can be monitored through wearable devices demonstrates the relevance, applicability, optimal use-case and sustainability of sports technology and automation.⁵ With such rapid evolutions,

What is already known on this topic

⇒ The fourth industrial revolution (4IR), technology and innovation have propelled exciting evolutions within the sporting and cricket fraternity.

What this study adds

⇒ This review paper discusses cricket coaching and cricket batting in the 4IR, with reference to performance, science and technology.
⇒ The way forward in cricket research requires main elements such as performance, prevention and psychology (as well as technology and innovation) in cricket to be integrated and applied as one holistic, systematic model.

it is imperative for all stakeholders to be updated with such trends and technologies. In addition, the need to identify the required training to leverage management and monitoring of athletes through a 21st century lens, is also important.

Although all sporting activities have experienced a sense of technological adoption (or migration), each sport has adapted uniquely. This is true, especially if it is team-based or an individual sport, or even categorised by season.² One particular sport in which people continue to marvel (in terms of how it has adapted through technology and innovation) is the game of cricket.

Over the last few centuries, cricket has consistently been recognised as a complex yet multifaceted sport in which each player’s ‘position’ has a role to play. As a result, this has made it increasingly challenging for a coach to manage. However, with 21st century skills and the availability of technological advances as well as innovative systems at the coaches’ footsteps, coaching and managing cricket teams has never been as exciting.⁶

Therefore, this review aims to discuss cricket coaching in the 21st century with reference to performance, science and technology.



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The paper will also be structured in the context of South Africa, taking into account various opportunities, challenges and evolvments that need to be considered for both the player and coach (including the support staff).

Cricket coaching in South Africa

Cricket South Africa, the recognised governing body for cricket played in South Africa, has offered coaching courses at the beginner (level 1), intermediate (level 2), advanced (level 3) and provincial/national (level 4) levels. Through these educational and developmental courses for cricket coaches, cricket coaching or management experts share various theories, skills, experiences and coaching philosophies.

Over the last two decades, these courses have proven to be useful and valuable to all candidates undertaking the course(s). These courses have also acted as a key attribute (and milestone) for coaches acquiring further experience and skills at the respective level of cricket they're working in. However, the key question is: how relevant are these cricket coaching courses in the context of the 4IR and modern-day technology? It can be postulated that minimal integrations have been conducted (to date) or by a vast minority. As such, this review also aims to fill this (potential) void by shedding light into how cricket coaching can be optimised and better managed through the incorporation of technology, innovations, updated science and research, to realise more effective coaching approaches in cricket.

CHALLENGES FOR COACHING CRICKET IN SOUTH AFRICA

Although it is an exciting time where cricket has made valuable strides in the 21st century, one also has to familiarise and be mindful of the numerous challenges facing South African cricket, especially at the grassroots level. It is a well established fact that socioeconomic factors persist to being a challenge within rural and semiurban areas. Among others, access to basic needs, cricket facilities, housing and access to opportunities (as well as equitable access) are the main challenges (still) encountered to this day.^{7,8} This indirectly makes it challenging for cricket coaching to prosper, making it increasingly difficult for rural and semiurban cricket coaches.

In addition to these challenges, and the high-school sport level, it was specifically investigated whether attending boys-only schools is an incidental or a strategic contributing factor to South African cricket development and success since international readmission in 1992.⁷ This study demonstrated that attendance at boys-only schools was a significant contributing factor to playing men's cricket at the highest level in South Africa, whereby more than 59% of players across all formats and groups attended boys-only schools. It was further shown that while attending boys-only schools is only at times incidental; it is primarily a strategic contributing factor to South African cricket development and success.⁷ In addition, it was found that no player who attended a school in a township or rural area played cricket for South

Africa (unless their talent was scouted for and they later attended a private or boys-only high school). However, there are instances where some players had also attended a co-ed school and played for South Africa.

Interestingly, it is the 'boys-only' nature of these schools that is essential (aside from race, socioeconomic and cultural factors) and a strategic contributing factor, and not necessarily whether these schools are private or public/co-ed schools.⁷ Indeed, individual player variations, as well as other factors such as the number of pupils in the school and coaching standards, have also to be considered. Based on the study population, it should be noted that the country's cricketers come from fewer than 50 schools. This is ironic, yet significant, given that thousands of schools in the country lack basic infrastructure such as toilets and potable running water, let alone standard sports facilities. Schools are crucial in producing cricketers for the country. For this reason, one has to also consider race, class, government neoliberal policies and the accountability for neglecting black schools through its policies and the elitist model of cricket development.⁸

After many years, it seems that boys-only schools still remain the preferred and optimal feeder system to cricket being played at the highest level in South Africa. A vast majority of the South African cricket fraternity remain hopeful that there would be a proliferation of players from various backgrounds (including women) through the cricket development system. The findings from this particular study may not be generalisable to other countries due to the varied dynamics and unique contextual determinants in each cricketing country.⁷ However, from a South African viewpoint, cricket stakeholders and coaches must be aware of this continued challenge in cricket (and probably, among other sporting codes too) as it indirectly affects the standard, management and uptake of effective cricket coaching.

Additionally, some cricketers may become disenchanted from playing cricket because of racial quotas and may emigrate to other countries. South African cricketers continue to originate mainly from cricket schools and middle-class families with exceptional facilities and high coaching standards. Unless the race and class imbalances are addressed, minimal change will occur.⁹ This substantially undermines the country's transformation agenda and continued efforts for equitable access.¹⁰

One has to surely ask, though: 'Although sports coaching is such an exciting area to be working in (alongside technological innovations), how realistic (and relevant) is this among communities that do not even have access to basic ('3IR') needs?' Until we are able to be in a position to deal with these challenges, be bold, honest and transparent at what the tangible challenges are, only then are we able to transition into an area (although exciting) that will require considerable education and training so that many cricket coaches in South Africa can succeed.

The subsequent sections discuss how cricket coaching can be optimised through batting; 4IR in cricket; the

link between coaching manuals, practice, skills and the individual player; as well as future research and recommendations.

BATTING

Despite the ongoing socioeconomic and sociopolitical challenges of cricket in South Africa, one of the main advancements of the beautiful game lies in batting. Presently, there are several reasons why one would regard cricket as mostly a batter's game. First, the cricket bats have become bigger and stronger than those used in the early eras.¹¹ Second, there is an additional advantage for batters to score runs easily and at a rapid scoring rate due to boundaries being currently smaller.⁶

In the early era (1895–1954), when batters faced bowlers, they hit the ball more frequently with fewer dot balls, whereas today, batters are leaving more balls in test cricket instead of hitting the ball.⁶ This poses an important question: has the modern game of cricket made batters more passive despite the popular shorter format of the game with twenty-20 (T20) cricket? In addition to the contemporary evolution of technology and equipment made available to cricketers, it can be deduced that T20 cricket has probably assisted in reducing the passivity of batters with regards to hitting the ball.

Although cricket has only been in existence for less than 240 years (since 1788), much has changed in the last fifty years of the game, in part, arguably due to rapid adaptations to the shorter forms of the game. In the past century, there have also been considerable variabilities in coaching and batting methods.¹² The role of the changing forms of cricket appears to be significant in the observed changes in batting (as well as bowling) practices. However, batters will continue to evolve in their individualistic way and apply unique shot selections. Batters will also be driven to score runs at a more rapid rate due to the changed demands of the shorter forms of the game.⁶ For scientists, biomechanists and coaches, it is imperative to evolve ways of thinking and approaches to keep pace with the developments within modern-day cricket batting.¹³

The coaching cricket bat

Due to the rapid and evolving developments in modern-day cricket batting, trial and testing various coaching aids and tools are essential in the (potential) discovery for effective coaching approaches in batting. Cricket batting expertise can be defined in various ways from the perspective of elite cricket coaches.¹⁴

There are several components of the batting technique.¹⁵ One of the components of the batting technique, which has been demonstrated as a key contributing factor for successful cricket batting, is the batting backlift technique (BBT) (for batters at all levels of cricket ability).^{16,17} However, it has been discovered that coaching a lateral BBT (LBBT) may not be as straightforward for coaches at any level, especially at the junior level.¹⁸ As such, one coaching tool that has evolved to enhance the coaching

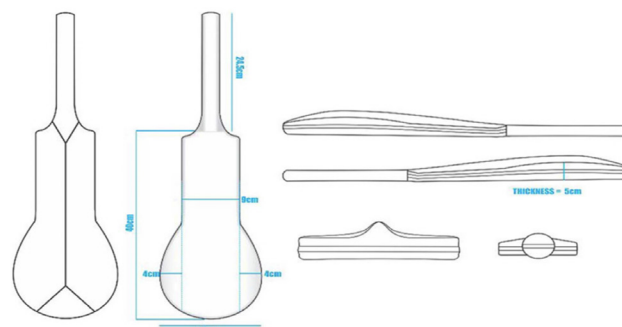


Figure 1 The coaching cricket bat in the frontal, rear, side-on and aerial views. Sourced from: Noorbhai *et al.*¹⁹

of batting techniques among young cricket players is a coaching cricket bat. An intervention study involving the use of such a bat demonstrated that coaches should encourage young cricketers to use a coaching cricket bat (figure 1).

This bat is perceived to be a potentially significant training aid for enhancing their performance. Furthermore, the bat can better guide the direction of their backlift compared with when they use a conventional cricket bat in match play.¹⁹

Over a period of repetitive practice and learning with the coaching bat, younger cricketers' motor control could enhance and improve their performance.²⁰ Therefore, over a long-term period, coaches need to be cognisant of players as they develop through various stages of training readiness levels.

Long-term batting development model

The long-term athlete development (LTAD) model developed by Balyi *et al.*²¹ discusses and illustrates biological growth and development by using peak height velocity (PHV) to determine training stages of readiness.^{22,23} The PHV is also used as an estimate of biological maturation, since the chronological age for this achievement varies among children.²³

The LTAD model that has seven stages,²⁴ provides a variety of pathways for participation, training, and competition throughout childhood and the adolescence period. Bearing the LTAD model in mind, a similar model was adapted in the context of batting development for a young cricketer. This is regarded as the long-term batting development model and can be used in conjunction with the coaching cricket bat (figure 2).

Successful traits of modern-day batting geniuses

Cricket batting will continue to evolve in more ways than we can ever imagine. Over the last few centuries, we have shed light into how batting, bowling and fielding can be optimised. As years went by, both batting and bowling have become more challenging, where players continued to work out strategies to overcome their opponents. Without these battles, we would not be able to appreciate the brilliance exhibited by some of the batting geniuses the world has ever seen. The likes of William

PHASE	AGE (YEARS)	DESCRIPTION	BAT USED
Training to Win	18+	Players should continue using a conventional bat during both training and matches.	Normal Bat
Training to Compete	15–21	Players should now start using a conventional bat during both training & matches.	Adapted – longer length and less surface area at distal end
Training to Train	12–15	Training with the coaching cricket bat during training and using a conventional bat during matches.	
Learning to Train	9–12	Learning the batting backlift technique with the coaching cricket bat (longer length and less surface area at the distal end of the bat).	Original Coaching Bat
FUNDamentals	6–9	Fun and participation with the coaching cricket bat. Emphasis should be drawn towards motor control, learning and enjoyment. There is an average length and wider surface area at the distal end of the bat.	
ACTIVE START	0–6		

Figure 2 Long-term batting development model—in relation to the coaching cricket bat. As the young cricketer gets older, the length of the bat increases and the ‘roundness’ (lateral surface area) at the distal end of the coaching cricket bat becomes reduced.

(W.G.) Grace, Sir Donald Bradman, Sir Viv Richards and Virat Kohli, over four different eras, will be compared and contrasted below (without excluding some prolific batters that have also contributed towards our current knowledge of cricket batting success).

It is paramount to understand that, in the sciences, one should not infer a ‘one-point extrapolation’ when observing any individual batter. This is for two reasons: (1) no batter is the same (individuality is vital), and (2) there are a myriad of factors that contribute to the success of batters. In light of these considerations, an attempt has been made to cast a lens on why Grace, Bradman, Richards and Kohli have contributed to the evolution of cricket batting (in some cases, comparisons are anecdotal yet observational in nature).

For example, most coaching literature suggests that the conventional (straight) backlift should enable the bat to be taken back in a line from wicket to wicket with the top hand taking control. There are several studies that have contested this theory. The findings demonstrated in one study are that the most common element that successful batters have is a backlift directed towards the gully or point region, otherwise known as the rotary method of batting.¹⁶ A distinctive feature of Grace, Bradman, Richards and Kohli, is this rotary method. If 77% of the greatest test batters of all time have adopted a rotary method, one has to ask how is it not regarded as orthodox? Furthermore, Bradman adopted a grip that was not consistent with the coaching literature, having the ‘vee’ of his left hand in line with the splice of the bat. Bradman held his bat with an open grip which allowed him to hit the ball in most scoring areas of the field.²⁵ In addition, Bradman made excellent use of the crease by manoeuvring the ball around the field with his short stature and quick feet.

Similarly, a combination of finesse, power and fearlessness is how many would also describe Sir Viv Richards. To complement these attributes, his calm temperament and relatively light bat allowed him to hit the ball in many areas around the field. Richards also had longer levers (compared with the other batters) allowing him

to generate power coupled with optimal timing. He and Grace were relatively taller and used height to their advantage. More often, Richards would step slightly across the off-stump and guide the ball to the boundary on the on-side. It is also interesting to note that both the ‘V’ batters (Viv and Virat) are prolific players with the ‘Vee’. Just like most successful batters, a distinctive feature of Virat Kohli (aside from his high level of confidence and cricket mindset) is the stillness of his head at the crease. His head is extremely still, and with adequate eyesight, it allows him to pick up the trajectory of the ball a lot better than others. In addition to his orthodox technique, Kohli exhibits a wide stance at the crease most of the time, plays the ball as late as possible and under his nose, which results in lower chances of getting caught.

A phenotypic feature of all the above batters (except W.G. Grace) is their body weight and being light on their feet (a concept communicated well by the former martial artist, Bruce Lee). This phenomenon is key, especially when facing bowlers of fast speeds (or when being approached by an attacking object; with cricket—the ball) and when transitioning between front-foot and back-foot shot selections (W.G. Grace was the first batter to adopt this). Lastly, these batters have/had an open face of the bat, especially when attacking the ball. This characteristic also contributes to the successful armoury of a batter.

In decades to come, we will come to witness even better batters (both orthodox and unorthodox), and even then, many will write about batting evolution and their defining characteristics. As much as we think of it as an evolution of batting, I’d instead call it a revolution. Batting will continue to innovate, and by watching successful batters, will help us better explain why cricket batting is not just an innovative art, but a science.

THE 4IR AND CRICKET

Batting and bowling have been the positional cornerstones of cricket being played at any level. Although each player has an important role in the team, cricket is still mainly played as a team sport. Over the years, various tools and approaches have been utilised and analysed in order to provide a cricket team with the best probability of winning matches.

In the 4IR, considerable work has been conducted using AI in cricket, specifically, prediction models for particular outcomes. These approaches have become increasingly popular, and more specifically, for the betting world in terms of predicting certain outcomes using various factors or datasets.^{26–29} For example, more than a decade ago, AI techniques through Bayesian classifiers in machine learning was used to predict how factors affect the outcome of a 1-day international (ODI) cricket match.²⁶ A software tool called CricAI was subsequently developed, which outputs the probability of victory in an ODI cricket match using input factors such as home game advantage available at the beginning of the match.²⁶ The CricAI tool can also be used in real-world applications by

teams playing cricket and helps adjust certain factors in order for teams to maximise the chances of winning the real game.

Similarly, also using machine learning, Kapadia *et al*²⁷ investigated machine learning technology to assist with the problem of predicting cricket match results based on historical match data of the Indian Premier League. Two featured subsets were formulated; the one based on home team advantage and the other based on the toss decision. Selected machine learning techniques were applied on both feature sets to determine a predictive model.²⁷

More recently, another prediction study was conducted by Awan *et al*²⁸ in which the use of 'big data' for cricket match analytics was applied. The study adopted a machine learning linear regression model to predict team scores without big data and the big data framework. The model that was built (inferring a 96% accuracy) indicated the winner of a cricket match with continued input conditions from the user (coach or analyst) of the ongoing game. This means that the model can be adjusted or refined in real-time based on what happens in match situations. It was discovered that this approach can be applied to other sports.²⁸

Aside from various computing models for prediction analytics, a recent study utilising AI was conducted with the use of an A* algorithm to search the state space to find the number of runs that should be scored off every over during a run chase in cricket.²⁹ The study addressed a particular problem at hand which is the need for batters to score runs at a rapid rate while risking losing their wickets. This is especially important in the context of the shorter format of the game, that is, 10-over or 20-over (T20) cricket.

Although computation models and machine learning have varied use cases in sport, another area that has given rise to technological prominence is through technologies that ignite automation (both on and off the field). One of the contested issues in cricket is to differentiate whether a bowler is using an illegal bowling action (a throw-like movement). Wixted *et al*³⁰ designed and formulated a technology and method for an in-game assessment using a wearable arm sensor for distinguishing between a legal bowling action and throwing movement. The method uses inertial sensors on the bowler's arms that do not impede the bowling action.³⁰ Illegal deliveries, as assessed by an expert biomechanist using high-speed video and motion capture, revealed valid distinctive inertial signatures. The study concluded that the technology is an important step in the monitoring of bowling action on-field in near real-time and that it can be used as a training tool both for coaching and developing athletes.³⁰

Based on the above, it is imperative for coaches to understand such technologies and innovations. In essence, at the elite level, the objective for a cricket match (or any other sport or game) is to be won. If such tools and approaches can significantly contribute towards teams winning games (or even improving performance), now is

a better time than any for coaches to adopt an innovative mindset and approach in their coaching philosophies and planning.

THE LINK BETWEEN COACHING MANUALS, PRACTICE, SKILLS AND THE INDIVIDUAL PLAYER

Although technology and innovation have shown to be promising within the sports coaching spheres, it is also essential to understand the link between coaching manuals, coaching practice, skills and the individual player. Each coach and player differs based on their unique backgrounds, experience, skill, personality, mindset and other characteristics. It is crucial to marry such characteristics together so that cricket coaches can understand their players (and vice-versa), understanding the link between coaching practice, skills and the individual player.

A study that evaluated cricket coaching methods revealed that coaches felt that the game has changed over the years, and formalising a specific (batting) technique may not be ideal for most purposes.¹⁸ This is supported by Renshaw *et al*,³¹ who states that a key feature in enhancing performance is variability. In addition, coaches felt that using the coaching manuals for players at a younger level provides a foundation for the acquisition of skills. When players are older, coaching manuals would not provide some of the answers that may be paramount for the player beyond their teenage years. Research demonstrates that through informal learning (such as coaching manuals, video footage, science videos), coaches are able to develop strategies to overcome the above practical coaching dilemmas.³² Therefore, this method of coach learning should not be underestimated.

One must remember that the game has changed drastically over the years and coaching textbooks have not. A coach should endeavour to realise this and continue to develop his coaching structures. – South African Secondary School Cricket Coach.¹⁸

It is important also to consider that each coaching structure may change over time, but it must also have a strong foundation.³³ For instance, some coaches advocate for a Humanistic approach that involves focusing on all aspects of the player while concentrating on a few key components of technique.³⁴ From a different perspective, it is perhaps unsurprising that one of the few robust and widely accepted findings in the coaching literature is that coaching knowledge and practices, among both elite and non-elite coaches, are derived from both formal and informal sources.^{32–37}

Cricket is evolving rapidly, and this poses another challenge for coaches. The challenge is that many coaches feel that some of the coaching manuals are outdated and not relevant to their current practice of cricket coaching for individual players. It can, therefore, be argued that these coaches rely on their experiences, which is the most important facet in the development of coaches.³⁶



It appears that cricket coaches consider the importance of individuality with a player,¹⁸ which supports adopting the athlete-centred approach.³⁸ However, a majority of coaches still apply the generic approach to young players and only later adopt a tailored approach to players as they age and develop. This might be a matter of concern even at the youth level. Although applying a (generic) foundation of skills at the younger age groups are sufficient, young cricketers are also (to an extent) individuals and have unique capabilities compared with their counterparts.

In the game of cricket, there is always a chance for players to improve, and coaches need to find a way to distinguish between the over and underutilisation of coaching manuals. Textbooks have limited use once the player advances to higher levels. However, the utility of coaching manuals for the basic fundamentals of cricket coaching is imperative.¹⁸ There has been a consistent need to establish a level of agreement and support between the coaching and biomechanical literature.³⁹ Therefore, it would be important for cricket coaches to read and consider the recommendations emanating from biomechanical literature, and not just coaching, when it comes to the individual player.

In terms of the individual player, the emphasis on enhancing natural ability is also important.³⁸ Weissensteiner *et al*⁴⁰ developed a model of expertise in cricket batting in which a favourable sociodevelopmental environment provides the essential foundation for the development of positive psychological attributes, technical skill mastery and superior visual-perceptual skill. Furthermore, Renshaw *et al*³¹ proposed a constraint-led approach in conjunction with the athlete-centred approach (individuality, noted above) to coaching cricket, which is a suitable theoretical method that coaches and scientists can use to underpin learning design. By adopting this approach, coaches understand that performance problems can be solved in a number of ways (such as coaching a batting technique). Therefore, there is a rejection of the concept of one optimal movement solution.

THE 'CRICKET BRAIN'

In modern times (approximately 2010–2022), technology has helped coaches, scientists and analysts win games, which was not the case in the eras of W.G. Grace, Sir Donald Bradman, Sir Viv Richards and more. The defining characteristics of Virat Kohli, AB de Villiers and Steven Smith are based on an advanced form of cognitive functioning (as well as an 'unconventional' orthodox batting technique), which can be rarely picked up with the naked eye, video and biomechanical analysis, and performance patterns.⁴¹ Instead, if scientists (and support staff) can understand what happens in a player's mind, this would provide a winning edge over any player(s)/team. If anyone would have access to this kind of (cognitive) technology and approach, we would have a more level playing field in further understanding

the determinants of cricket batting success. I refer to this approach as 'the cricket brain'.

One of the closest ways to administer and measure cognitive functioning (and neuroscientific analysis) of batters is through the use of an electroencephalogram (which would be entirely dependent on the approval by the Laws of Cricket Committee in London and the International Cricket Council). This kind of study would allow one to track the brain activity and patterns of players while they are being analysed biomechanically. In addition, motion capture analysis would be used, thereby understanding cognitive batting behaviour. Only once we can attenuate advanced objective studies among batters (as well as bowlers) will we be able to understand (explicitly) why and how players display such talent on the field.

SUMMARY AND IMPLICATIONS FOR CRICKET COACHING IN THE 21ST CENTURY

As much as on-field performances are important, it is also salient to identify and observe players' behaviour and lifestyle patterns off the field. Cricket players' nutrition, sleep patterns, stress levels, activity and training loads, rest periods, etc; are imperative to elucidate a holistic picture of what constitutes athlete success for coaches. If these are not considered, it prevents one from obtaining a broader viewpoint of why and how players are successful. It is reassuring that this kind of analysis can still be achieved with modern-day players if coaches and support staff make it a priority.

The way forward in cricket research requires main elements such as performance, prevention and psychology (as well as technology and innovation) in cricket to be integrated and applied as one holistic, systematic model. This would ultimately assist coaches, scientists, support staff and medical professionals in coaching (and managing) cricket players optimally.

ANSWERS TO QUESTIONS

What factors contribute to the uniqueness of cricket (as well as cricket coaching) in South Africa?

- ▶ It is a well-established fact that socioeconomic factors persist to being a challenge within rural and semi-urban areas in South Africa.
- ▶ Among others, access to basic needs, cricket facilities, housing and access to opportunities (as well as equitable access) are the main challenges (still) encountered to this day.
- ▶ This indirectly makes it challenging for cricket coaching to prosper, making it increasingly difficult for rural and semiurban cricket coaches.
- ▶ It also seems that boys-only schools still remain the preferred and optimal feeder system to cricket being played at the highest level in South Africa.

Why is technology and innovation for cricket (and sports in general) important in the context of the 4IR?

- ▶ Technology and innovation have propelled exciting evolutions within the sports fraternity. All

stakeholders ranging from coaches, players, sports scientists and biomechanists are in a position to better monitor, analyse, prepare and track performance.

- ▶ It is imperative for all stakeholders to be updated with such trends and technologies as well as identify the importance of constantly acquiring training to leverage management and monitoring of athletes through a 21st century lens.

What tangible examples of technological and innovative applications can be used to advance cricket coaching in the modern era?

- ▶ In the 4IR, considerable work has been conducted using AI in cricket, specifically, prediction models for particular outcomes.
- ▶ Although computation models and machine learning have varied use cases in cricket, another area that has given rise to technological prominence is through technologies that ignite automation (both on and off the field) in cricket.

What factors contribute to a batter being successful in the modern era?

- ▶ A combination of finesse, power and fearlessness at the crease.
- ▶ Being light on one's feet in any format of the game.
- ▶ Batters having an open face of the bat and a LBBT.
- ▶ Balance in all aspects of the kinetic chain (head, feet, etc).
- ▶ A clear mindset (applying a 'cricket brain') before executing any tasks.

What links exist between coaching manuals, coaching practice, skills and the individual player?

- ▶ Coaching knowledge and practices, among both elite and non-elite coaches, are derived from both formal and informal sources.
- ▶ There is always a chance for players to improve, and coaches need to find a way to distinguish between the over and under-utilisation of coaching manuals.
- ▶ Textbooks have limited use once the player advances to higher levels. The utility of coaching manuals for the basic fundamentals of cricket coaching remains paramount.
- ▶ There has been a consistent need to establish a level of agreement and support between the coaching and biomechanical literature.
- ▶ It would be important for cricket coaches to read and consider the recommendations emanating from biomechanical literature, and not just coaching, when it comes to the individual player.
- ▶ The emphasis on enhancing natural ability is important for the individual player.

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