



The Future of Australian Sport

Megatrends shaping the sport sector
over the coming decades

Second report
December 2022



Australian Government
Australian Sports Commission





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Foreword

Building a generation defining era for sport

In 2013, the Australian Sports Commission and the CSIRO joined forces to release a ground-breaking report, *The Future of Australian Sport: Megatrends shaping the sports sector over coming decades*, that helped inform long-term strategy and planning in Australian sport. In 2022 we have collaborated again, and I am pleased to present this update to our first report.

A lot has changed in 10 years and as we begin the Green and Gold decade to the Brisbane Olympic and Paralympic Games in 2032, we must ensure we are ready to capitalise on the enormous opportunities ahead to unite and inspire Australia through sport.

We know people are changing the way they interact with sport. As an example, the COVID-19 pandemic accelerated a trend towards more home-based physical activity.

That's not to say organised sport doesn't play an important role. It does, but clubs need to evolve to suit the needs and wants of today's participants and volunteers.

We've also seen a rise in the use of fitness apps and 'exergaming' to get active as users opt for convenience and flexibility in an increasingly busy world.

That's why this new report is so important.

By understanding the challenges and changes facing sport, we can better face them and embrace the opportunities they create.

Many of these challenges relate directly to our key focus areas as outlined in our strategic vision, The Australian Sports Commission's Strategic Vision: Our Green and Gold decade of opportunity.

By building the capability of sport and the people involved we are investing in athletes and sports to achieve and succeed, while attracting, retaining and developing talent – in all areas of sport – that is world's best.

Another key focus area is promoting and supporting inclusive and diverse sporting environments. We have seen in recent years, and confirmed in this report, that many groups of Australia's diverse population remain under-represented in sport.

We also strive to drive innovation in sport and lead and enable the world's best sport system. By expanding our knowledge-base and understanding of optimal athlete performance we can champion solutions that benefit the entire sport sector.

I commend everyone involved in the development of this report. The findings will help all of us ensure we are at the top of our game and well placed to embrace this defining era for Australian sport.

I'm incredibly excited about what the future for sport in this country looks like and how we can establish Australia as the world's best sporting nation.



Kieren Perkins OAM
Australian Sports Commission CEO

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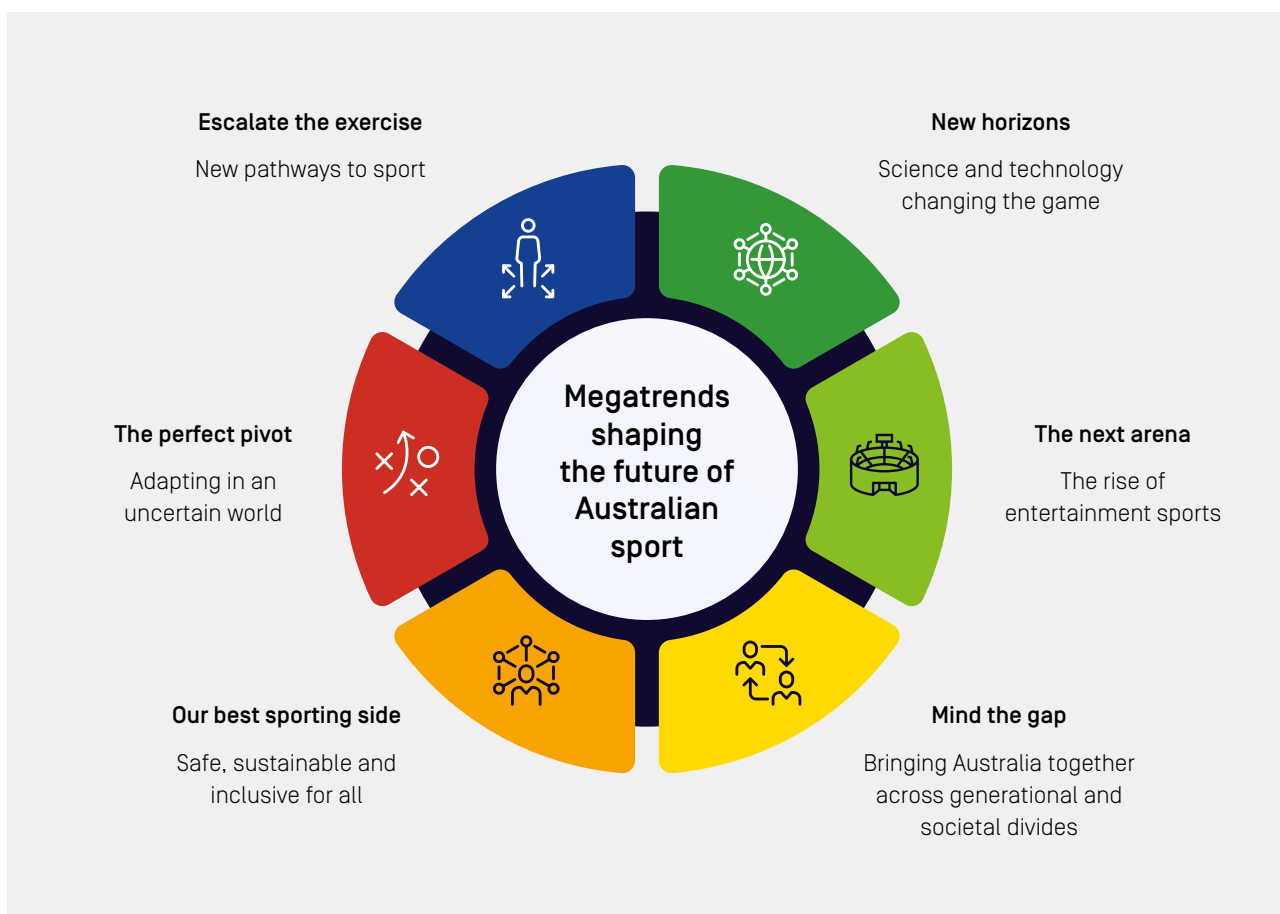
Executive summary

The Australian sports sector will look very different in 2032 when Australia once again hosts the Olympic and Paralympic Games and becomes the focus of global attention.

Australian sports, and the ways in which we engage with sport and physical exercise, are being transformed by new technologies, changing environmental conditions, shifting value systems, new habits and lifestyles and the increasing diversity of the Australian population.

This report identifies six megatrends that will shape the Australian sports sector over the coming decade and beyond and provides a decadal update on the first ground-breaking report, *The Future of Australian Sport: Megatrends shaping the sports sector over coming decades*, released by CSIRO and the Australian Sports Commission in 2013.

Megatrends describe connected groupings of smaller social, political, economic, technological, legal and environmental trends. They create an overarching narrative for the main drivers of longitudinal change that can steer policy formation, strategic planning and investment decisions for the long and medium-term future.



Megatrends in Australian sport



ESCALATE THE EXERCISE – NEW PATHWAYS TO SPORT

Participation in organised sports across Australia has remained relatively steady over the past decade, but there has been a rise in participation in non-organised physical activities such as walking, running, cycling and gym-based fitness. This trend was further boosted by the COVID-19 pandemic, social distancing, periods of home isolation, and increased adoption of home-based gym equipment, fitness apps, and wearable technologies. Much of the increase in fitness-based activity has been through non-formal or semi-formalised participation in fitness centres, home gyms, exercise groups, online communities, and individuals accessing outdoor recreational infrastructure and green space within their communities.

The increase in convenient and ad-hoc exercise by a proportion of the population hasn't generally translated to involvement in more formalised sports competitions and leagues. The rise of fitness-based activities presents new opportunities for sports organisers who can bring the game to the people, increase inclusion, promote the social benefits of playing together and utilise new technologies to increase convenience.

Barriers to participation in formalised sports remain significant for some groups, including older populations, people from regional and remote areas, First Nations peoples, low socio-economic individuals, LGBTQ+ people, people from culturally diverse backgrounds, and people with disability. These groups may benefit from specialised or modified sporting services and competitions.



NEW HORIZONS – SCIENCE AND TECHNOLOGY CHANGING THE GAME

Over the next decade the world will look to Australia as we approach the Brisbane 2032 Olympic and Paralympic Games. Much of the success of Australia's high-performance sports system to date can be attributed to advances in sports science and medicine, coaching, organisation, and ongoing investment in the potential of Australia's elite athletes.

New technologies and advances in areas of technical expertise that support the enhancement of performance (including but not limited to human physiology, nutrition, psychology, engineering and materials science) are now changing the game in sports. A better understanding of the individual and biological diversity of athletes is leading to a personalised approach to performance support across a range of technical direction disciplines, from coaching to sports medicine and training.

Training programs tailored to the individual, resulting from the work of multi-disciplinary teams, can optimise sports performance, assist with injury prevention, enhance physical and mental recovery, and maximise the well-being and long-term psychological benefits of sport. The adoption of new and emerging technologies will support this individualised approach but comes with issues to be negotiated around ethical implementation and privacy protections.

The global sport technology and innovation market continues to see substantial growth. Australia will host a significant number of international sporting events over the next decade, and this will provide our science, technology, health, education and manufacturing sectors with an opportunity to invest in sport innovation and showcase and export their know-how and products to the world.



THE NEXT ARENA – THE RISE OF ENTERTAINMENT SPORTS

Australians consume sport across a range of markets and platforms. Many Australians love to be entertained by sport, whether this is attending a live event or listening to or watching sport through the various broadcast and online options available.

Over-the-top (OTT) video-streaming platforms, with the ability to deliver sports content to many Internet-enabled devices, are increasingly challenging traditional sports broadcasting business models on satellite, cable, free-to-air (FTA) television and radio, creating new audiences and connecting viewers globally.

Some sporting organisations – particularly the major codes in Australia – generate significant revenue streams through broadcast rights deals, major events, merchandising, sponsorship activities, endorsements and branding.

Digital sport and e-sports are becoming increasingly popular, offering access to new activities in virtual environments. Some of these digital sport variants more recently supplemented or provided redundancy for cancelled real-world sporting events during the COVID-19 pandemic. At the same time, urban and adventure sports are engaging the next generation of sports fans as they become more visible and available to mainstream audiences.

Over the coming decade, we will see more sporting organisations and products compete for a share of national and global audiences. As a result, both established sporting codes and sports new to these markets will consider how to engage contemporary consumers and adjust their view of spectators to take advantage of the increasingly dynamic and diverse global media landscape.



MIND THE GAP – BRINGING AUSTRALIA TOGETHER ACROSS GENERATIONAL AND SOCIETAL DIVIDES

Sports organisations can champion positive change across society. They do this by emphasising sporting values of fair play, egalitarianism, inclusivity and teamwork. By showcasing these values and creating a meritocracy based on commitment, fitness and skills development, sports offer a source of inspiration, create shared experiences, and build pride.

Sport can bridge the cultural and demographic gaps existing and emerging across Australian society. Australia's population overall is aging and increasingly diverse. In 2022, nearly a third of Australians are born overseas, 3.2% are members of First Nations groups, 18% live with disability, and just over half of the population are women. Young Australians are growing up with new technologies and global connections, creating distinctly different behaviours and values.

Over the coming decades, sports organisations and individual athletes will play a unique role in broader societal change and help bridge the gaps between demographic groups. Sport will provide a sense of common purpose, identity and belonging to Australians from many different backgrounds, genders and abilities.



OUR BEST SPORTING SIDE – SAFE, SUSTAINABLE AND INCLUSIVE FOR ALL

As Australia's demographic profile becomes more diverse and social values shift, organised sports in Australia will also transform and reflect these changes.

Persistent societal challenges such as racism, violence, abuse and other poor behaviours in sport have elevated the importance of sports integrity, safety and ethics in the sports industry at all levels. Stronger accountability, reporting structures and advocacy for vulnerable Australians will place further requirements on sports to provide a safe and welcoming place for all.

Community-driven sports clubs will increasingly seek to tap into the benefits of engaging a broader cross-section of Australian society. Many will place more emphasis on providing positive participant experiences and promoting inclusive behaviours on- and off-field. Growth in competing markets and competition for new participants will also provide further impetus for sporting organisations and clubs to implement positive change.

In the coming decades sports organisations will be faced with even stronger social licence obligations and will seek well-informed practices to encourage diversity, inclusivity and fair-play, and offer athletes more choice, advocacy and individual expression.



THE PERFECT PIVOT – ADAPTING IN AN UNCERTAIN WORLD

The world is entering historically uncertain times. Climate change is increasing seasonal temperatures and the frequency of extreme weather events. Heightened geopolitical tensions have given rise to more wars along with the threat of further military conflicts globally, trade sanctions, and threats and acts of terrorism. Pandemics, like the COVID-19 pandemic, have increased in likelihood – with a 47% to 57% chance of a second pandemic of the same magnitude occurring in the next 25 years.

All these factors have disrupted scheduled sporting activities over recent years and this disruption is likely to continue and increase in frequency over the coming decades. This uncertainty will affect all sports, including event planning, infrastructure design and the types of sports that can be played in certain seasons. It will increase the need for some sports and their associated business models to make strategic 'pivots' or rapidly deploy alternative approaches and resources, move venues and competitions at short notice, or respond to other unexpected challenges when required.

This megatrend is far broader than just sport but has relevance to a sector with multiple points of exposure to geopolitical, extreme climate and pandemic-related risks. Australian sporting organisations will need to be flexible and ingenious over the coming decades.

Introduction

Ten years on from the first *Future of Australian Sport* report: Australians still love sport, but the sporting field is changing

Sport is part of the cultural identity of many Australians. We love participating in sports for health, relaxation, fitness and social engagement, we love seeing our elite athletes punch above their weight to achieve success in international competitions, and we love watching sports live or via an increasing variety of digital channels. In Australia, sports and recreational organisations attract more volunteers than any other type of organisation.¹⁹ Major sporting events – grand finals, international cricket, grand slam tournaments, surfing competitions and cycling challenges – as well as less watched events – weekend matches, morning and afternoon training sessions and amateur competitions – fill our calendars and recreational time.

Sport isn't just a favoured pastime for Australians; it is a significant contributor to the Australian economy. Sport is estimated to contribute around 0.8% of Australia's GDP and 1.5% of total employment in Australia (2016/2017).²⁰ This figure is likely to underestimate the value of exercise and physical fitness to national productivity, human capital uplift, savings to government expenditure on other areas such as health, education and justice, and investment in sporting infrastructure and facilities.²¹

The ways we engage with sports are changing, however. This report outlines the evidence behind emerging megatrends in Australian sport, megatrends that will play out over the next ten years leading up to the Brisbane 2032 Olympic and Paralympic Games and beyond.

In 2013 CSIRO, in partnership with the Australian Sports Commission (ASC), published the first landmark megatrends report, *The Future of Australian Sport: Megatrends shaping the sports sector over coming decades*.²² That report outlined six megatrends that accurately described the movement in the Australian sporting landscape over the last ten years (see Table 1).

Those megatrends foretold the large shifts we have seen in sports between 2013 and 2022. For instance, *A perfect fit* described the rise of fitness industries, gym memberships and personal trainers based on growing health consciousness within the community. This trend has played out with an almost doubling of Australians participating in fitness and gym activities between 2012 and 2021.²³

From extreme to mainstream foretold the inclusion of many of the newer sports in the Olympics – skateboarding, freestyle BMX and rock climbing²⁴ – while *More than sport* focused attention on the broader benefits of sport for health and well-being and was a forerunner for growing activity in older Australian (pre- and post-COVID-19 pandemic)⁷ and the new awareness on declining physical literacy in Australian children.²⁵ *Everybody's game* outlined the growing diversity in Australia's population and sports participation, and this trend continues with even greater diversity in the Australian community in 2022. *Tracksuits to business suits* described changes to the economics of sports including the rising costs of community sports and the growing professionalism in elite and televised club sports. This trend is extended in this report with the growth of social media, streaming services and fragmentation of global audiences impacting both community and professional sports. Finally, *New wealth, new talent* examined the growing economic and other influences of the Asia-Pacific region on Australian and global sport, and again, the last decade has seen this trend continue with growth in migration to Australia (predominately from the Asia-Pacific region and particularly from India, China and New Zealand), and growing global sports participation in the South-East Asian region.^{26,27}

But a lot has changed since publication of *The Future of Australian Sport* report in 2013.²² There have been game-changing technological advances, the COVID-19 pandemic, increases in the impacts of climate change on our organisations and everyday lives, and a new generation of Australians with new habits, values, expectations, and attitudes to sports and physical activity. Sporting populations and organisations everywhere are seeking greater diversity, access and integrity in play and participation at all levels.

In front of us is the anticipation and excitement of the Brisbane 2032 Olympic and Paralympic Games and the chance to inspire sports participation across Australia through new pathways and in new fields on what has been described as 'the green and gold runway'.²⁸ The Olympic and Paralympic Games also provide the opportunity for Australians to be first in many areas – both on and off the field.

The social, economic, scientific, technical and diplomatic opportunities for Australia that the Brisbane 2032 Olympic and Paralympic Games may inspire reach far beyond the actual events. This report outlines the ways in which new megatrends will impact our sports participation, performance and organisation in the lead-up to the Brisbane 2032 Games. It poses some questions for government, industry, sporting organisations and players on how they can move early to meet some of these challenges and capitalise on the benefits of those megatrends.



Table 1. Mapping the new and old megatrends

THE FUTURE OF AUSTRALIAN SPORT – 2013 ²²

-  A perfect fit – personalised sport for health and fitness
-  Tracksuits to business suits – market pressures and new business models
-  From extreme to mainstream – the rise of lifestyle sports
-  Everybody’s game – demographic, generational and cultural change
-  More than sport – the attainment of health and community, and overseas aid objectives via sport
-  New wealth, new talent – economic growth and sports development in Asia

THE FUTURE OF AUSTRALIAN SPORT: SECOND REPORT – 2022

-  Escalate the exercise – new pathways to sport
-  New horizons – science and technology changing the game
-  The next arena – the rise of entertainment sports
-  Mind the gap – bringing Australia together across generational and societal divides
-  Our best sporting side – safe, sustainable and inclusive for all
-  The perfect pivot – adapting in an uncertain world



Methodology – defining megatrends

This report describes megatrends that shape our longer-term futures. A megatrend is defined as a deep-set and gradual trajectory of change that builds with increasing momentum and eventually alters the business, social or policy context in which an organisation operates. Megatrends occur at the intersection of multiple smaller trends, which may have a more specific geographical, temporal or topographical definition. The trends that make up a megatrend can be political, economic, social, technological, legal or environmental.²⁹⁻³¹ This report covers all of these areas.

Megatrends are typically decadal in that they span patterns of change occurring over periods of 10, 20 or 30+ years.

Defining megatrends helps us anticipate futures beyond what we can accurately predict through data extrapolation. Their varying intersecting lines allow us to imagine various futures. As the timeframes move further out from the present, the certainty of a particular future decreases.

We use megatrends to create future narratives, and we test these narratives with experts in the field. In this work, we consulted widely with sports experts across Australia identified by the ASC and our own teams within CSIRO. We asked sports experts about the changes they've seen in sports and the trends they anticipate continuing (Figure 1).

Definition of sport

For this report, sport has been defined as:

A human activity involving physical exertion and skill as the primary focus of the activity, with elements of competition or social participation where rules and patterns of behaviour governing the activity exist formally through organisations.³²

In addition to this definition, there are varying levels of competitive, non-competitive, organised and non-organised sports and physical activity. For example, non-formalised physical activities (such as walking and jogging) are discussed in this report as part of the Australian sporting environment, sometimes leading to more organised sports participation.

Process undertaken for this report

Figure 1. Methodology for crafting megatrends in Australian sport





TOKYO



Megga- trends



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Escalate the exercise — new pathways to sport





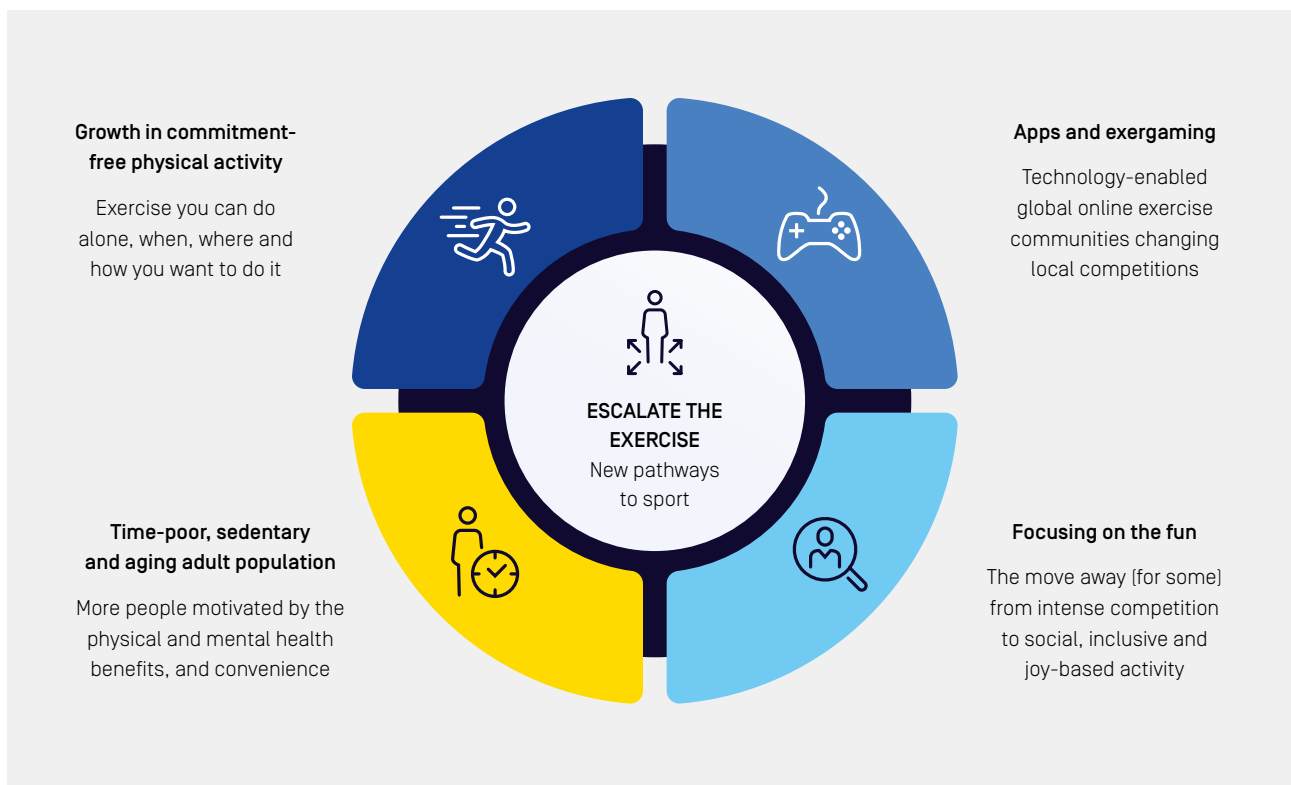
Organised sports across Australia bring communities together and provide a platform where volunteers, players, sponsors, local businesses and organisers can form relationships on and beyond the sporting fields. This is particularly apparent in regional and rural communities where sporting competitions build deep social connections and create a meeting place for people who live across larger distances.

Participation in organised sports across Australia has remained relatively steady over the past decade, but there has been a rise in participation in non-organised physical activities such as walking, running, cycling and gym-based fitness. This trend was further boosted by the COVID-19 pandemic, social distancing, periods of home isolation, and the subsequent increase in adoption of home-based gym equipment, fitness apps, and wearable technologies. Much of the increase in fitness-based activity has been through non-formal or semi-formalised participation in fitness centres, home gyms, exercise groups, online communities, and individuals accessing outdoor recreational infrastructure and green space within their communities.

The increase in convenient and ad-hoc exercise by a proportion of the population hasn't generally translated to involvement in more formalised sports competitions and leagues. The rise of fitness-based activities presents new opportunities for sports organisers who can bring the game to the people, increase inclusion, promote the social benefits of playing together and utilise new technologies to increase convenience.

Barriers to participation in formalised sports remain significant for some groups, including older populations, people from regional and remote areas, First Nations peoples, low socio-economic individuals, LGBTIQ+ people, people from culturally diverse backgrounds, and people with disability. These groups may benefit from specialised or modified sporting services and competitions.

Overall, the pathways into organised sport are changing and diversifying.



Growth in commitment-free physical activity

Organised sports will continue serving communities as platforms to engage and get more Australians physically active more often. Over the past decade, we have seen organised sports supplemented with more convenience-based, health and well-being motivated, non-sport-related physical activities (Figure 2).

SPORT AND NON-SPORT RELATED ACTIVITIES (EXERCISE)

Australians describe 'organised sport' as having an organiser and organisational structure, venue or location, program of events, record of the performances of teams or individuals, and an expectation for participants to turn up more than once at particular times.³⁴ Organised sport involves commitment in money, effort and time.

Non-sport-related activity (exercise) is more casual and flexible, including active travel (walking, running or cycling), individual exercise and physical activity that can occur spontaneously or extreme activities.³⁵ There are several grey areas of loosely organised, semi-regular physical activities between sport and just exercise. These may include, for instance, fun runs, online communities on fitness apps, or gym or yoga classes.

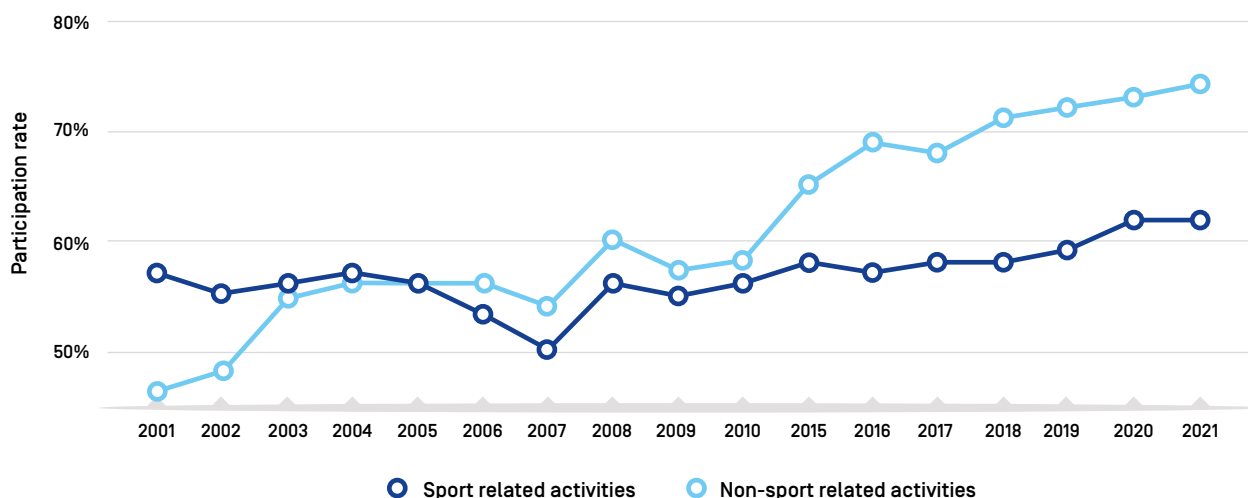
All physical activity is increasing, but exercise-related activities are growing faster than sport-related-activity.

The Australian population's participation in organised sports has increased over the previous 20 years, but the primary growth has been in exercise (non-sport)-related activities.³⁶ This includes walking, cycling, fitness/gym-based and running activities in particular. In 2021, 74% of the population participated in non-sport-related activities, compared to only 46% in 2001 (Figure 2). Exercise-based activity is supplementing rather than displacing sport-related activities.

Fitness/gym activities have grown the most over the past two decades, with an increase in participation of 21.2% since 2001. One-third of Australian adults reported participating in gym-based fitness activities in 2021. Individual activities such as running/jogging and cycling have also seen significant increases in participation over the last 20 years.²³ Walking has been the most popular non-sport activity among adults aged 15 and over during the previous two decades – with nearly half of the surveyed Australian adults participating – with an increase of 19.1% since 2001.³⁷ These trends were accelerated by the COVID-19 pandemic, driven by the need for social distancing and the closure of many club-based sports and sport and recreation facilities.

Figure 2. Participation in sport-related and non-sport-related physical activity

Source: AusPlay.⁷ The ASC's AusPlay survey defines sport-related activity as physical activity that is typically associated with a National Sporting Organisation.³³





GYMS AND HOME GYMS ON THE RISE

The gym and fitness industry has been expanding over the last two decades. Pre-COVID-19, between 2014 and 2019, the Australian fitness industry grew on average by 4.9% per year and is expected to grow by 3.9% annually until 2024.³⁸ The number of gyms or fitness centres in Australia also increased by 67% between 2016 and 2021 – to over 6,462 gyms and fitness clubs.³⁹ Gym members are generally younger, with the highest proportion of members aged 25 to 35.³⁹ During the COVID-19 pandemic, the fitness industry lost substantial income due to lockdowns and concerns over airborne infection in indoor environments. This led to a proportion of gyms closing.⁴⁰ At the same time, there was a boom in sales of home-based fitness equipment.⁴¹ The American College of Sports Medicine worldwide survey found home exercise gyms to be their number two trend in 2022 (after wearable technology), with many people pivoting their gym exercise routines to home and online.⁴²

POST-PANDEMIC HYBRID SPORTS

Sport plays a crucial role in bringing communities together and will remain important to many Australians, fulfilling a need for social contact and promoting feelings of connectedness. Local sporting clubs will continue to create a shared sense of belonging outside of family and workplaces previously filled by religious and other community institutions. Participation in sports is greater in regional and rural areas of Australia.⁴³

There is evidence that in late 2022 many people had had enough of exercising in isolation at home. As COVID-19 restrictions ease, many people are returning to sports venues, gyms, clubs and fields, as well as outdoor sports organisations such as bushwalking clubs and running groups.⁷ This may be powered by the need to supplement exercise for health and fitness with the socialisation that face-to-face sports provide.³⁵

The pandemic also impacted volunteering, with only 82% of pre-COVID-19 and current volunteers indicating they are likely to volunteer in the next 12 months.⁷

Some suggest that, like work location, the pandemic has created a demand for a hybrid sport and fitness delivery model – with personalised home-based sports or exercise being combined with attendance at venues, including gyms or sports clubs. Another hybrid model combines some online exercise with some face-to-face.⁴⁴ Options for hybrid sports will continue to offer flexibility and convenience over the coming decade.



THE PANDEMIC PAUSES

The 2019, COVID-19 pandemic caused a significant shock to sports in Australia. Lockdowns forced an immediate decline in organised and club-based sport and a spike in people using alternative means to fulfil their need for physical exercise. These included fitness apps, walking, running, cycling, and home-based gym activities. Organised sports that could maintain social distancing – such as tennis and golf – increased participation levels between 2019–2022, while most other organised sports declined.⁷ The pandemic also saw a disruption in volunteering levels.

Since the pandemic, Australians over 15 years have returned to organised sport but also maintained some of the alternative forms of exercise, resulting in a greater mix of activities.

Time-poor, sedentary and aging adult population

Like many developed nations, Australia's population is aging. The proportion of the population aged over 65 between 2000 and 2020 increased from 12.4% to 16.3%. This group is predicted to increase in size rapidly over the next decade as more 'baby boomers' reach 65.²⁶ Physical activity plays a vital role in healthy ageing, and participation in group sport or exercise is associated with increased longevity.^{45,46} Older adults who are members of sports or exercise groups are more likely to remain engaged in physical activity and significantly less likely to die prematurely compared to physically active non-group members.⁴⁶ Participation in teams sport is also linked to positive psychological and social health outcomes, including improved self-esteem, a sense of belonging, improved social support, and reduced feelings of social isolation and stress.⁴⁷

Our work lives have become more sedentary over the past decades. Nearly half of all employed people in Australia aged 18–64 report that their days at work are spent predominately sitting.⁴⁸ Adjacent to this change is the motivation to engage in physical exercise for mental and physical health. According to the AusPlay survey, most Australians engage in sports for physical health, fitness, fun and enjoyment; however, an increasing proportion of the population also participates in sport for social reasons and mental health.⁷ Growing awareness of the benefits of exercise is a positive trend in an increasingly aging and sedentary population.

APPS AND EXERGAMING

The growth of 'exergaming' after the COVID-19 pandemic, including the use of augmented and virtual reality (AR/VR), and wearable technologies, is likely to continue to gain popularity and offer greater convenience and flexibility for a new generation of sports participants.

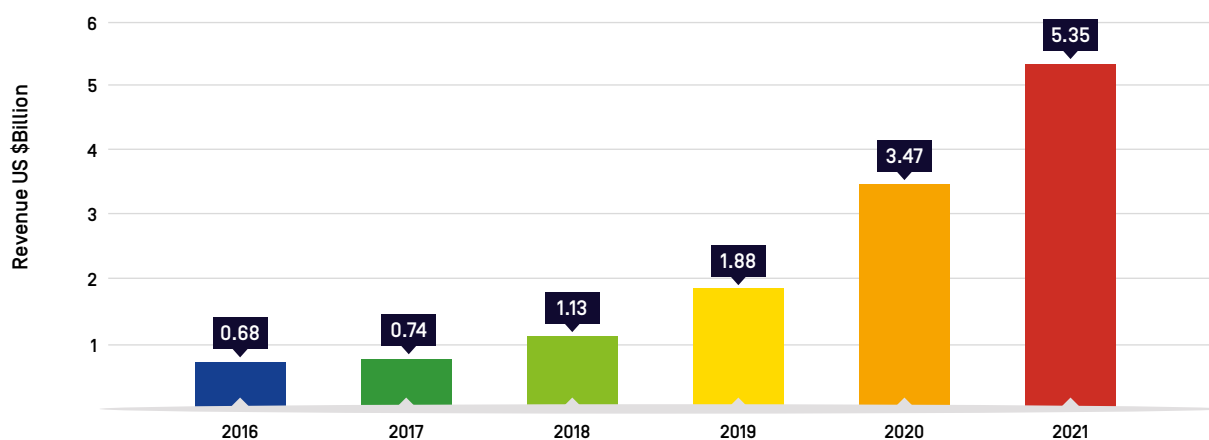
Fitness apps and 'exergaming' – or exercising via online games such as Nintendo, Xbox or Playstation, or Internet-connected treadmills and trainers such as Zwift or Peloton – have been increasing in use over the last decade and were boosted further during the COVID-19 pandemic. Fitness app revenue has also grown steeply over the previous five years, from an estimated US\$0.68 billion in 2016 to US\$3.47 billion in 2020 (Figure 3)⁴⁹ – see also **The next arena** megatrend.

Strava, a physical exercise tracking and social network app, saw more than 1.1 billion uploads globally between October 2019 and September 2020, a 33% increase from the previous year. Strava reported a significant increase in virtual competition in 2020. Social distancing and the cancellation of competitive events led to athletes creating more than 170,000 new clubs on Strava to compete virtually against each other.³⁷

Over the next decade, it is anticipated that many sporting and non-sporting organisations will introduce new physical activity and fitness products modified and tailored to a diverse and time-poor generation of Australians.

Figure 3. Growth of revenues from fitness apps such as MyFitnessPal, Fitbit, Strava, Sweat, Zwift and Peloton

Source: Business of Apps⁴⁹





FOCUSING ON THE FUN

For many people, sport is about far more than competing and winning; it is about physical and mental health, getting to know the community, personal achievement and having fun with friends.⁷ For some people, it is also about image and professional networking.³⁶

An increasing number of Australian sports organisations acknowledge these diverse motivators for sports participation and are establishing social leagues and events. Social sports can encourage people back into sports after they leave competitions in high school. They may also introduce adults to sports for the first time. Social sporting events and leagues focus on inclusivity, participation, health, convenience and simplicity.

There are great differences in the motivators and profiles of adults and children regarding sports participation.³⁶ Many people lose their confidence to play sports competitively as they age – feeling unfit, forgetting the rules or not being able to commit to rigorous training schedules. Many adults still play sports, but not in traditional club-based settings.³⁶

MODIFIED SPORTS FOR GREATER INCLUSION

Some sports are creating specialist or modified leagues to be more inclusive of players with differences or disability and all ages. A few Australian examples include bike-riding groups for girls organised by female instructors and focused on providing enjoyable group riding experiences instead of competitive racing,⁵⁰ cricket games modified and designed for people with neurodiversity⁵¹ or the increasingly popular global sports of 'walking netball, football or basketball'. Walking sports are mildly competitive games that provide enjoyable low-risk physical exercise for older people, those returning to sport after a break, or those who have never played before. These modified games offer all the positive benefits of social inclusion to groups of the community that commonly experience social exclusion and isolation.^{52, 53, 54} Modified sports groups have been rising over the last decade.⁵⁵



SOCIAL SPORTS AND COMPETITIONS

Social sports are proliferating and can build up game fitness and familiarity without an intense focus on winning. Examples of the growth in all-ages social sports include:

Social Sport, a Melbourne-based organisation established in 2007, aims to 'take the hassle out of playing sport'. It started as a weekly social futsal game among friends in the northern suburbs of Melbourne. In 2022 *Social Sport* had grown to run competitions for over 10,000 players of all ages and abilities in four different sporting codes.⁵

parkrun, a casual 5 km walk, run or jog on Saturday mornings, started in the UK in 2004 when 13 runners regularly met for a group run to kick off the weekend. An organisation formed that now has over 3 million participants in 24 countries and is the largest running event and provider of volunteer opportunities worldwide.⁹ Participation is free, but regular runners/walkers are encouraged to volunteer. In Australia, *parkrun* takes place in over 440 locations across all states and territories every Saturday morning.⁹

ADAPTABLE SPORTS FACILITIES FOR EVERYONE

Community sports facilities (indoor and outdoor venues) will also become more adaptable and cater to increasingly diverse patronage. This adaptability is likely to be technology-assisted. For example, automated venues and sports facilities with embedded sensors and Internet-of-things (IoT) technologies will be able to provide micro-climates suitable to divergent groups of players, control watering and mowing systems, and adjust heating, ventilation and air-conditioning (HVAC) ⁵⁶ and lighting. ⁵⁷ They may also use artificial intelligence (AI) assisted cameras and intelligent equipment to automatically keep score and provide umpiring services.

Automated match officiating will devolve decision making and match adjudication calls during training sessions and competitions to technology systems integrated within sporting facilities. ⁵⁸ These developments may reduce the need for specific types of manual tasks performed by volunteers and create changeable surfaces and structures that can switch between codes, games and abilities. ⁵⁹

Integrated monitoring, analysis and reporting technologies will provide unprecedented levels of connectivity, interactivity, and participant (player, coach, match official, and spectator) connectivity within real-world training and competition environments. ^{60, 61}

DATA-COLLECTION ETHICS IN COMMUNITY SPORTS

Multinational technology giants will continue to develop consumer technologies capable of monitoring and collecting data on personal health, athletic performance, and well-being, reaching new levels of sophistication and connectivity with the Internet. These technologies and wearable devices, capable of capturing and sharing large volumes of personal biometric, performance and health data via the Internet, will continue to pose a range of ethical, commercial, and legislative challenges for consumers, sporting organisations, corporations and governments. ⁶²⁻⁶⁶

The better use of websites, apps and social media will make it easier for people to sign on, pay, and find games and teammates. In addition, it will allow organisations to automate or share services such as administration and insurance. ^{67,68} Some new programs may seek to reward participants for their time and involvement, including volunteers, through redeemable credit systems that have broad appeal. ⁶⁹

TECHNOLOGY OPPORTUNITIES ATTRACTING INVESTMENT

The growing popularity of modified and social sports is likely to lead to increased government and corporate-sector investment to encourage and accelerate innovation in developing new community sport pathways and products. ^{70,71}

In addition, as consumer demand increases, new partnerships and innovative business models will emerge in the growing field of sports tech. ⁷² The Australian Sports Technology Network (ASTN) programs are geared to assist Australian sports technology companies to scale and commercialise their technologies into international markets and assist universities and research institutions to commercialise projects. The ASTN is working with the Victorian Government on the Australian Sports Innovation Centre of Excellence (ASICE). ⁷³

Community sporting organisations and clubs seeking to grow their membership and participant numbers back to and beyond pre-pandemic levels will increasingly be challenged by alternative convenience-based exercise and fitness offerings targeting individuals and families. These programs and products will seek to reach new markets and engage greater numbers of participants from socially and culturally diverse backgrounds, providing more inclusive, inviting, flexible and rewarding sports opportunities.





The Future of Australian Sport report (2013) ²² correctly identified the rise of individualised sport, non-organised sport, and physical activity as a key trend for the future [A perfect fit]. Australians were looking for more tailored options to meet their health and fitness goals and were not as focused on competitive outcomes or traditional sporting options. They were also using emerging digital technologies and social media platforms to find new ways to connect.

In this new report we highlight how, over the past decade, and especially during the COVID-19 pandemic, this trend has been further accentuated and accelerated. Participation in flexible, convenient, fitness-based activities continues to grow, while sport participation remains relatively stable. Physical and mental health continue to be key drivers for people's participation, and sport has a role to play in building mental well-being and social connectedness.

Additionally, barriers to participation for older populations, people from regional and remote areas, First Nations peoples, LGBTIQ+ people, people from culturally diverse backgrounds, and people with disability remain significant.

Technology solutions and products will increasingly impact all aspects of sport, including community sport facilities and playing spaces, officiating, consumer wearables and monitoring, athlete training, performance analysis, personal well-being and more.

Monitoring technologies and wearable devices – capable of capturing and sharing large volumes of personal biometric, performance and health data via the Internet – will continue to pose a range of ethical, commercial, and legislative challenges for consumers, sporting organisations, corporations and governments.

Questions for the future

What will sports participation look like in the coming decades?

Will sports provide participation opportunities with broad community appeal that are more flexible, inclusive, inviting and personally rewarding?

Will there be multiple pathways into community and club sport for children and adults? Will we see new approaches and products matching sports participants with opportunities better tailored to their needs?

Will we observe greater future growth in flexible and personalised sports participation compared with scheduled and fixture-based team sports?

Will we enjoy interactive experiences combining computer generated content with real-world environments?
Will our games and activities be adjudicated by virtual referees and officials?

Will modified sports programs, advances in medical sciences, better treatments for chronic conditions, and improved surveillance and awareness of sports injury management and prevention, allow more of us to participate in the sports we love well into our later years?



New horizons — science and technology changing the game



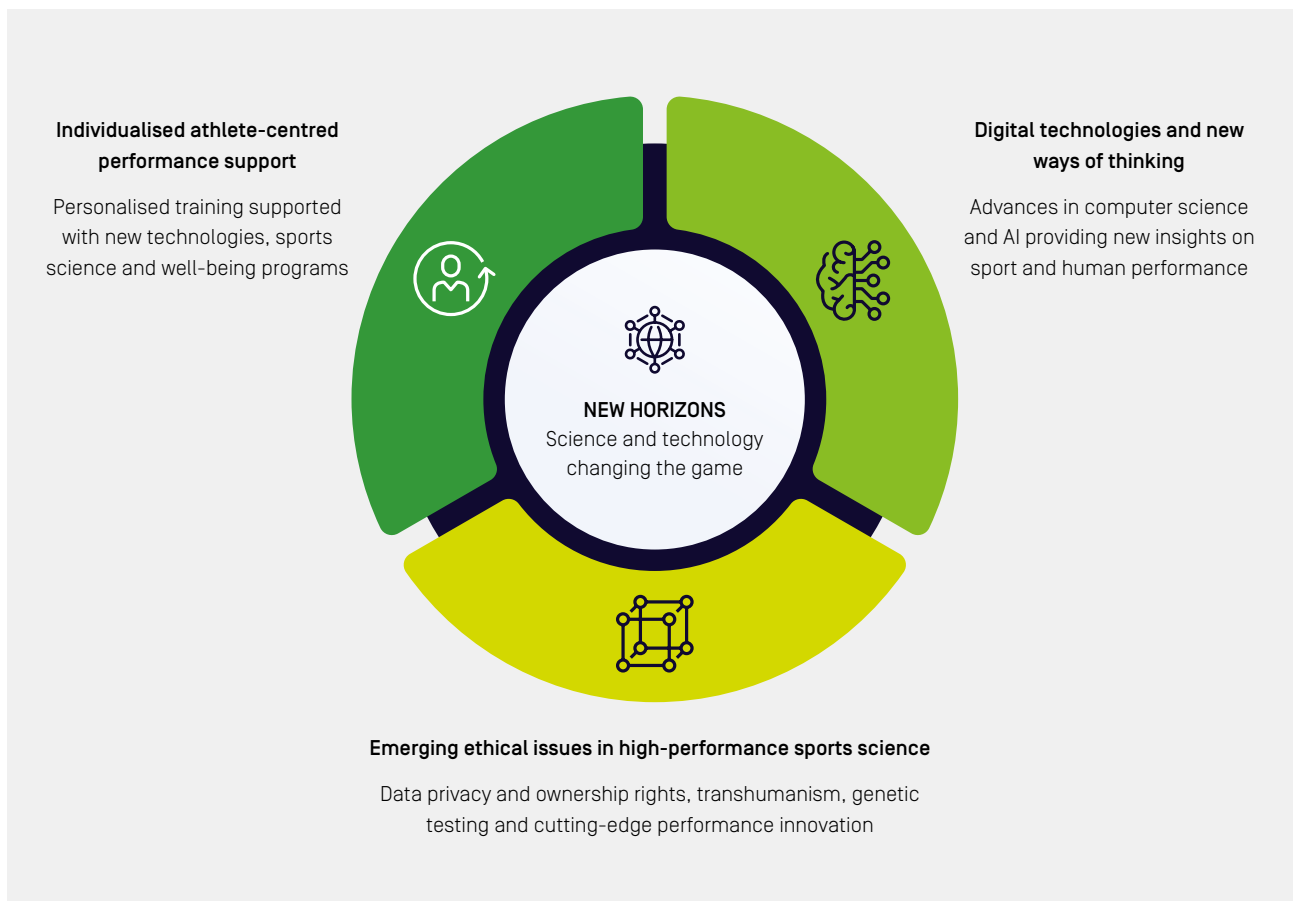


Australia has long been seen as a global leader in sport. ⁷⁴ Despite having a population of just over 26 million, Australia has been in the top ten on the medal tally of Summer Olympic and Paralympic Games since Sydney 2000, and in many games before then. Our global reputation in this sector can be linked to several factors including support for sport at all levels from Australian governments, and a strong high-performance system led by the Australian Institute of Sport [AIS].

Over the next decade the world will look to Australia as we approach the Brisbane 2032 Olympic and Paralympic Games. Much of the success of Australian high-performance sports teams to date can be attributed to advances in sports science and medicine, coaching, organisation, and ongoing investment in the potential of Australia's elite athletes.

New technologies and advances in areas of technical expertise that support the enhancement of performance (including but not limited to human physiology, nutrition, psychology, genetics, engineering and materials science) are now changing the game in sports. A better understanding of the individual and biological diversity of athletes is leading to an individualised approach to performance support across a range of technical direction disciplines, from coaching to sports medicine and training. Training programs tailored to the individual, resulting from the work of multi-disciplinary teams, can optimise sports performance, assist with injury prevention, enhance physical and mental recovery, and maximise the well-being and long-term psychological benefits of sport. The adoption of new and emerging technologies will support this individualised approach but comes with issues to be negotiated around ethical implementation and privacy protections.

The global sport technology and innovation market continues to see significant growth. Australia will host a significant number of international sporting events over the next decade, and this will provide our science, technology, health, education and manufacturing sectors with an opportunity to invest in sport innovation and showcase and export their know-how and products to the world.



Individualised athlete-centred performance support

Advances in technology, wearable devices, computer science and AI continue to provide new insights and perspectives on sport and human performance. As a result, training, monitoring, and coaching approaches will become progressively more individualised, precise, and tailored to meet an athlete's unique performance development needs. Advanced data-informed performance support programs will provide athletes, coaches and sports practitioners with new insights to maximise their performances and well-being.

Athletes with diverse physiological and psychological needs enter high-performance sports from a broad range of different pathways.^{75, 76} Paralympians are a cohort of elite athletes currently leading the trend towards individualised performance support. More elite athletes today are turning to an individualised approach assisted by training apps, wearable technologies, and easier access to new technologies and processes such as additive manufacturing, including 3D printing. Early examples exist today where these technologies are being used during major competitions and tournaments to repair equipment components or make late alterations to enhance the fit between the athlete and their personal equipment and devices.¹⁵

Innovation in biometric measurement gives sports scientists new insight into the vast variation in individual biochemistries, muscle fibre types, microbiomes, biomechanics, and biological responses to different training programs, stressors, nutrition, and psychology.⁷⁷ Advances in physiological monitoring technologies may enable athletes to use their own self-diagnostic kits – perhaps in some cases in the form of wearable patches.⁷⁸

Australian high-performance sports continue to adopt individualised training approaches with a greater appreciation of the physiological diversity of individual athletes – including an improved understanding of the unique and varied human responses to training stress and the specific recovery needs for peak sports performance. Improvements in sports medicine and sports science support may also help to increase the longevity of an elite athlete's competitive career.

A NEW FOCUS ON FEMALE SPORT

Historically, the majority of research in sports has involved male participants.⁷⁹ As a consequence, most research implementation activities, such as training planning, have been based on an understanding of male physiology. Females have different physiologies, including female developmental patterns, menstrual cycles, breast health, pregnancy, post-partum recovery and pre- and post-menopausal changes.

Females experience external conditions differently from men and are susceptible to a range of medical conditions that do not affect male athletes or that may affect them differently.^{80, 81}

In 2019, the AIS opened the Female Performance and Health Initiative to improve female athlete-specific knowledge and support.⁸¹ In 2021, research methods considerations specific to studies with women as participants were published with the aim to improve the quality of such studies, resulting in more high-quality female-specific data.⁸² A better understanding of sex-based physiology may also help inform debates around competition and gender diversity, including transgender, intersex and gender-diverse athlete performance and pathways.

The AIS partnered with the La Trobe Sport and Exercise Medicine (LASEM) Research Centre and the Victorian Institute of Sport to become an International Olympic Committee (IOC) Research Centre 2023–2026 to support and promote health, participation, and performance of women in sport.⁸³

Over time these approaches will lead to a far greater understanding of the individual factors that contribute to performance improvements under varying training and competition conditions for athletes with different physiologies at different stages of their careers.





Digital technologies and new ways of thinking

The availability of high-quality 'big data' will accelerate the adoption of new ways of thinking. Complex problems will be solved by multi-disciplinary teams of performance support practitioners supported by AI solutions.

SENSORS AND WEARABLES

Motion sensors, 3D analysis, high-speed video analysis, electromyography (EMG), force plate analysis and scanning technologies have long been used to improve the techniques and performances of elite athletes. Improving biomechanical and physiological performance through studying the kinetics and kinematics of athletes and their equipment is now crucial to success in many fields, particularly those that involve jumping, swimming, throwing, vaulting, walking or running.⁸⁴ These tested technologies are increasingly being supplemented with a new generation of wearable and embedded sensors. Sensors to monitor bodily processes and dynamics can be woven into fabrics of sports clothes, applied as films, strips or patches directly onto the skin or implanted in the body, broadening the range of ways performance can be monitored in real time.

Body sensors work with other motion capture, filming and scanning environments that provide analysts with the information to continuously improve performance. These can be set up in sports laboratories, arenas or other outdoor settings and are becoming cheaper and more accessible over time. The IoT – or embedded sensors in the environment – can coordinate data capture from moving players as well as balls, equipment, and the environment (air/water/snow). Increasingly these are being supplemented with augmented and virtual reality (AR/VR) applications.⁸⁵ AR/VR applications have the potential to allow athletes and trainers to better see potential performance gains from improved technique while in specific environments.⁸⁶ Technology integration and the use of imagery and data through AR/VR applications will reach new levels of sophistication in elite sport training and competition environments, further enhancing technical direction and coaching techniques.⁸⁷



HUMAN DIGITAL TWIN

CSIRO is currently working on creating a human digital twin. A digital twin is a virtual or digital representation of a physical object or being. The human digital twin project uses readily available cameras on mobiles, iPads, webcams and computers to capture the movements of a human body and creates an overlay of biomechanical modelling of bones and muscles. By combining deep-learning algorithms with knowledge of a person's musculoskeletal mechanics, the human digital twin could identify movements that present a risk of injury. The digital twin can be used to devise modifications to these movements aimed at increased efficiency and decreased injury risk.

Over time a human digital twin will likely have additional information on blood flow, digestion, and respiration and be able to provide comprehensive real-time analysis of athletic physiological performance during training and competition.

Image: A human digital twin showing musculoskeletal movement and individual physiology in real time. Photo: Simon Harrison



VIRTUAL WORLDS

Virtual worlds can enhance training by linking elite sports fitness apps, online communities in virtually mediated classes or gamified lessons, and remote coaching sessions. Virtual digital worlds, including exergaming, sports in the metaverse and competition in digital twins (a digital environment modelled on a physical environment, such as a track or a course), provide avenues for new sports engagement, training and competition.⁸⁸ In particular, digital connections and virtual competitions can improve sports training accessibility for people with medical conditions,⁸⁹ disabilities⁹⁰ and those living in regional or remote locations. These would supplement, rather than replace, training options. In the future, virtual worlds might also make training accessible to people living in places away from suitable sports conditions (see, for example, virtual *Everesting*⁹¹) – see also **The next arena** megatrend.

DEMAND FOR QUALITY

With the growing number of devices, apps and performance solutions, the sports tech market will keep growing more competitive. The focus on novelty will generate a high-paced market, and some products and services will be short-lived. An increase in the polarisation of users' opinion on solutions and brands is to be expected. Tech solutions will be positioned along a broad spectrum, from fad-like solutions to solutions backed by scientific principles and high-quality evidence. There will be an increase in influencer, marketing and paid reviews of tech solutions, rather than more independent and/or comparative reviews from trusted sources (e.g. *Choice* magazine). Online consumer reviews and comments will increasingly provide a bottom-up pressure that, together with improved quality-assurance practices, will push products and services towards higher standards of quality.



GROWING USE OF AI IN SPORTS

The use of AI technology has also expanded in elite sports over the past decade and this growth is set to continue.⁹² The sports analytics market is forecast to be valued at US\$5.11 billion by 2026, a compound annual growth rate of 30.13% from 2020 (Figure 4).⁹³ Multinational corporations such as IBM Corporation, Oracle Corporation, SAS Institute, and other specialised companies such as Agile Sports Analytics, Catapult, Sportradar AG, and Genius Sports Group, are among the top sports data analytics providers. Catapult, an Australian company originally formed from a partnership between the AIS and the Cooperative Research Centres during the lead-up to the Sydney 2000 Olympic and Paralympic Games, is today one of several commercial businesses pursuing the use of AI for sports analytics.

AI techniques for sports have incorporated statistical learning, game theory and new forms of computer vision to provide further layers of insight into player and team performances.⁹⁴ For instance, AI is being used by players in Grand Slam tennis to analyse competitor weaknesses and pre-match training is adjusted to focus on those areas, leading to higher match success.⁹⁵ Similar AI applications are being used in football, basketball, cricket and baseball.⁹²

Data analytics and AI are now being applied across a range of areas in sports, including talent identification and selection, organisational management, athlete management and payments, customer inquiries, media and fan experience, sponsorship, officiating, sports-betting and more.⁹⁶

DATA ANALYTICS AND NEW WAYS OF THINKING

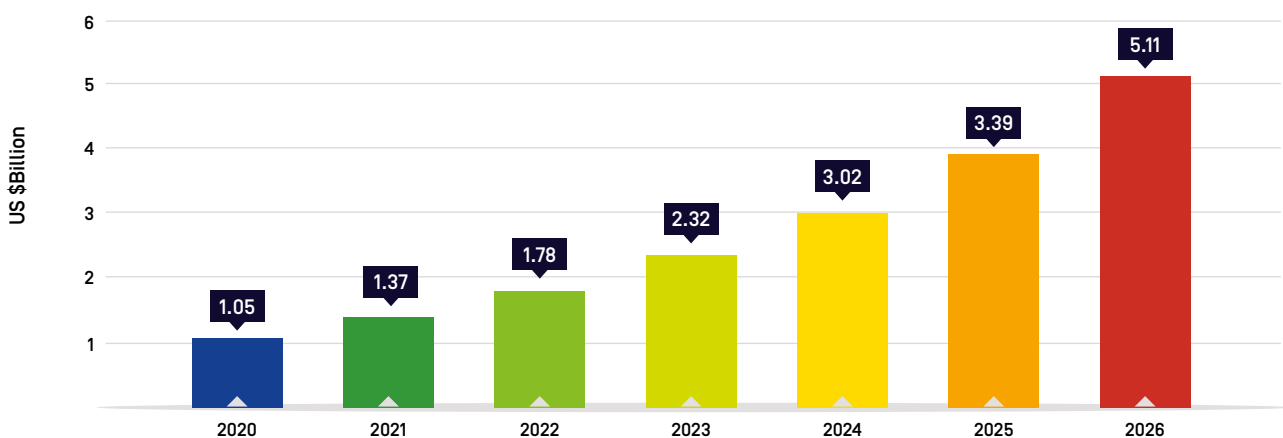
Sports teams have successfully applied data analytics and statistical analysis to improve their games for over half a century, but the last two decades have seen a boom in their effective applications. Increasingly sophisticated data analytics are being used across sports in talent identification, athlete selection, training and development, game and match analytics, organisational management and audience attraction. Multiple sports associations and companies have implemented data analytics for player selection and team training, including the US National Basketball Association (NBA), Spanish Football Federation, and German Football Association.⁹⁷⁻⁹⁹ Today, most elite teams use player performance metrics along with GPS, semi-automatic cameras or radio-frequency systems, alone or in combination, to track training and match performance.

In the coming decades we will continue to see an emphasis on improving and refining research translation and implementation, maximising the use of available technologies to accelerate learning. Advanced data analytics will continue to evolve and establish new governance standards supporting data management processes, including data cleansing, ensuring 'big-data' is used optimally to achieve high-quality outcomes in sport.

Unprecedented access to vast and high-quality data sources and datasets by sports researchers and practitioners will accelerate the adoption of new ways of thinking. Sport professionals and performance support roles (including doctors and coaches) will increasingly focus more on the interpretation of data and implementation of learnings into practice and complex problems will be solved by multi-disciplinary teams. Multi-disciplinary teams will include a broad range of roles including generalists and experts with deep theoretical knowledge and expertise, including sub-discipline specialists or 'hyper-specialists'.

Figure 4. Estimated value of the Sports Analytics Market between 2020 and 2026

Source: Estimated from Mordor Intelligence⁹³



Emerging ethical issues in high-performance sports science

Sport governing bodies will continue to wrestle with the ethical challenges science, medicine and technology advances bring as they work to ensure the integrity and fairness of sporting competitions.

DATA PRIVACY

As data and digital technology play an increasingly important role in the development of the sports industry, issues continue to emerge around sports data governance, privacy and ethics, including questions of standardisation, integration, safety and monetisation of data.^{96,100,101} Sports wearables can collect data on various personal health metrics, which are often stored on Internet cloud services in numerous international jurisdictions. A level of distrust exists with some elite athletes and coaches today when it comes to digital data collection through apps and wearable sensors and this continues to pose a significant barrier to their use.¹⁰²

Wearable technology devices can collect data on location, heart rate, heart rate variability, diurnal patterns and sleep cycles.¹⁰³ More sophisticated patches and strips can track hormone levels, oxygen concentrations, menstrual cycles and blood sugars.¹⁰⁴ Headsets can track eye movements, pupil dilation and body movement metrics.¹⁰⁵

The data collected by much of this technology can also be of interest to health insurance companies, health researchers, market researchers and advertisers, employers, spectators, sports content providers, sports talent scouts, sports betting and gaming companies, gamblers, and other sports rivals and competitors.

Athlete performance data are generated, shared and subject to varying levels of public scrutiny, and athletes' informed consent is not always obtained – particularly if they are competing in the public domain or their performances are televised or streamed via the Internet. Data collected in public forums may also be monetised or used in commercial gambling assessments, and the principles around the licencing and rights of data are not always clear and well formed.¹⁰⁶⁻¹⁰⁸

There are both ethical and commercial questions around whether much of the personal data collected does or does not benefit the athlete, and there is concern in relation to the fact that some data collected and stored cannot be managed or controlled by the athlete.¹⁰⁸

It is possible that future legislative reforms and data governance polices relating to the use of data via the Internet will give athletes greater control over their personal data. Professional athletes may also gain greater economic participation in the revenues generated through their labour and media exposure, including greater commercial returns from the use of their personal sports performance data.





NEW MATERIALS, BIOLOGICAL SCIENCES, AND 'TRANSHUMANISM'

Our Paralympians will continue to benefit from Australian innovation and design in prosthetic engineering and sports equipment development. Athletes with a disability often take a design-led approach to their sports development and this has led to world-leading developments in materials science, sporting equipment and physiological enhancements that provide a competitive advantage.^{109, 110}

The Netherlands Sports Council is working towards integrating disability sports into all-abilities sporting competitions,¹¹¹ while all-abilities wheelchair basketball competitions in Canada are providing opportunities for 'reverse integration' – competitions that use the same equipment and facilities for people with and without disability.¹¹² The integration of sporting facilities, equipment and competitions for athletes with and without disability may become more common over the coming decade.¹¹¹

New therapies and continued advances in medical science could better treat or cure some chronic injury and disease in the wider population. The same advances may help to overcome physical impairment and improve the performance of athletes in elite sport, including athletes with disability.

As medical science and technology improves and provides new opportunities to enhance human performance, there will be debates centred around the ethical use of cutting-edge human performance sciences, such as trans-human technology, as competitors question the fairness and integrity of competitions that integrate various degrees of assistance to human performance.

GENETIC TESTING IN SPORTS

In 2003 the World Anti-Doping Agency prohibited 'gene doping' – or the 'non therapeutic use of genes or genetic elements and/or cells that have the capacity to enhance athletic performance'.¹¹³

Over the past decade there has been significant growth in the knowledge of how genes influence both performance and training and an athlete's predisposition to injury. Genes can also be used to identify chronic diseases that make participation in certain sports dangerous to individuals.¹¹⁴⁻¹¹⁶ As the physiological determinants for sports performance become better understood, however, there is increasing debate around the use of genetic markers to identify potential high-performance athletes.¹¹⁷

Direct-to-consumer genetic testing kits have arrived on the market, offering athletes personalised training and nutritional programs to maximise their sporting potential according to their genetic make-up. However, these often come with inaccurate, unreliable and untested advice on the genetic potential of athletes, and do not require trained medical personnel to help interpret the advice or its application.¹¹⁸ Organisations such as the AIS, Sports Medicine Australia and the British Association of Sport and Exercise Sciences have suggested commercial genetic test kits can put athletes at risk by either falsely reassuring them of their suitability for a sport, or by giving inappropriate nutritional and training advice. Using these tests to pick athletes for sporting teams or events may also contravene Australian anti-discrimination laws.

Ethical debate over the development and application of new technologies that include digital sensors, material enhancements and genetic testing of athletes will increase in the future





The Future of Australian Sport report [2013]²² foresaw increasing competition in high-performance sport from developed and developing countries, including China, South Korea, India and Brazil. While not all of these countries have become significant sporting rivals or markets to date, China and India continue to expand their reach, and South Korea could be considered an e-sport super-power.

In this new report we highlight that development in sport is not just about business, media and market opportunities. Increased competition and development in technology, sports science and sports medicine at all levels has the potential to impact who and how we participate, how we compete, who has control of our data, and to push the ethical limits of human performance.

The next decade and beyond will provide our science, technology, health, education and manufacturing sectors with an opportunity to invest in sport innovation and performance, and to highlight and export their expertise and products to the world.

Questions for the future

Faster, higher, stronger – will world records in sport continue to fall in the decades ahead?

Will elite athletes continue to achieve unprecedented sporting competition feats of skill, endurance, power and strength?

Will science and technology continue to unlock and provide new insights and perspectives on improving and enhancing mental and physical performance? Will the same insights be used to protect athletes and reduce the frequency of sports injuries and harm to their mental health and well-being?

Will the application of wearable, micro and nano technologies play an increasing role in human performance monitoring and testing?

Will athletes gain greater control and licence over their personal biometric and performance data? Will new therapies and advances in medical science over the coming decades better treat or cure chronic injury and disease? Will the same advances overcome physical impairment and some disabilities in sport?

Will sport one day look to emerging biosciences such as trans-human technology to advance performance?

Will governing and anti-doping bodies continue to develop innovative approaches and detection technologies to protect the integrity of sporting competitions?



The next arena — the rise of entertainment sports





Australians consume sport across a range of markets and platforms. Many Australians love to be entertained by sport, whether this is attending a live event or listening to or watching sport through the various broadcast and online options available.

Over-the-top (OTT) video-streaming platforms, with the ability to deliver sports content to many Internet-enabled devices, are increasingly challenging traditional sports broadcasting business models on satellite, cable, free-to-air (FTA) television and radio, creating new audiences and connecting viewers globally.

Some sporting organisations – particularly the major codes in Australia – generate significant revenue streams through broadcast rights deals, major events, merchandising, sponsorship activities, endorsements and branding.

Digital sport and e-sports are becoming increasingly popular, offering access to new activities in virtual environments. Some of these digital sport variants more recently supplemented or provided redundancy for cancelled real-world sporting events during the COVID-19 pandemic. At the same time, urban and adventure sports are engaging the next generation of sports fans as they become more visible and available to mainstream audiences.

Over the coming decade, we will see more sporting organisations and products compete for a share of national and global audiences. As a result, both established sporting codes and sports new to these markets will consider how to engage contemporary consumers and adjust their view of spectators to take advantage of the increasingly dynamic and diverse global media landscape.



Globally connected audiences, streaming platforms and more content

The last decade has witnessed a rapid uptake of internet-connected devices (phones, tablets, smart TVs, laptops and watches), along with ubiquitous high-speed broadband services as the primary means for Australians to consume live sport.

Global OTT subscription streaming services offer a range of downloadable live and stored entertainment content in the form of movies, serials, podcasts, music, video clips and sports. These are also promoted and consumed on global social networks. Social media platforms also allow users to distribute video and live user content. As the Australian Media and Communications Authority states, '[As] Australians have gained access to faster, easier and more reliable ways to get connected, digital online media has become increasingly popular as a medium for sport, news and entertainment.'¹¹⁹

A 2021 survey stated, 58% of Australians had watched video content online in the past week, while only 54% watched via traditional FTA broadcast TV. For the first time, streaming video content had become the predominant form of receiving audio-visual content for Australians (see Figure 5).¹²⁰ Younger Australians are the primary users of this content, and this demographic seeks a richer, more participatory role in the content they view and share.¹¹⁹ This adoption of digital streaming services and digital distribution was accelerated by the COVID-19 pandemic.¹²⁰

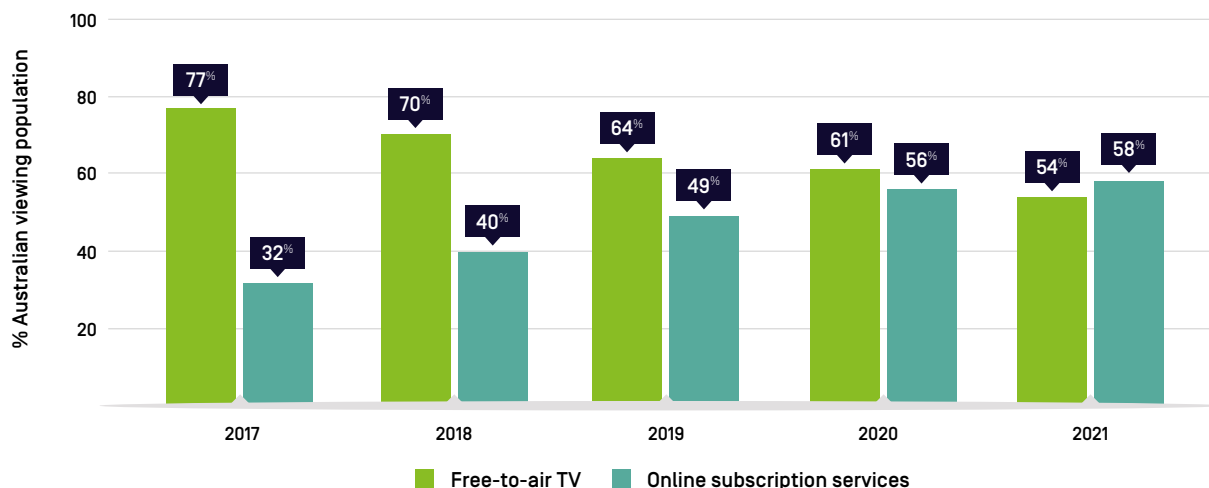
'Sports and major events are a significant drawcard for both FTA and pay TV services,' says the Australian Media and Communications Authority.¹¹⁹ Sports now provide essential revenue for FTA broadcasting and vice versa. The cessation of some sports competitions during the COVID-19 pandemic saw FTA revenues drop, only recovering after regular sporting events resumed and brought back audiences and advertisers.¹¹⁹

Popular sports content is often used to drive audiences to subscription services. Pay-TV service Foxtel, launched the Kayo streamed-video service dedicated to sports in 2018, and has attracted over one million subscribers in the first three years. Acknowledging the value of sports audiences, media companies invest significant sums to secure broadcast rights to sports competitions. Increasingly, media deals are being struck between traditional media with sports broadcast rights and social media in order to amplify coverage.¹²¹

Sports audiences are fragmenting and globalising as a result of the shift to online viewing, and this is a significant shift in the economics of sports.¹²² Over the next decade, streaming and OTT services will continue to increase their market share of sports and all broadcast media.

Figure 5. Percentage of the Australian viewing population watching free-to-air and online subscription services (such as Netflix or Stan TV) in the past week

Source: Australia Media and Communications Authority¹¹⁹





The sport broadcast market and digital media landscape will continue to experience significant disruption and change over the next decade:

- Increasingly sophisticated mobile devices, network coverage, cameras, analytics software and platform services will enable much greater global access to a wider variety of amateur and professional sports from weekend matches of the local club to highly publicised international events. ¹²³ Major sporting codes will continue to play a leading role in attracting and driving audiences to a growing range of digital media entertainment platforms. ^{123, 122}
- Smaller niche sports will gain greater exposure in a more competitive and fragmented media landscape. Some sports will realise new fan engagement opportunities, membership growth and revenue streams. This will likely include more specialist leagues for women, multicultural groups, and more minor sports. ¹²⁴
- More prominent and international sports will supplement streamed content with rich interactive digital features – such as augmented vision, live analytics and multiple perspectives. Augmented reality attendance to large events may be sold to supplement live audience tickets. Many sports may also add e-sports games or become multi-platform experiences. ¹²⁵
- ‘Backchannels’ for sports discussion, content distribution and commentary will continue to supplement broadcasts from larger media companies. Deals between stadiums, codes, media platforms, social media and telecommunications and data analytics companies will seek to monopolise and grow global sports audiences.
- Exclusive rights to broadcast sports games will be harder to enforce. FIFA, the IOC and other significant sports rights holders have sought to restrict or ban live-streaming of events on social media. The World Intellectual Property Organisation (WIPO) is updating its regulations on the IP of sports coverage to ‘adequately and efficiently protect against the piracy of broadcast signals’. ¹²⁶
- Sports betting agencies will seek involvement and sponsorship of more sports, including amateur competitions, and this will challenge the integrity of play in many competitions where resources are limited. ¹²⁷ Sports organisations, advocacy groups and government regulatory bodies will continue to work to minimise harm from match fixing and sports wagering. ¹²⁸
- Community concerns around junk food, alcohol, sports betting and ‘greenwashing’ or ‘sportswashing’ sponsorship may be more challenging for authorities to address and regulate on multiple distribution channels. ¹²⁹



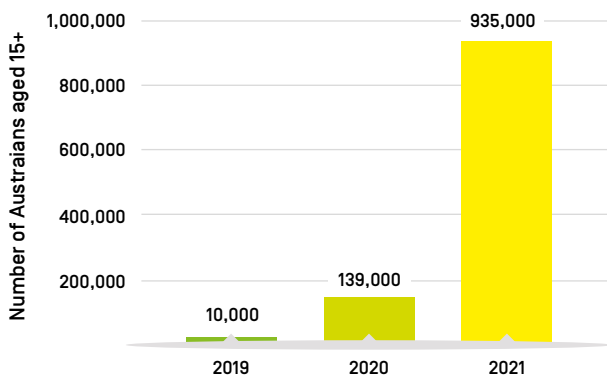
Entering virtual worlds

As more and more people play sports in virtual worlds through exergaming and digital twins, online competitions will attract online and virtual audiences.

Exergaming (that is, technology-driven physical activities, such as video game play, that requires participants to be physically active or exercise to play the game) has shown rapid growth in Australia over the last three years, accelerated by the COVID-19 pandemic and lockdowns. Over 930,000 Australians aged 15 years and over engaged in exergaming in 2021, up nearly tenfold from under 10,000 in 2019 (Figure 6). This places exergaming in the top 20 sports activities enjoyed by Australians.

Figure 6. Number of Australians aged 15+ years participating in exergaming

Source: AusPlay ¹³⁰



The demographics most likely to participate in exergaming and watch sports in virtual worlds include people under 35 who live in families with children. Women are more likely than men to use technology to exercise at home, possibly due to convenience and personal safety concerns about exercise outside. ⁷

Along with physical sports, there is now often a digital twin or virtual competition happening in cyberspace. A digital twin is a virtual replica of an event environment viewed on a screen or via virtual reality headsets. Exergaming, digital twins and integrating real-life and virtual world competitions may make broader participation (including viewing and being a competitor) in some sports easier. People in remote areas, places without training facilities, places without the required climate (for winter sports, for example), or people with a disability or ability difference can participate with athletes of similar capability in an online community. Building competitive capacity through motivational training in digital twins substantially extends the reach of sports organisations to subgroups that may have been previously excluded. ¹³¹ Exergaming is also being used extensively in rehabilitation from injury or surgery and in treatment protocols for particular conditions. ¹³²⁻¹³⁴

Digital competitions run alongside in-real-life (IRL) competitors will be increasingly offered over the coming decade. More sports will adopt augmented and virtual reality arenas through connected cloud-based virtual worlds and digital twins – moving at least part of the sporting arena into cyberspace. ¹³⁵

THE VIRTUAL GAMES

A key principle of the Olympic 2020+5 agenda is to encourage the development of virtual sports and further engage with video-gaming communities. In 2021 the IOC announced the inclusion of an Olympic Virtual Series in the forthcoming Paris 2024 Olympic Games consisting of virtual games of baseball, cycling, rowing and sailing. ¹³⁶ These aim to offer digital engagement with physical events (phygital experiences) and encourage youth participation. ¹³⁷ This embrace of digital engagement is as much about inclusion as about reaching broader audiences.

Virtual games may also mean the rise of virtual audiences, especially as technologies evolve to improve the virtual audience experience. For example, Tennis Australia, in partnership with Monash University and digital design and communication company AKQA, has developed 'Action Audio'. ¹³⁹ This technology uses ball-tracking technology and spatial data to produce 3D audio of the position of the players and ball on the court so blind and low-vision audiences can follow the play. The 3D audio provides the sound experience of a live-cast game. The technology was first trialled at the Australian Open 2021, was subsequently used at the Australian Open 2022 and has started to be used at tournaments around the world. ¹³⁹ Whether the virtual experience supplements or replaces real-life audiences remains to be seen. Applications and rights for digital audiences may also either supplement or change the business case for significant events.

THE RISE OF E-SPORTS

E-sport is a collective term to describe 'the activity of playing computer games against other people on the Internet, often for money, and often watched by other people using the Internet, sometimes at specially organised events'. ^{140, 141}

Are e-sports a sport?

E-sports have created controversy within the traditional sport community, as many have argued they don't fit into the commonly used definitions of 'sport'. ^{142, 143} People participating in some e-sports may be perceived differently from those participating in established real-life physical sports. They also do not exert themselves in the same way as those who engage in exergaming or enter a sporting competition via a digital twin. ¹⁴³



However, e-sport competitors play intensively, exert themselves mentally and through muscle reactions, and may play strategically in teams. Proponents of greater recognition of e-sports point to hand-eye coordination and the skills in strategic teamwork and course knowledge required to play.¹⁴² E-sports are also increasingly organised into leagues with amateur and school-based clubs participating in player-drafting rounds. These result in highly skilled teams competing in significant, international events that are watched by increasing numbers of people globally in real life and via multiple digital channels.¹⁴²

E-sports have been included as part of the Asian Games, and there have been ongoing attempts for e-sports to be included as a demonstration sport in the Olympic and Paralympic Games.¹⁴⁴ There is increasing recognition and formalisation of e-sports as a sport, and this is likely to continue over the coming decade.¹⁴¹

E-sports in Australia

In 2019, the e-sports industry website, Esports.net, stated Australia was the 14th largest e-sports market in the world, with 12.4 million players spending more than \$1.3 billion per year.¹⁴⁵ Australian amateur leagues in schools and universities have been growing, as have industry associations and representative bodies.^{146,147} A sharp increase in players and audiences over the COVID-19 pandemic saw a boost in projected participants and revenues for the next decade. PwC calculates Australian interactive games and e-sports revenues will grow by 7.5% (compound annual growth rate) and will reach \$4.9 billion in 2025 – outstripping the revenues from subscription-TV services such as Netflix and Stan.¹⁴⁸

With such heady industry growth, some traditional sports in Australia are now including e-sport side events. For example, the Australian Tennis Open introduced a 'Fortnite Summer Smash' competitive video-gaming event to accompany the men's final game on Margaret Court Arena in Melbourne in 2019.

In 2018 Football Australia created the inaugural E-League which was broadcast on Fox Sports and Twitch. The 2022 edition provided pathway competitions to the national championships, as well as the EA SPORTS FIFA 22 Global Series Playoffs.¹⁴⁹

Globally, live-streaming audiences of e-sports games reportedly reached 921 million in 2022, with audience numbers rising sharply in 2020–2021 during the COVID-19 pandemic.¹⁵⁰ Broader audiences for e-sports competitions are being found via 'co-streaming' on popular non-gaming platforms such as Netflix, YouTube, and, in Australia, broadcast on Network 10.

Cryptocurrency and e-sports

E-sports are creating new revenue models for sports. For example, rewards for winning in e-sports include rankings on leader boards, badges, tokens or items of value in the game. Some games allow these rewards to be cashed in for cryptocurrencies such as Bitcoin, Ethereum or an inbuilt game token. In addition to earning cryptocurrency for game scores or wins, e-sports participants can use cryptocurrency to buy digital products – such as digital weapons or equipment to operate within the game, sponsor other players or place bets on games.

Cryptocurrency allows global payments. Participants can also pay anonymously in many jurisdictions and can become part of the game itself. Some platforms sell gaming avatars as non-fungible tokens (NFTs). The NFTs can then be used to earn other digital currency within the game.¹⁵¹


Digital and virtual events may back up, enhance or become new versions of in-person events. In addition, e-sports and hybrid sports will have increased recognition in international sports competitions (especially in Asia and commercial leagues).

BLOCKCHAIN-BASED SPORT COLLECTABLES

In 2022, FIFA World Cup Soccer announced a partnership with an official partner blockchain provider to release their own NFT player collection ahead of the start of the World Cup in Qatar.³

'FIFA's platform – via a truly decentralised and scalable public blockchain – is the first tangible representation of the technical partnership recently announced between FIFA and Algorand,' said W. Sean Ford, interim CEO of Algorand. 'The commitment FIFA has made to bridge to Web3 enabled by Algorand, is a testament to their innovative spirit and desire to directly and seamlessly engage with football fans around the world.'³

The blockchain platform claims to be carbon neutral and accessible via multiple currencies and payment methods – appealing to global audiences.



Video games are bringing communities together with people gathering around their passion. By entering strategic partnerships with those communities at a regional level, sports organisations can reach youth demographics outside of their direct environment and get these youth engaged in sport while reaching out to new populations.

– International Olympic Committee statement on announcing the Virtual Olympics ¹³⁸

Adventure sports

Almost a counter trend to the intense digital immersion of e-sports and digital twins is the rise of urban and adventure sports – new outdoor arenas that move beyond the traditional stadium.

The latest additions to the Olympic Games include BMX freestyle, surfing, skateboarding, breakdancing, and competition rock climbing (sport climbing). The IOC suggests that the Paris 2024 Olympic Games will build on the success of youth and urban sports from the Tokyo 2020 Games (run in 2021) and encourage participation from a new cohort of participants from different demographic groups.¹³⁸

URBAN SPORTS

Urban sports include breakdancing, parkour, skateboarding, BMX biking, street skating and urban climbing.¹⁵² Fuelled by a greater proportion of the global population living in larger and denser city environments, urban sports make use of the existing city spaces such as parks, streets, transport routes, vacant blocks and existing street furniture – such as railings, sidings and gutters – as well as purpose-built parks and performance spaces. The new urban sports can include a performative element and are often filmed or showcased with music on platforms such as YouTube or social media.¹⁵³⁻¹⁵⁵

NATURAL ARENAS

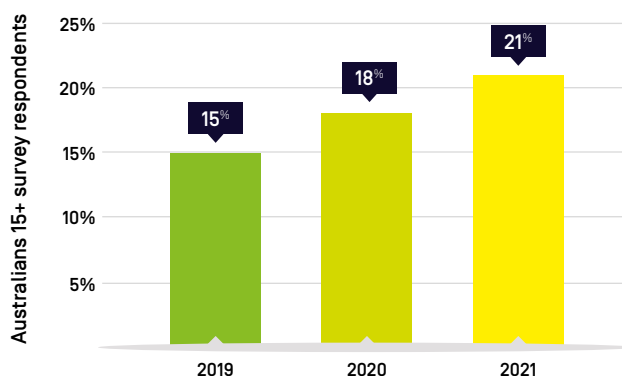
The Olympic focus on these sports also coincides with the growth in participation in outdoor ‘in-the-environment’ sports such as mountain-bike riding, bushwalking, canoeing and kayaking.^{7,23} People retreated to these infection-safe activities during the COVID-19 pandemic, along with the greater use of green and blue public spaces such as parks, beaches, rivers, lakes, bushland and forest areas. The growth of urban living and housing densification may also be fuelling our need to ‘escape’ to the natural environment in our sporting habits, to overcome isolation and loneliness in the post-pandemic world.^{156,157}

The number of Australians participating in sports to be outdoors or to enjoy nature has increased from 15% to 21% over the last three years (Figure 7).⁷ Also, while the number of Australians swimming has remained stable (18% of Australians 15+), a lot more of these swimmers are swimming in the ocean rather than in constructed pools – up to 42% of swimmers in 2021 from just 34% in 2019.⁷ Bushwalking also saw significant increases in participation over the pandemic period – from 6.3% of the population in 2019 to 9.3% in 2021.¹⁵⁸ New ‘adventure racing’ that uses tracking apps to map four-member teams running, cycling, bushwalking, kayaking and camping over a number of days in various locations around the world is also growing in popularity.¹⁵⁹⁻¹⁶¹

Over the next decade, there will be a significant shift in sports economics fuelled by the rise of online-streaming services, the growth of virtual worlds for contest, and increased expectations for supplementary services on multiple platforms. Sports are also moving out into the natural and urban environments. In 2032 the sports arenas will have diversified, globalised and offered new opportunities for clubs, athletes and organisations that can adapt to this change.

Figure 7. Number of Australians 15+ who stated they engage in sport to be outdoors or enjoy nature

Source: AusPlay⁷







The Future of Australian Sport report (2013) ²² correctly identified that young Australians were looking for new and engaging sports that they often discovered through online, social and other digital media platforms.

Sports, including BMX, skateboarding, sport climbing and snowboard half-pipe, have become increasingly mainstream and part of the Olympic Games program. These sports may no longer be considered extreme, but the lifestyle elements are especially important to many participants, and the degree of organisation is still developing.

In this new report we highlight how long-standing trends in sport are increasingly being disrupted and shaped by new technologies, broadcasting business models, changing social behaviours and global activities.

Traditional and emerging sports will continue to evolve over the next decades and will be shaped by changing consumer demand and social behaviours.

Questions for the future

What will the future of sports entertainment look like?

How will we experience live sport and major events in the decades ahead?

Will we share immersive experiences through AR and VR technologies?

How will the digital interfaces we use influence the way we consume sports media and other content?

Will high-profile traditional competition platforms include e-sports?

How will the sports broadcast and media landscape change in Australia over the coming decades?

Will there be tighter regulatory controls on sports betting and media advertising during sporting events in the future?

Will more Australian sports realise broadcast rights deals, mainstream exposure and new revenue streams?

Will the sports that enjoy broad and free exposure on multiple media platforms attract more grassroots participants and a diverse community fan base?

Will more professional athletes gain greater economic participation in the revenues generated through their labour and media exposure?

How can we balance protection of ecological values with the rise of outdoor and adventure sports?



**Mind the gap —
bringing Australia together across
generational and societal divides**





Sports organisations can champion positive change across society. They do this by emphasising sporting values of fair play, egalitarianism, inclusivity and teamwork. By showcasing these values and creating a meritocracy based on commitment, fitness and skills development, sports offer a source of inspiration, create shared experiences, and build pride.

Sport can bridge the cultural and demographic gaps existing and emerging across Australian society. Australia’s population overall is aging and increasingly diverse. In 2022, nearly a third of Australians were born overseas, 3.2% are members of First Nations groups, 18% live with disability, and just over half of the population are women. Young Australians are growing up with new technologies and global connections, creating distinctly different behaviours and values.

Over the coming decades, sports organisations and individual athletes will play a unique role in broader societal change and help bridge the gaps between demographic groups. Sport will provide a sense of common purpose, identity and belonging to Australians from many different backgrounds and abilities.



Cultural gap

Australia’s cultural profile is rapidly diversifying.²⁷ The demographic profile of Australia will influence our social, cultural and political systems over the coming decade, and this will impact how sports are delivered and embraced by Australians.¹⁶²

In 2022, nearly a third of Australians were born overseas, with the proportion of people born overseas increasing since 1946. In recent years the greatest number of migrants to Australia have been from India, China, the United Kingdom (UK) and New Zealand (Figure 8). By 2060, around 74% of Australia’s population growth is expected to come from overseas migration.¹⁶⁵ The proportion of First Nations peoples of Australia is also increasing. In 2021, 3.2% of Australians were from Australian First Nation groups, up from 2.3% in 2001.¹⁶³ The population of First Nations Australians is expected to grow faster than the general population to reach 1 million, or 2.8%, by 2027.¹⁶⁴

Sports can bridge the gaps between diverse communities. Sport plays an important role in introducing newcomers to local communities, assisting people in making friends, establishing social networks, gaining a sense of belonging and staying physically active. In addition, sports participation can also help young migrants increase their confidence and self-esteem in a new society.^{166, 167} Although the benefits are great, the use of sport in acculturation to a new community is complex and should be done in consultation with specific cultural groups. Many sporting organisations fail to meet the needs of people with diverse cultural

backgrounds or struggle to provide inclusive environments; while some sporting organisations appear more successful, sharing a high proportion of participants who speak a language other than English (LOTE), including badminton (66%) and table tennis (34%).²³

The ASC and large sporting organisations such as Football Australia have developed specialist support material and research to assist and encourage the inclusion of more culturally and linguistically diverse players in sports competitions. There are also calls to ensure sports management better reflects the diversity in the community.^{168, 169}

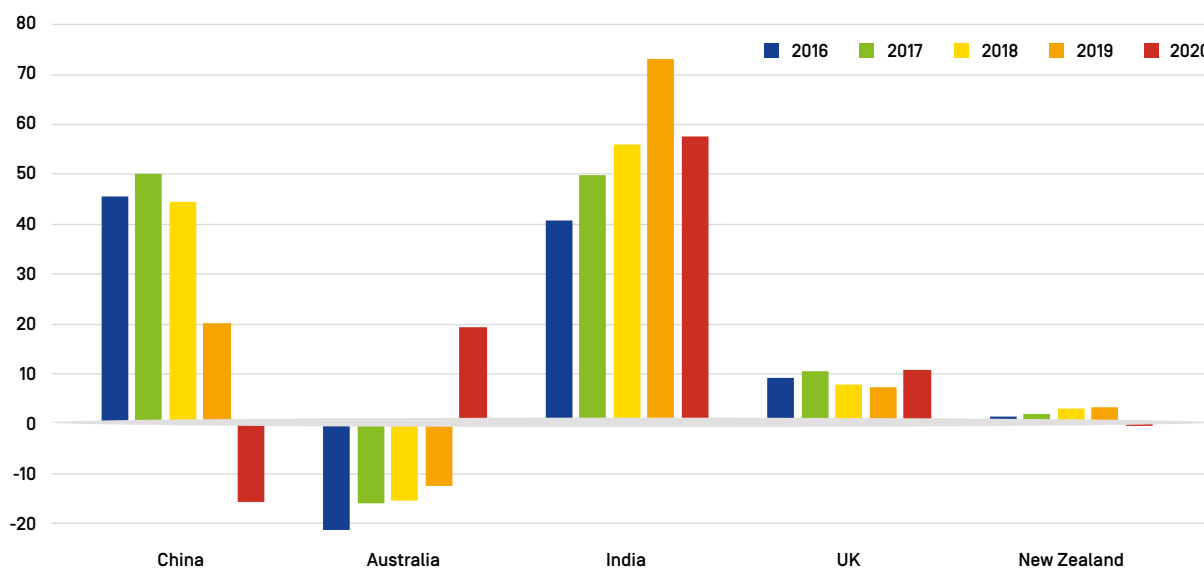
First Nations individuals and communities have reported improving health and well-being, building social connections, making friends, having fun, and being role models in their community as positive outcomes and motivators for sports participation.^{170, 171} The most common sports in First Nations communities are football, basketball, netball and softball.¹⁷⁰ Regular participation is highest in school-aged children and decreases in older teenagers and adults.¹⁷⁰

More sporting organisations will benefit from implementing affirmative action measures and policies to build socially and culturally diverse competitions and workforces. For example, culturally sensitive uniform policies, greater efficacy of member protection and spectator behaviour policies, and gender inclusive sporting facilities for all abilities are just some of the important issues that will need to be considered to accommodate the increasing diversity of the Australian sports population.

Figure 8. Net migration to Australia by country of birth 2016–2020

Source: Australian Bureau of Statistics²⁷

Note: Australians living overseas returned home in 2020 due to the COVID-19 pandemic, while travel restrictions in 2020 prevented migration from China.





Gender gap

The gender gap in Australian sport is still very apparent in 2022. Compared to women, men’s sport receives far greater airtime on television and streaming services,^{172,174} men dominate in sports administration (76%) and high-performance coaching (85%), and male players are often paid more in match fees and player contracts or retainers.¹⁷⁵ But there has been significant progress in recent years and things are changing.

There has been rapid growth in women’s representation in major national sporting codes, including Australian football (AFLW started in 2017), rugby league (NRLW started in 2018), cricket (WNCL started in 1996) and football (soccer) (NWSL started in 1996).¹⁷² The representation of women at the Olympic Games has also been steadily increasing since 1900 where just 2% of all athletes were women. In Tokyo 2020, women made up 48% of athletes (Figure 9). The Australian Olympic Team for Tokyo 2020 was 54% women. The first official Paralympic Games took place in Rome in 1960, when Australia sent a team of twelve athletes, including our first and only female athlete at these Games, Daphne Ceeney. In Tokyo 2020, the Australian Paralympic Team of athletes included 101 males and 78 females. In 2022, Women’s sport is also growing in audience numbers. 2020–2022 saw record viewers for the Matilda’s Olympic match against Sweden.¹⁷⁶ Women’s tennis, Big Bash League and T20 World Cup (cricket), netball, and the AFLW (Australian football), NRLW (rugby league) and WNBL (basketball) are also attracting record engagement on free-to-air channels, social media and dedicated streaming channels.^{177,178}

SEXUALITY AND GENDER IDENTITIES

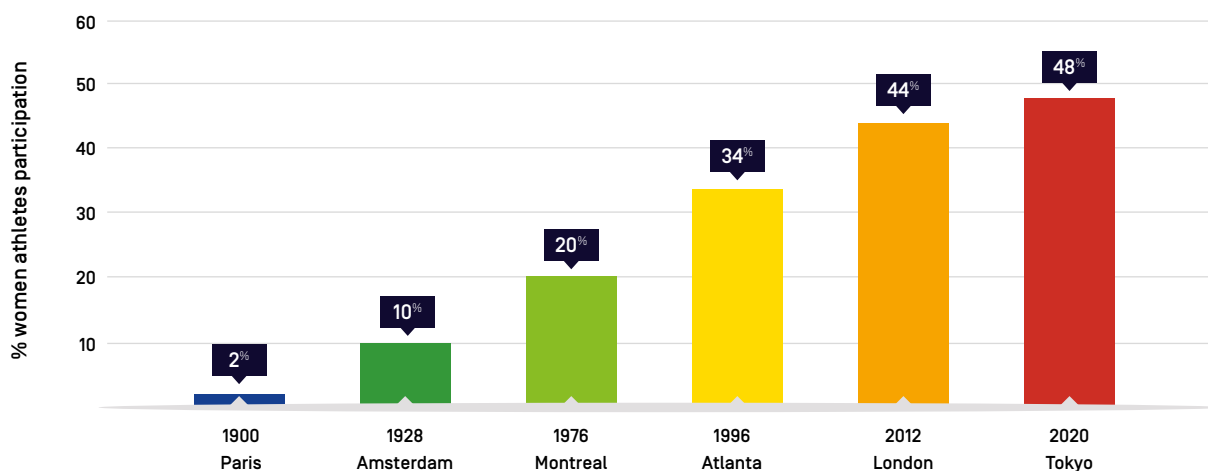
Accurate estimates of how many people in Australia are lesbian, gay, bisexual, transexual, intersex, queer or other gender identities (LGBTIQ+) are unavailable.¹⁷⁹ Around 4% of people who responded to the Australian Bureau of Statistics’ General Social Survey in 2020 stated they were gay, lesbian or bisexual. However, this is likely to under-represent the actual figures and not include other non-binary groups.¹⁹

LGBTIQ+ survey participants aged 18 years and over reported facing more challenges in engaging with sport compared to heterosexual participants due to their sexual identity or gender identification.¹⁸⁰ The LGBTIQ+ participants were also more likely to report feeling vulnerable or unsafe within the sporting environment.¹⁸⁰

More sports and clubs are working to create and promote environments that are visibly welcoming and inclusive of LGBTIQ+ communities. The Pride in Sport Index™ is the first and only benchmarking instrument specifically designed to assess the inclusion of people with diverse sexualities and genders within Australian sporting organisations and codes. Pride in Sport now has over 67 members from national and state sports organisations and runs education and events at a sports organisational level to increase the knowledge and participation of LGBTIQ+ athletes and players.¹⁸¹

Figure 9. Percentage of women athletes at the Olympics

Source: IOC Gender Equality & Inclusion Report¹⁷³





EQUAL PAY IN WOMEN'S SPORTS

In 2015 the Australian Women's Football Team (the Matildas) went on strike for equal pay from the Football Federation Australia¹ and in November 2019, a ground-breaking equal pay agreement was announced.⁸

This has now become part of a global movement to eliminate gender discrimination in pay in elite team sport.¹² Equal pay deals for women's football teams in England, Brazil, Norway and New Zealand have now been announced. Groups such as 'Women Sport Australia' and 'Male Champions of Change: Sport' are actively mapping pathways for gender pay equality across all major sporting codes in Australia.¹⁵

Abilities gap

People with disability comprise around 18% or one in six Australians. This includes disabilities relating to sensory and speech, intellectual, physical, psychosocial, head injury, stroke or acquired brain injury, or other restrictions in everyday activities due to other long-term conditions or ailments. This proportion will almost certainly increase over the next two decades as the population ages.¹⁸²

Sport can build bridges between communities of people of all abilities. The benefits of playing sports for people with disability are broad. For children, sports provide a social outlet and a chance to form friendships and experience a team atmosphere and can increase their happiness and enjoyment of life. Adults can find freedom, purpose and pride in sports and an arena to challenge stereotypes.¹⁸³

On average, people with disability are given fewer opportunities to play sports and be active. The results of the second annual Disability and Activity Survey, conducted in the UK, found that 59% of survey respondents with disability were active or fairly active pre-pandemic (2019–2020) but far less active compared to 91% of the survey respondents without disability. Only around 40% of people with a disability felt that they were given an opportunity to be as active as they would want to be, compared to 71% of respondents without disability. Four in five people with a disability wanted to be more active (Figure 10).¹⁸⁴

Due to the work of the Paralympic movement, and other international disability sport organisations and events, access to elite sports and sports development for people with disability has expanded significantly over the last 60 years (Figure 11).

However, there are still many barriers and complexities for people with disability navigating sports pathways at all levels – from club sports to high-performance sports. These include understanding and adhering to the classifications for disability, learning how to play with other differently abled players, and overcoming resourcing and support restraints, especially for those with more complex needs.⁷⁶

Competitions such as the Paralympic Games also do not cover competition for people with all disabilities – such as people with hearing impairment or intellectual disability. Understanding the multiple pathways into elite sports for people with disability and taking a constraint-led approach may lead to better access in the future.¹⁸⁵ Many athletes with disability have been assisted by prosthetic and telecommunication technology.^{186,187} E-sports and v-sports may also help increase the accessibility of sports and facilities.

Since Neroli Fairhall, the first Paralympian to compete in an Olympic Games in 1984, multiple Para athletes have competed in both the Olympic and Paralympic Games. These athletes have competed across ten sports, including archery, table tennis, swimming and equestrian events.¹⁹⁰ The trend towards diversification of participation pathways will provide more opportunity for athletes of all abilities to participate in activities of their choice.





Figure 10. Proportion of respondents who answered the selected questions about their physical activity in 2019–2020 in the UK

Source: Annual Disability and Activity Survey ¹⁸⁴

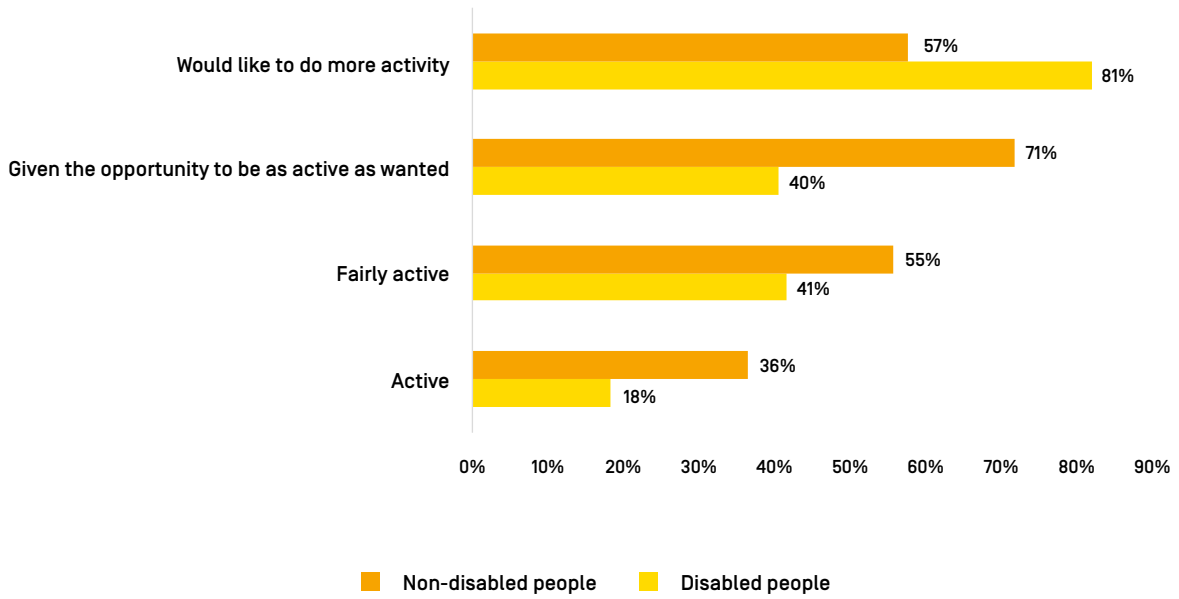
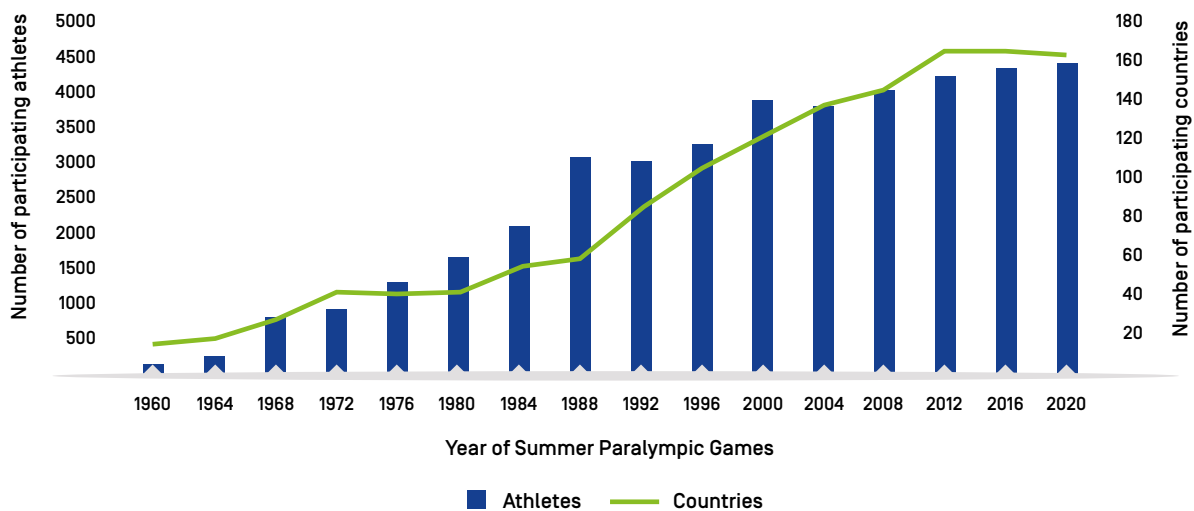


Figure 11. Growth in the Summer Paralympic Games – athlete numbers and countries – since 1960

Source: Mauerberg-deCastro et al. ¹⁸⁸ and the International Paralympic Committee ¹⁸⁹



Generation gap

The generations born after the mid-1990s, or generations Z and Alpha, have distinctly different behaviours and values reflected in their attitudes to and engagement with sports. They have grown up with the Internet, mobile devices and social media and are sometimes referred to as 'digital natives'.¹⁹¹ These generations engage in sedentary behaviour for longer each day, spend more time on screens, and participate in less physical activity than previous generations.^{192, 193}

Less than one-third of Australians aged 2–17 undertake the recommended physical activity each day, which drops to just 2% of adolescents aged 13–17 years.¹⁹⁴ This translates to lower physical literacy in younger Australians, a decline in physical fitness and skilfulness, with potential life-long effects on health and physical activity.^{195–197}

The decline of physical activity in human populations worldwide is a long-term trend in developed countries. US researchers from Cincinnati Children's Hospital Medical Center state that physical activity declined 32% between 1965 and 2009 and is projected to fall a further 46% from 1965 to 2030.¹⁹⁸ This long-term decline in daily physical activity is thought to be a result of changes to transport systems, city design, occupational practice and the impact of new technology.

In Australia, the decline in physical activity may be associated with other trends of increased urbanisation and urban densification, leading to more apartment living, smaller backyards and less access to green space.^{199, 200} Increased child safety concerns and regulation on parental supervision also limit the personal freedom and independent mobility given to children.²⁰¹ When children are outside playing, moving between places and engaging in the environment, they are more active – they move more and sit less.²⁰²

A significant proportion of Australian youth stop participating in sports in their high school years (between 13 to 17 years old).²⁰³ Young women and youth from culturally and linguistically diverse backgrounds are more likely to leave organised sports.²⁰³ Barriers to participation include sports costs, transport needs, lack of interest, skill, family support or fitness. Peer pressure, parental expectations on academic achievement, and social and gender norms are also barriers to sports in the teen years.²⁰³ Non-sport activity increases significantly in high school when other priority learning areas often crowd out time dedicated to sports and physical education.^{25, 204}

SPORTS IMPROVE PHYSICAL LITERACY AND A RANGE OF OTHER LIFE OUTCOMES – CLOSING THE GENERATIONAL GAP

Physical literacy in childhood and adolescence is achieved through physical play, movement and exertion and delivers physical, psychological, social and cognitive health and well-being benefits throughout a person's life. Physical literacy contributes to lifelong physical activity and good health, reducing chronic health issues and improving functional well-being. Physical literacy also supports the development of other literacies such as reading, writing and numeracy.¹⁹⁸

Participation in a sport during childhood is associated with improved physical literacy and has other positive benefits, such as improved adolescent mental health.²⁰⁵ Sports participation during adolescence is linked to improved cardiorespiratory fitness and academic performance.²⁰⁶ Once established, habits related to physical activity and sport participation have lifelong health and other benefits.²⁰⁷

CHANGING VALUES – WHAT THE NEXT GENERATIONS WANT FROM SPORT

The digital native generations of Z and Alpha have different values from older generations. They are more accepting of gender and cultural diversity, want greater online privacy but global connectivity and are influenced by a wider network of peers than previous generations. Members of Gen Z, now of working age, are highly educated and value intellectualism.^{162, 191, 208–210} They are less nationalistic and more concerned about sustainability and egalitarianism.

We can see the influence of this changing value set in Australian sports. The new focus on digital technology, sustainability, cultural diversity, disability sport, global communities and gender inclusion is closing the gaps in sport, while sport itself is helping to close the gaps across the broader Australian society.





The Future of Australian Sport report (2013) ²² correctly predicted many of the changes in age and cultural diversity in Australia, and that Australian sports would look to develop products for specific groups, such as walking versions of sports for older Australians.

But there were more gaps, and more significant ones, that weren't given attention – such as First Nations, LGBTIQ+, people with disability, women and low socio-economic status.

In this new report we identify that the diverse cultural and social population demographics across Australia remain under-represented in sports, not just in those playing, but in the paid and volunteer workforce, including in coaching, leadership and management roles, sports media and more.

Generational change, especially in values, is having a significant impact on the drive for inclusion, equality and integrity, and the focus needs to be on all participants, not just players.

Factors impacting on participation, or the types of sports participated in, include: denser cities/housing (less facilities/space for certain sports, smaller backyards and/or ability for social play); PE/school sport crowded out of school timetables; obesity; child safety concerns restricting children's activities; increased use of digital devices; and, rising costs.

Mind the gap — bringing Australia together across generational and societal divides

Questions for the future

Are we beginning to witness a major shift in the social values Australians hold? If so, what will this mean for sport?

Will sport over the coming decades reflect wider social demographic change in Australia?

Will participation in sports at all levels grow to be more diverse and representative of communities across Australia?

Will the gender, social and cultural gaps in sport close over the coming decades?

Will more Australian women lead national and global sporting organisations and professional leagues?

How will the needs of a new generation of Australians influence and shape sport into the future? Which sports stand poised to benefit from a more diverse Australia – and which sports risk becoming marginalised and less relevant? Will new sports emerge?



Our best sporting side — safe, sustainable and inclusive for all





As Australia's demographic profile becomes more diverse and social values shift, organised sports in Australia will also transform and reflect these changes.

Persistent societal challenges such as racism, violence, abuse and other poor behaviours in sport have elevated the importance of sports integrity, safety and ethics in the sports industry at all levels. Stronger accountability, reporting structures and advocacy for vulnerable Australians will place further pressures on sports to provide a safe and welcoming place for all.

Community-driven sports clubs will increasingly seek to tap into the benefits of engaging a broader cross-section of Australian society. Many will place more emphasis on providing positive participant experiences and promoting inclusive behaviours on- and off-field. Growth in competing markets and competition for new participants will also provide further impetus for sporting organisations and clubs to implement positive change.

In the coming decades sports organisations will be faced with even stronger social licence obligations and will seek well-informed practices to encourage diversity, inclusivity and fair-play and offer athletes more choice, advocacy and individual expression.



Inclusive behaviours and practices

Increased cultural and social diversity within the community and changing generational values will influence Australian sports over the coming decades. Increased representation of diverse groups is likely across sport at all levels, including professional leagues and elite sports. High-profile athletes, coaches, match officials and sports administrators are seen as role models and ambassadors. Increasing diversity may provide an opportunity to positively change community perceptions of difference, forge greater social inclusion, and enhance Australia's reputation overseas, helping to strengthen markets in adjacent sectors, including education and international tourism.²¹¹

To remain sustainable, Australian sports rely on support from local communities. Many Australian sporting organisations and clubs are not-for-profit and depend on high levels of volunteerism to conduct competitions and administer business operations.

Many sports participants – players, volunteers, officials, particularly some high-profile athletes and game officials – still endure the harmful and discriminatory attitudes of the broader Australian society. Sports participants in Australia can be the target of distressing and damaging racist, sexist, ableist and homophobic abuse on and off the field, online and offline.²¹²⁻²¹⁵

Unacceptable behaviour from a minority of people involved with sport is a deterrent for potential new participants. Some sports participants who experience abuse or marginalisation leave and don't return.²¹³ Abusive and discriminatory behaviour is not limited to high-profile professional leagues and competitions but is also found in community grassroots and junior sports.²¹³⁻²¹⁶

This abuse can come from other players, spectators, commentators, dignitaries and the Australian public, and can impact participants' mental and physical health.²¹⁷ Athletes from First Nations, in particular, are targets for racial abuse in Australian elite sports, particularly when demonstrating pride in their culture. For example, AFL players Nicky Winmar, Michael Long and Adam Goodes endured years of racist abuse after high-profile protests and demonstrations of cultural pride.²¹⁸

Greater recognition and mounting pressure to stop the implicit and explicit discrimination in Australian sport over the last decade has seen the creation and implementation of vilification policies, codes of conduct, guidelines for addressing spectator racism at sporting venues, and nationwide educational resources for preventing and dealing with discrimination, harassment and inclusion at all levels of sport.^{219,220}

Issues associated with body image and self-esteem can be significant barrier to sports participation in the community.²²¹ There is also a higher prevalence of eating disorders in elite athletes compared to non-athletes.²²² Self-esteem and body image will continue to be an important focus for sporting organisations seeking to create a safe and inclusive environment for all participants.

As Australia further diversifies over the coming decades, there will be increased pressure on sports organisations to reflect community demographics and disparate emerging values by changing their offerings and how sports are organised, played and watched.

To attract more people as players, spectators, officials, fans and volunteers, sports will need to provide safe and welcoming environments where diverse communities can participate without fear of abuse.





Safety and integrity in sport

Sporting organisations, governments and other community groups work collaboratively to ensure those most vulnerable, including children and young people, are safe from all forms of abuse (verbal, physical and sexual), including when they are in sporting environments.

Issues related to safety and integrity in sports have received increased attention over the last decade. This is likely to continue, driven by growth in the global sports industry and increased government and community focus on ethical sponsorship, sports betting, child and athlete safety and well-being, and the long-term impacts of sports injuries on players.

Integrity in sports covers child, worker and player protection and safety, discrimination, e-safety and social media policies, use of drugs and alcohol, match manipulation and wagering, doping and performance-enhancing drugs, and overall conduct and behaviour.²²³

A comprehensive review of integrity in Australian sport (the Wood Review) was initiated in 2017 in the face of increasing sports betting or wagering and 'revelations of ongoing manipulation of sports competitions and doping scandals'.²²³ Although only a small proportion of all betting in Australia, sports betting has been increasing over the last twenty years (see Figure 12).

In the wake of the Wood Review, Sports Integrity Australia (SIA) was created in 2020 as the single agency for dealing with existing and emerging integrity related issues. Additionally, new laws to criminalise sports corrupting activities (such as match-fixing and doping) and to establish a National Sports Tribunal have been introduced.

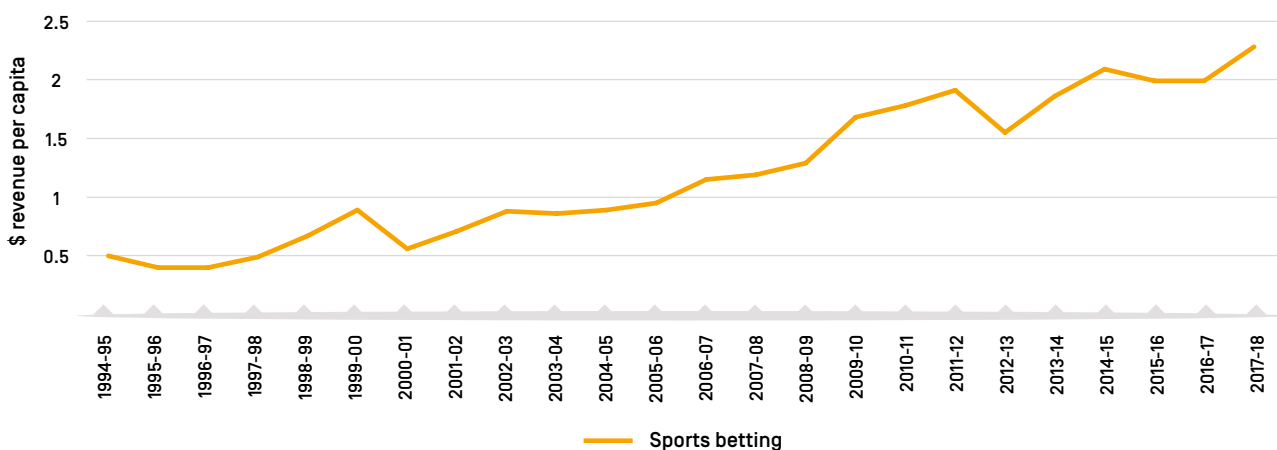
SIA educates organisations on their responsibilities and the new laws, conducts research into integrity issues such as, anti-doping and the detection of match-fixing, provides an avenue for individuals to report misconduct, and manages complaints on child safety and sports corruption.

Although SIA is a significant step forward in addressing structural issues in reporting abuse in sports, it is likely that the number of advocacy bodies for athletes will grow over the coming decade. In addition, some sports will see a change in standards to protect younger participants from the pressures of competitive play. For example, in 2022, the International Ice Skating Union raised the minimum age for athletes competing in major events from 15 to 17.²²⁵

The focus on athlete safety and welfare will grow stronger in the years ahead and will extend to other roles, including coaches, officials, and volunteers at all levels of Australian sport. The focus on integrity in sports will help develop the industry by maintaining trust and engagement.

Figure 12. Total Australian Government revenue per capita from sports betting (excludes racing and gaming)

Source: Queensland Government Statisticians Office: Australian Gambling Statistics²²⁴



Athlete expression

Until recently, professional and high-profile athletes were discouraged from making political or personal statements on current issues. Athletes who expressed political or personal views were often penalised.

Political expression by professional or amateur sportspeople can impact sporting careers.²²⁶ High-profile cases include, for instance, US football players like Colin Kaepernick, who “took the knee” during the national anthem to protest racism in sports.

The acceptability of personal political expression on the sporting field is changing. In 2021 the IOC loosened its ban on protests and political expression by athletes for the 2020 Tokyo Olympic Games (run in 2021). The Olympic rules now allow athletes to protest for causes consistent with the “Fundamental Principles of Olympism” on the field of play before the competition.²²⁷

Groups such as ‘Global Athlete’ have formed to ‘inspire and lead positive change in the world and collectively address the balance of power between athletes and administrators’ in sports political expression. Global Athlete support the use of positive political messaging by athletes on issues such as sports inclusion and diversity, support for victims of global aggression (such as Ukraine), and whistle-blowers of abuse in sports.²²⁸

Over the coming decades, it is likely that many more high-profile athletes will feel empowered to champion social, cultural, environmental and political causes, through a variety of channels and methods both on and off the field of play.

Sustainability

Changing generational priorities will focus on greater environmental awareness and sustainability in sports, driven by athletes, sponsors, fans and sports organisations. Sports organisations are stepping up to find solutions as the world aspires to net-zero carbon emissions targets and tackles issues such as plastic waste and water shortages.²²⁹

Increased expectations that sports organisations and athletes receiving public money must act in a socially and environmentally responsible manner can impose additional costs on sporting organisations. These may include, broader recruitment practices or additional staff requirements; player support and travel (e.g. maternity provisions; better collective bargaining agreements and player terms); rule changes; power/energy transformation. However, it can also improve a club’s reputation and reach – boosting player recruitment, volunteerism, and the games’ social significance.^{230, 231, 232}

Environmental sustainability projects undertaken by sports organisations include initiatives in recycling, employing renewable energy, sustainable water use projects and designs of new sports facilities.^{233, 234}



THE ATHLETE INFLUENCER

Athletes have become social influencers, ambassadors and role models through the growth of social media platforms and channels that promote individual followings. The value of athletes’ brands is growing economically and in political influence.⁴ Athletes can increase their personal brand value through social media platforms – such as Instagram, YouTube and Twitter – and capitalise on online presence through sponsorships, licences for merchandise, branded businesses, booking fees and endorsements.⁴ In 2022, Portuguese soccer player Cristiano Ronaldo was the most followed person on Instagram with over 690 million followers, up from 200 million in 2020, of which 75% were 18–24-year-olds. He has been in Forbes Magazine’s top three highest paid athletes since 2014.¹³ The influence of an athlete’s personal brand extends beyond the sporting world. During the COVID-19 pandemic, some high-profile athletes became a trusted source of health information, particularly influencing the younger generations of Gen Z and Gen Alpha.¹⁶ Tennis player Serena Williams had 15.8 million followers on Instagram in 2022 and uses the platform to campaign for racial and gender equity.

SUSTAINABILITY OF SPORTING EVENTS

Sustainability is one of the three pillars of the Olympic Agenda by the International Olympic Committee.²³⁵ The United Nations also acknowledged the contribution of the Olympic and Paralympic Games to the UN Sustainable Development Goals.²³⁶ However, there is scope to improve the sustainability of sports organisations' operations and sporting events.

Scholars are already debating the technologies, material and systems design that can ensure that the 2032 Brisbane Games don't just meet sustainability targets but contributes more broadly to Australia's efforts to meet global obligations on achieving net-zero emissions and reducing plastic waste.²³⁷

As action on climate change accelerates, sustainability in sports events and sports organisations will be increasingly central to everyday operations and objectives.

GREENING OF THE GAMES

Since the first 'Green' Olympic and Paralympic Games in Lillehammer (1994), sporting events have been seeking to minimise their environmental impact, including waste and carbon emissions, sustainable sourcing of construction materials, and understanding potential impacts of facilities and events on biodiversity.³ Some research has ranked the sustainability of previous Olympic and Paralympic Games as 'medium' and shown that its sustainability rating has declined over time. For example, between 1992 and 2020 the most sustainable Games were in Salt Lake City in 2002, while the least sustainable were Sochi 2014 and Rio de Janeiro 2016.¹¹ The Olympic, Paralympic and Commonwealth Games are now expected to have sustainability and human rights strategies and outcomes as part of their planning and legacy.^{14,17,18}





The Future of Australian Sport report [2013] ²² recognised that sport was seen as more than just a recreational activity and would play a role in helping governments and society address policy areas in health, crime reduction, diplomacy and social development.

In this new report we discuss how sport can mirror society, with many Australians expecting sport to set strong examples within our communities, including on equality, integrity, inclusion, diversity and providing a safe place for all involved.

The Australian sport sector is also driving and implementing stronger accountability and reporting structures, and providing advocacy for vulnerable members of our community.

Maintaining and improving sport integrity and sustainability will be key aspects in building a sport system that provides a safe and inclusive environment for all involved in Australian sport.

Questions for the future

How will Australian governments, sporting organisations and communities protect the integrity of sport into the future?

What measures will need to be taken to help ensure sport is safe and sustainable?

Will sport be accessible to disadvantaged and lower socio-economic communities?

Will parents and families continue to be the most influential sport and physical activity role models for their children?

Will high-profile athletes, coaches and sporting personalities continue to be seen as ambassadors and role models in Australia and internationally?

Will high-profile athletes become even stronger influencers championing various social, environmental and political causes?

Will the performances of our elite athletes on the international stage continue to inspire us as a nation?

Will most Australians continue to view sport as an important part of our national culture in the decades ahead?



The perfect pivot — adapting in an uncertain world

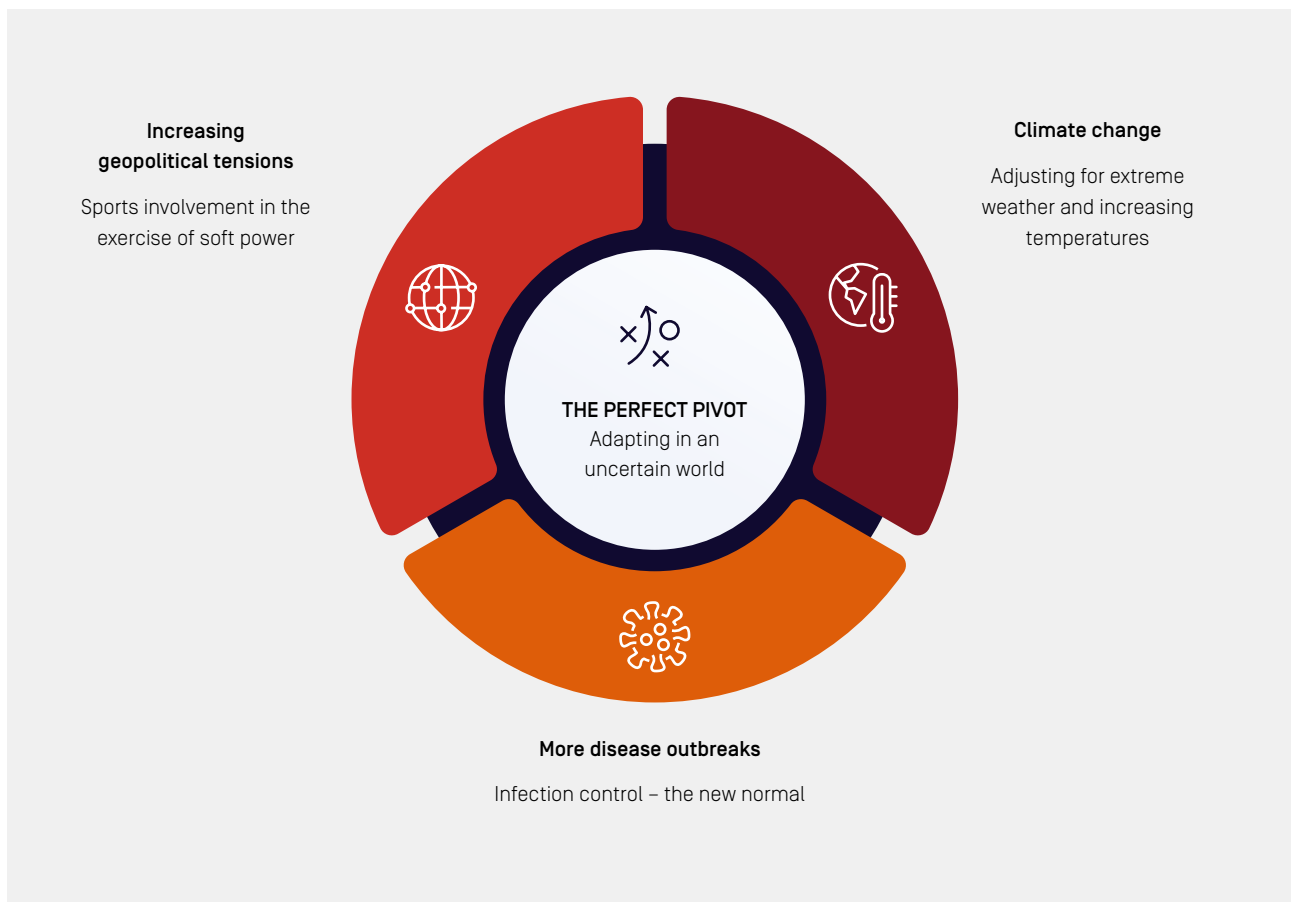




The world is entering historically uncertain times. Climate change is increasing seasonal temperatures and the frequency of extreme weather events. Heightened geopolitical tensions have given rise to more wars along with the threat of further military conflicts globally, trade sanctions, and threats and acts of terrorism. Pandemics, like the COVID-19 pandemic, have increased in likelihood – with a 47% to 57% chance of a second pandemic of the same magnitude occurring in the next 25 years.

All these factors have disrupted scheduled sporting activities over recent years and this disruption is likely to continue and increase in frequency over the coming decades. This uncertainty will affect all sports, including event planning, infrastructure design and the types of sports that can be played in certain seasons. It will increase the need for some sports and their associated business models to make strategic 'pivots' or rapidly deploy alternative approaches and resources, move venues and competitions at short notice, or respond to other unexpected challenges when required.

This megatrend is far broader than just sport but has relevance to a sector with multiple points of exposure to geopolitical, extreme climate and pandemic-related risks. Australian sporting organisations will need to be flexible and ingenious over the coming decades.



Increasing geopolitical tensions

A shift in the global power balance and the threat of conflict in the Asia-Pacific region will cause tensions that will likely have flow-on effects to international sport over the next decade.

Armed conflict around the world has been trending up since the 1950s (see Figure 13), and there has been recent escalation in geopolitical tensions in the Asia-Pacific region.³¹

Military defence spending in 2022 is the highest since 1988 at 2.4% of global GDP, and trade tensions between superpowers China and the United States have heightened over the previous decade, particularly in relation to contested territories such as Taiwan and the South China Sea.²³⁸

THE THREAT OF TERRORISM INCREASES SECURITY COSTS FOR SPORTING EVENTS

Sporting events attract crowds and public attention and because of this they are sometimes terrorist targets, although this is rare. The Institute of Economics and Peace (IEP) predicts the Ukraine conflict, and subsequent impacts to the global economy, may drive higher rates of terrorism, including cyberterrorism.²⁴¹

The threat of terrorist attacks has led to tighter, and more costly, security at sports events (Figure 14). Major sport event organisation is likely to increase in security cost and complexity as event organisers consider new threats such as cybersecurity.

SOFT DIPLOMACY THROUGH SPORTS BOYCOTTS

The potential for international boycotts and sanctions will be present as Australia hosts a series of major sporting events over the next decade culminating in the 2032 Brisbane Olympic and Paralympic Games.

Sporting competitions have played a significant role around the world in soft diplomacy – actions that achieve social, political or financial goals through participation in sports or cultural events.²⁴⁴ Geopolitical tensions increase the potential of nations or athletes boycotting or being sanctioned, preventing their attendance at major sporting events. It is theorised that sport can also act as a pressure valve to release a degree of political and military tension.^{245,246}

Over the coming decade political uncertainty will call for higher levels of contingency planning – particularly for global mega-events such as the FIFA World Cup soccer and the Olympics and Paralympics. The threat of violence in sport and acts of terrorism in Australia will increase with the hosting of more major sporting events – but these threats can be mitigated with appropriate policing and security controls.

At the same time the importance of sports in diplomacy and acting to relieve political tensions will increase and potentially play a critical role in reducing geopolitical tensions. Sport will continue to be used as a soft power promoting diplomacy, international cooperation and peace across the Asia-Pacific region and the world.





Figure 13. A conflict-year dataset with information on armed conflict where at least one party is the government of a state in the time period 1946–2021

Source: Uppsala Conflict Data Program ^{239, 240}

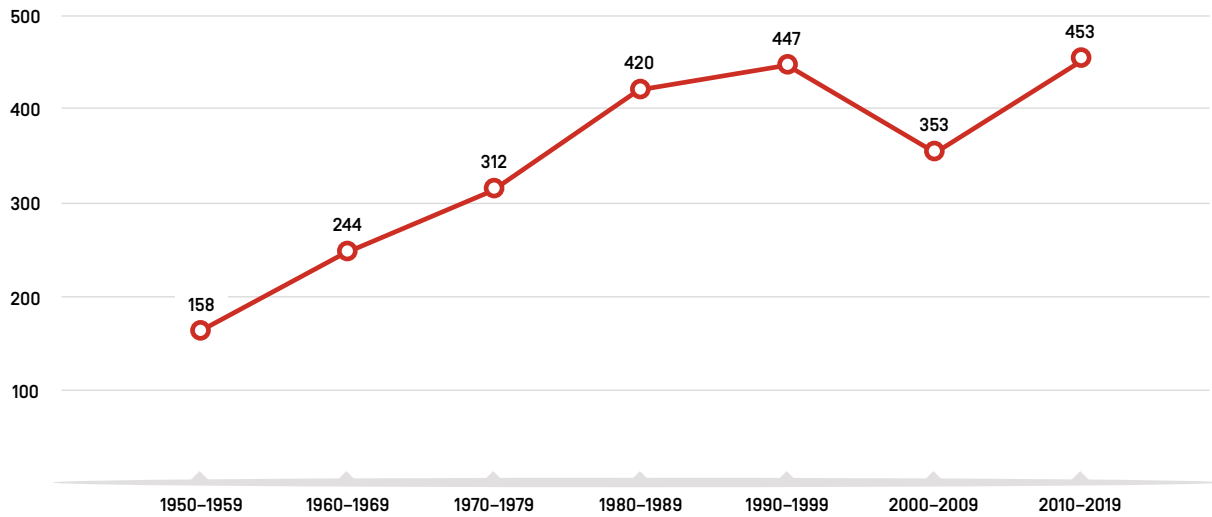
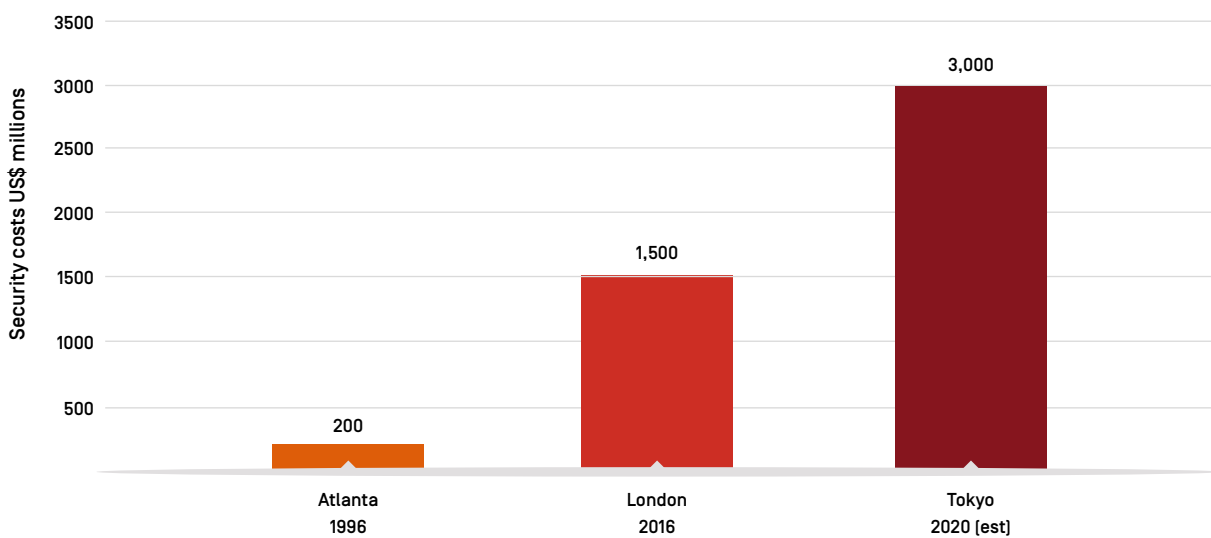


Figure 14. Security costs at the Olympic Games

Source: IOC ²⁴² and Friedmann ²⁴³



Climate change

Over the last decade, we have seen a rapid increase in climate-change-related weather events. These will continue to have a significant impact on sports (and lives) across Australia over the coming decades.

Climate change is increasing average global temperatures and the likelihood of extreme weather events, including heatwaves, floods, droughts, cyclones, heavy rainfall events, intense storms, days of increased exposure to UV radiation and days of risk of bushfires (Figure 15). Climate-change-related weather events will also increase associated conditions such as days of reduced air quality (due to bushfire smoke or high pollen counts from winds), thunderstorms and intense rain.²⁴⁸ Over time, climate change will have greater impacts on:

- winter sports reliant on snow conditions
- summer sports usually played in the hotter months and vulnerable to extreme heat conditions
- sporting infrastructure being affected by heat and extreme weather events, particularly infrastructure on vulnerable lands such as floodplains, coastlines and natural forests
- sports health guidelines to accommodate varying environmental conditions on participants health and performance.^{249,250}

SUMMER SPORTS

Climate-change-related weather events are increasingly interrupting Australian sports participation and athletes' performance. Athletes are considered a risk group for heat-related health risks but they are also vulnerable to air quality changes due to smoke from bushfires, high pollen counts and pollution.²⁵¹ Increased outdoor temperatures and poor air quality stress the cardiovascular, respiratory and metabolic systems of human bodies, and this is amplified in people who exercise.²⁴⁹

The bushfires of the summer of 2019–2020, alongside extreme heat days, caused the cancellation of, or disruption to, several major Australian sporting events, including the Australian Open Tennis in Melbourne, Cricket's Big Bash League and baseball competitions in Canberra, and the Australian Open Golf tournament in Sydney amongst others.²⁵²⁻²⁵⁵

Sports organisations and authorities are actively adopting rules and regulations to mitigate risks during extreme weather and summer sport.²⁵⁶ Strategic mitigation and active adoption of sports sustainability programs are being developed and actioned for the safety of future sports activities, events, participants and spectators and this will continue over the coming decade.²⁴⁹ In the US, sporting bodies are being warned they risk litigation if they don't take measures to mitigate heat stress in players.²⁵⁷

Future-proofing sporting activities, fields and facilities with climate-controlled heating and cooling – such as air conditioning, misters and access to water, shade and cool zones – will increase their adaptability to changing conditions. Sharing the costs of constructing all-weather facilities in secure sites may also mean pivoting to become more multi-use venues or fields, reducing energy consumption or adopting local renewable energy systems, and following sustainable principles in development and construction.

WINTER SPORTS RELIANT ON SNOW

Natural snow depth across Australia's alpine region has been declining since the late 1950s (Figure 16).²⁴⁸ There was a 10% decline in annual maximum snow depth between 1962 and 2022, accelerating to a 15% decline between 2001–2010, with the largest declines in spring.^{258,259} The geographic coverage of snow in Australia each winter is also in long-term decline.²⁴⁸ Atmospheric temperatures have been found to be the most important factor determining snow depth in Australia, and thus we can expect snow coverage to retreat as the global warming trends continue over the coming decades. Some lower-level resorts may not receive natural snowfalls by 2050.²⁶⁰

The decline of snow cover in Australia will shorten the snow season and reduce the time available for Australian winter sports athletes to practice and train. In response to the higher variability and shorter predicted ski seasons, many Australian ski destinations have installed snowmaking machines and snow guns and undertake extensive snow grooming practices to retain snow cover for as long as possible. These can be energy and water intensive and may place additional stress on fragile alpine ecosystems coping with changed climatic conditions.²⁵⁹ Planning for future uses of the Australian alpine regions can help preserve some training grounds. Digital pivots for training in augmented and virtual reality will also assist athletes in maintaining fitness in the longer seasons between snowfalls.

Sporting organisations and local governments will continue to transform or rebuild sporting facilities, so they are more accessible and fit for purpose for a new generation of sports participants. Accessibility, energy efficiency and sustainability, technology integration, and multipurpose community use will be at the centre of these designs.



Figure 15. Maximum temperature anomaly in Australia annually (based on climatology for 1961–2021)

Source: Bureau of Meteorology ²⁴⁷

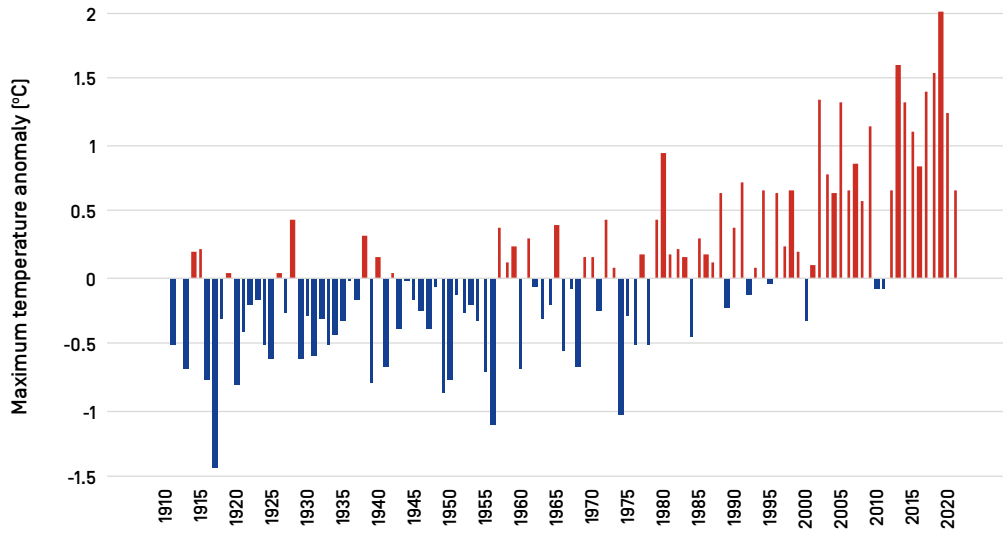
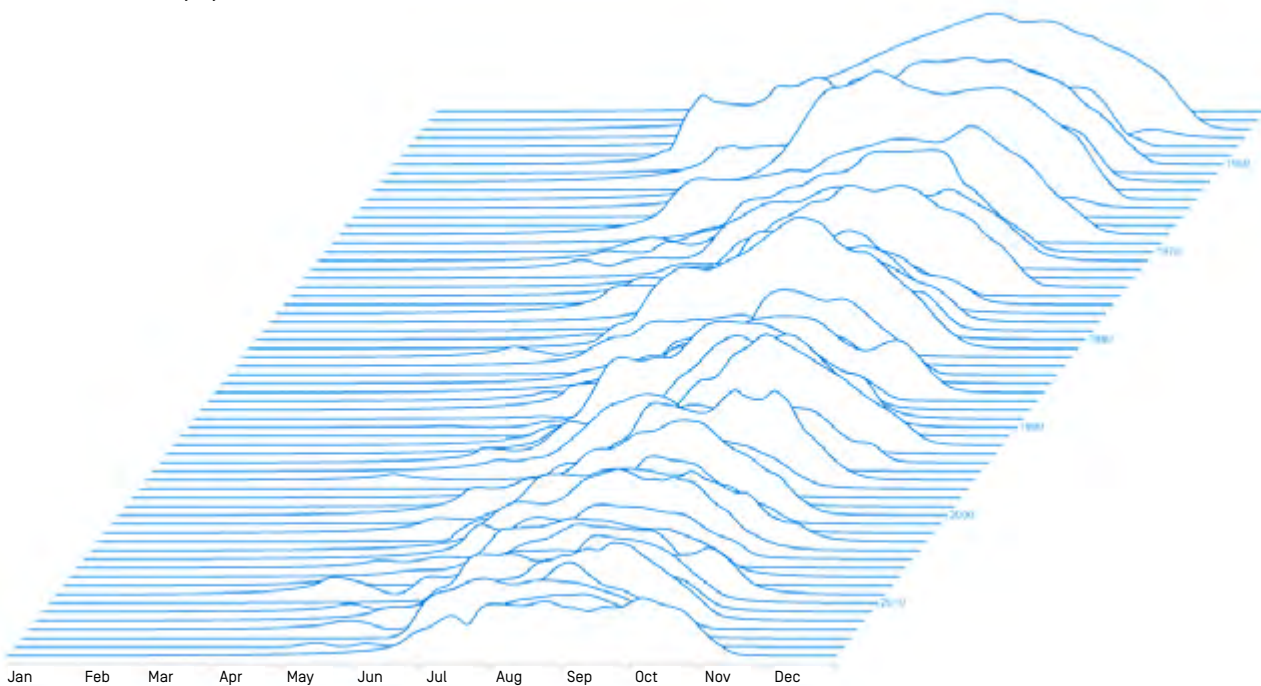


Figure 16. Annual snow falls [January to December] at Spencers Creek [Mount Kosciuszko] 1954 [back] – 2016 [front]

Source: Snow fall at Spencers Creek 1954–2016, SBS Interactive ²⁶¹

Data source: Snowy Hydro Limited



More disease outbreaks

The COVID-19 pandemic has shown the world just how profoundly disease outbreaks can affect daily life, our economies and our organisations. ²⁶² It caused significant disruption to the sporting ecosystem in Australia. During the pandemic, 93% of sports clubs lost money, and it is estimated to have cost Australian sports organisations \$1.6 billion in costs and lost revenues – particularly over the lock-down periods of 2020 ²⁶² There were also increased costs for organisations in infection controls, supplementing a reduced volunteer workforce, transport and logistics, and providing alternative schedules and playing arrangements.

Children’s participation in physical activity was the most impacted due to restrictions on organised sport. ¹³⁰ The easing of restrictions saw 80% of children and adults returning to at least one of their organised sports by March 2021. Approximately one-third of children and adults who did not return to organised sport reported concerns about safety and the risk of contracting COVID-19 from playing sport. ¹³⁰

The loss of the sporting season in 2020 resulted in a decline in mental health, motivation and physical activity, and increased feelings of emotional struggle and disappointment in much of Australia’s youth. ²⁶³ These impacts were significantly more prevalent among high-performing youth athletes. ²⁶³ There were also challenges in re-engaging sports participants post-pandemic.

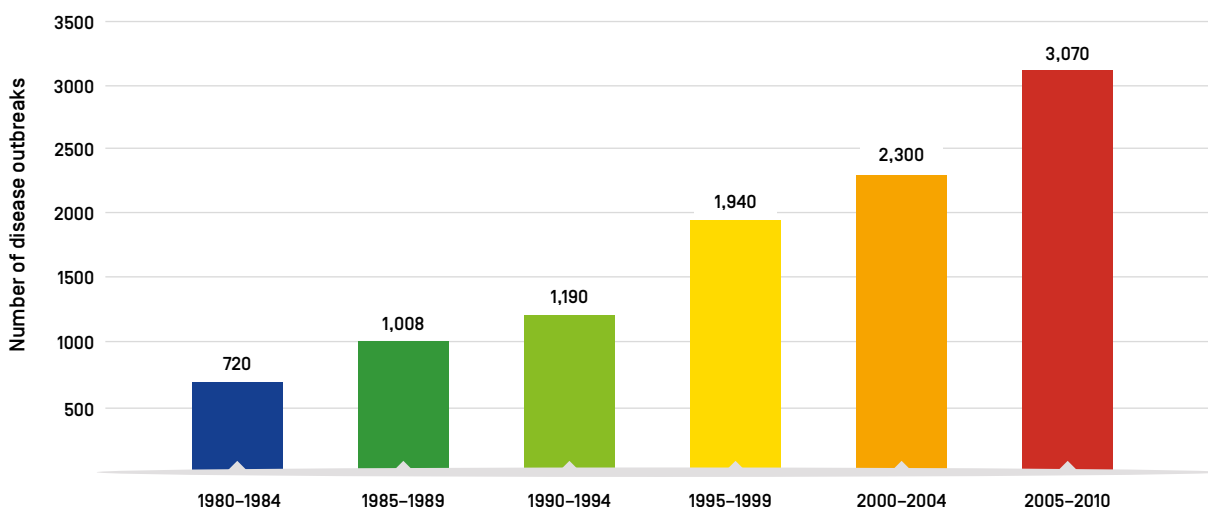
Youth athletes felt that sport was too focused on winning before COVID-19, which decreased enjoyment in playing. ²⁶³ Many people became focused on other things, unfit, unconfident and reluctant to return to sports. ²⁶³ However, the pandemic created an opportunity to re-imagine sports. ²⁶³

The COVID-19 pandemic may not be the only outbreak of infectious diseases to occur over this decade. The frequency of disease outbreaks has been increasing over the last two decades (Figure 17). Climate change, greater contact with wild animals, the thawing of large ice-bound areas and increased antimicrobial resistance are all factors increasing the likelihood of new infectious disease outbreaks in the coming years. ²⁶⁴ The likelihood of an infectious disease outbreak of the magnitude of the recent COVID-19 pandemic may increase up to threefold in the coming decades. ²⁶⁵ That means that there is a 22%–28% chance of another COVID-19-sized pandemic in the next 10 years and a 47%–57% chance of one over the next 25 years.

New outbreaks may see infection control measures – such as quarantine, contact tracing and social distancing – re-introduced from time to time. Although our ability to find vaccines and fight some infectious diseases may be improving, any serious disease outbreak is likely to cause disruption to play and event scheduling, impose extra costs upon clubs and sporting bodies for infection control measures, and intermittently pause several high-contact or indoor sports.

Figure 17. Global rise in infectious diseases 1980–2010

Source: Adapted from Smith et al. ²⁶⁴



Finding the perfect pivot

Navigating through this period of uncertainty due to climate change, disease outbreaks and increased geopolitical tensions will mean greater attention to contingency measures, scenario planning and building industries more resilient to traumatic events.

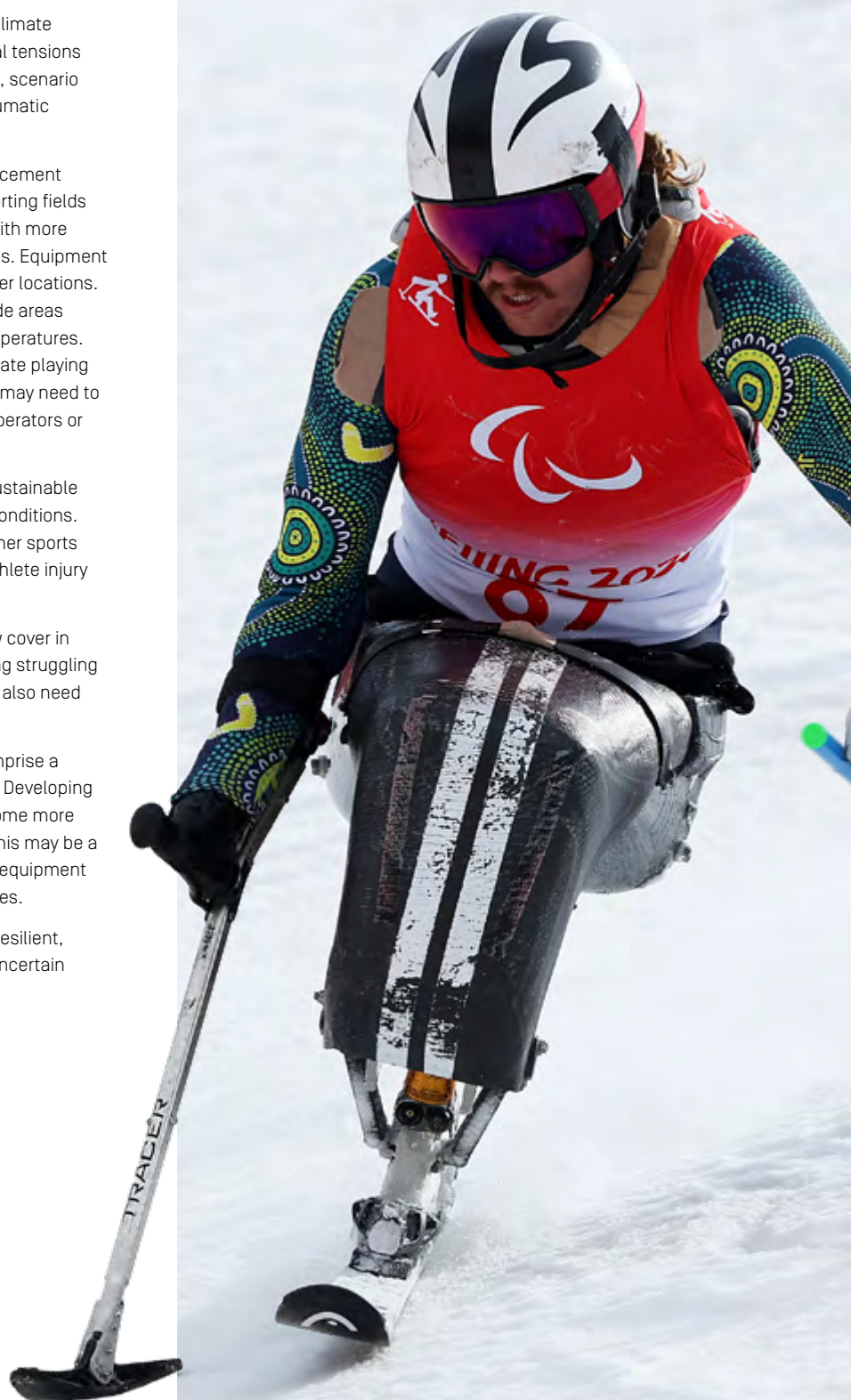
For community sports, it will mean examining the placement and insurance for all facilities. Many of Australia's sporting fields are on floodplains, and these may need to be fitted with more flood-resilience or removable equipment and surfaces. Equipment may need to be stored away from the fields or in higher locations. Water fountains, cooling stations, treed borders, shade areas and misters are options to provide relief in hotter temperatures. Multi-use indoor sports complexes can provide alternate playing environments but are expensive and operating costs may need to be shared with multiple sports, commercial leisure operators or other community users.

Sector collaboration will be needed to deliver more sustainable playing environments that can cope with the future conditions. Many sports organisations will reschedule their summer sports outside of the hottest months to reduce the risk of athlete injury due to heat, UV light and possible bushfire smoke.

Snow guns will increasingly supplement natural snow cover in alpine regions, and careful planning around preserving struggling alpine ecosystems in partnership with sports use will also need consideration.

Security budgets, including for cybersecurity, will comprise a large proportion of major event budgets in the future. Developing contingency plans for major sporting events will become more essential over the coming decades. In some cases, this may be a digital pivot – to a virtual competition on exergaming equipment and augmented and virtual reality (AR/VR) technologies.

Australian sports organisations will need to be more resilient, become better at planning and be adaptable for an uncertain future.





The Future of Australian Sport report (2013) ²² correctly identified that there would be both challenges and opportunities from significant global and local market shifts, changes that are still evolving today. The Australian sport industry continues to see growth as it recovers from the COVID-19 pandemic. Sport integrity and governance requirements have also seen rapid growth.

Military conflicts, threats and acts of terrorism, pandemics, and climate change, including increasing temperatures and extreme weather events, have disrupted scheduled sporting activities over the previous decade.

In this new report, we highlight that these types of extreme weather events will likely continue and increase in frequency over the coming decades. They will require consideration in the planning and execution of Australia's 'green and gold' decade of events leading up to the 2032 Brisbane Olympic and Paralympic Games.

Diversifying existing business models, tapping into new markets, attracting new participants and fans, innovating, delivering new products, forming new partnerships, sharing the cost of critical services and infrastructure, building stronger organisational governance, and growing a capable workforce will help to underpin the 'perfect pivot' for Australian sporting organisations over the next decade.

Questions for the future

How will sports overcome future catastrophic threats and natural disasters?

Will local sporting clubs continue to draw on the strength and resilience within Australian communities?

How will sporting organisations build greater resilience within their operations to better respond to unforeseen events?

How will sports participants cope with increasing temperatures, higher levels of ultraviolet radiation and extreme weather events in the decades ahead?

Will more sport organisers seek to move their activities and competitions into indoor environments, or time-shift to early mornings, late evenings, or a different season?

How will extreme weather events and a changing climate influence sport infrastructure and facilities design?

Will sporting facilities become more accessible, resilient and fit for purpose in the future?

Will growing geopolitical tensions and the threat of terrorism and war disrupt major sporting events in the future?



Conclusion

This report describes the significant shifts, or megatrends, likely to occur in the Australian sports sector over the coming decade. These shifts are emerging due to the longer term social, political, legal, economic, environmental and technological changes in the broader Australian society.

Just as the ground-breaking 2013 report, *The Future of Australian Sport: Megatrends shaping the sports sector over coming decades*²² identified many of the megatrends and themes that influenced Australian sport over the last decade, this report sets out to inform decision-makers and sports strategists of the next waves of change in the decade leading to the 2032 Brisbane Olympic and Paralympic Games and beyond.

The Australian sporting landscape of 2032 is likely to be very different from that of today. It will be changed by new sports technologies used at all levels of sports competition, demographic changes in the Australian population, the rise of e-sports, exergaming and new adventure sports, the social values of the next generation, and by responding to a new era of geopolitical and environmental uncertainty.

These offer Australian sports organisations, participants and audiences' new opportunities and challenges. We look forward to looking back in 2032 and reviewing how the megatrends described in this report have informed the actions that have arisen from greater awareness of these trends.

If managed well, Australian sports will continue to support Australia's health and well-being, along with our national pride and strong cultural identity, well into this century.





References

1. Australian Associated Press (2015). Matildas go on strike as pay dispute between FFA and PFA escalates. 8 September, The Guardian – Australia.
2. May C (2022). Major sporting event legacies. Sustainability and environmental impact. Canberra: Clearinghouse for Sport.
3. Federation Internationale de Football Association (FIFA) (2022). FIFA to launch FIFA+ Collect [Media Release]. Zurich: FIFA, 2 September.
4. Antonucci G, Della Porta A, Venditti M (2019). The value of the elite athlete as influencer in the era of social media. ECIC 2019 10th European Conference on Intangibles and Intellectual Capital. Academic Conferences and Publishing Limited.
5. Social Sport (2022). About us – our goal is to make sport simple. Melbourne: Socialsport.com.au.
6. Craik J (2011). The fastskin revolution: from human fish to swimming androids. Culture Unbound: Journal of Current Cultural Research, 3(1): 71–82.
7. Australian Sports Commission (2022). AusPlay Focus: How Australians' participation in sport and physical activity is adapting to COVID-normal. Canberra: Australian Sports Commission.
8. Williams C (2019). Matildas equal pay deal officially announced. 5 November 2019, HuffPost.
9. parkrun. A healthier, happier planet [Available from: <https://www.parkrun.com/about/>].
10. Dyer B (2015). The controversy of sports technology: a systematic review. SpringerPlus, 4(1): 1–12.
11. Müller M, Wolfe S D, Gaffney C, Gogishvili D, Hug M, Leick A (2021). An evaluation of the sustainability of the Olympic Games. Nature Sustainability, 4(4): 340–348.
12. Clarkson B, Culvin A, Bowes A (2021). Women in sport are winning the fight for equal pay – slowly. 30 November 2021, The Conversation.
13. Knight B, Birnbaum J, Craig M (2022). Highest paid athletes: the top 50 sports stars combine to make nearly \$3 billion in a year, crushing the record. 11 May 2022, Forbes Magazine.
14. Male Champions of Change (2020). Pathway to pay equality: elite women athletes progress report 2019–2020. Canberra: Male Champions of Change.
15. International Paralympic Committee, Ottobock (2021). Worldwide Paralympic Partner Ottobock continues tradition at Tokyo 2020. 27 August, IPC News [available from: <https://www.paralympic.org/news/worldwide-paralympic-partner-ottobock-continues-tradition-tokyo-2020>].
16. Beaupre J G, Alfaro-Barrantes P, Jacobs B (2020). Professional athletes and Gen Z: a commentary on social media influence during the COVID-19 pandemic. The Journal of Social Media in Society, 9(2): 381–392.
17. Queensland Government (2022). Brisbane 2032 Climate positive games [Media Release]. Brisbane: Department of Environment and Science, 26 July.
18. Gold Coast Commonwealth Games. Sustainability [cited Available from: <https://gc2018.com/about/sustainability>].
19. Australian Bureau of Statistics (2021). General social survey: summary results, Australia. Canberra: Australian Bureau of Statistics.
20. KPMG, Department of Health (2020). Sports industry economic analysis: exploring the size and growth potential of the sport industry in Australia.
21. Australian Bureau of Statistics (2013). Sport scores goals for Aussie economy 2013 [Media Release]. Canberra: Australian Bureau of Statistics, 24 October 2013.
22. Hajkowicz S, Cook H, Wilhelmseder L, Boughen N (2013). The future of Australian sport: megatrends shaping the sports sector over coming decades. A consultancy report for the Australian Sports Commission. Australia: CSIRO.
23. Australian Sports Commission (2022). AusPlay survey [Participation trends in Australia]. [Dataset].
24. Batuev (2021). Olympics: why not all new sports will return at Paris 2024 – but breakdancing will make its debut. 10 August 2021, The Conversation.
25. Keegan R, Dudley D, Barnett L (2019). A brief history of physical literacy in Australia. Physical Literacy across the World: 105–124.
26. Australian Bureau of Statistics (2020). Twenty years of population change: statistics about the population and components of change (births, deaths, migration) for Australia and its states and territories. Canberra: Australian Bureau of Statistics.
27. Australian Bureau of Statistics (2022). Migration: statistics on Australia's international migration, internal migration (interstate and intrastate), and the population by country of birth. Canberra: Australian Bureau of Statistics.
28. Australian Sports Commission (2022). 2022–2026 Corporate plan. Canberra: Australian Sports Commission.



29. Hajkowicz S, Reeson A, Rudd L, Bratanova A, Hodggers L, Mason C, Boughen N (2016). Tomorrow's digitally enabled workforce: megatrends and scenarios for jobs and employment in Australia over the coming twenty years. Brisbane: CSIRO.
30. Naughtin C, Schleiger E, Bratanova A, Hajkowicz S (Under review). Forty years in the making: a systematic review of the megatrends literature. Technology forecasting and social change. Brisbane: CSIRO.
31. Naughtin C, Hajkowicz S, Schleiger E, Bratanova A, Cameron A, Zamin T, Dutta A (2022). Our future world: global megatrends impacting the way we live over coming decades. Brisbane: CSIRO.
32. May C (2021). What is sport? Defining sport. Canberra: Clearinghouse for Sport.
33. Australian Sports Commission (2022). Ausplay: key terms and definitions. Canberra: Australian Sports Commission.
34. Australian Sports Commission (2022). Snapshot: how Australians describe the value and benefits of sport. Canberra: Australian Sports Commission.
35. Australian Sports Commission, ORIMA (2022). Value and benefits of organised sport – Research report. Canberra: Australian Sports Commission & ORIMA.
36. Eime R, Harvey J, Charity M (2020). Sport participation settings: where and 'how' do Australians play sport? BMC Public Health, 20(1): 1344.
37. Strava (2020). Strava releases 2020 Year in sport data report [Media Release]. San Francisco: 16 December 2020.
38. Australian Fitness Academy. Fitness industry growth [Available from: <https://www.fitnesseducation.edu.au/wp-content/uploads/2020/11/Fitness-Infographic-Final.pdf>].
39. Statista (2021). Number of fitness centers and gyms in Australia from financial year 2016 to 2021 [Chart]. Statista.
40. Nguyen K (2022). How the Omicron COVID-19 outbreak is derailing the gym and fitness sector in Australia. ABC News, 15 January 2022.
41. Market Research.com (2022). Global home fitness equipment market – 2022–2029. Rockville: Market Research.com.
42. Thompson W R (2022). Worldwide survey of fitness trends for 2022. ACSM's Health & Fitness Journal, 26(1): 11–20.
43. Eime R M, Harvey J T (2018). 'Sport participation across the lifespan: Australian trends and policy implications'. In: Sport and physical activity across the lifespan. Springer.
44. Falardeau E (2021). Fitness customers' habits have evolved during the COVID-19 pandemic, offering fitness-industry providers the opportunity to reexamine their value propositions and target specific segments. McKinsey & Company.
45. Marques A, Santos T, Martins J, Matos M G D, Valeiro M G (2018). The association between physical activity and chronic diseases in European adults. European Journal of Sport Science, 18(1): 140–149.
46. Stevens M, Cruwys T (2020). Membership in sport or exercise groups predicts sustained physical activity and longevity in older adults compared to physically active matched controls. Annals of Behavioral Medicine, 54(8): 557–566.
47. Andersen M H, Ottesen L, Thing L F (2018). The social and psychological health outcomes of team sport participation in adults: an integrative review of research. Scandinavian Journal of Public Health, 47(8): 832–850.
48. Australian Bureau of Statistics (2022). Physical activity: results from the national health survey 2020–2021 financial year. Latest release. Canberra: Australian Bureau of Statistics.
49. Curry D (2022). Fitness app revenue and usage statistics (2022). Business of Apps, 4 May 2022.
50. VicHealth (2019). Innovation challenge: sport winners. Melbourne: Victoria Department of Health.
51. Blowfly Cricket Club. Blowfly Cricket [Available from: <https://wphccc.com.au/blowfly/>].
52. Corepal R, Zhang J Y, Grover S, Hubball H, Ashe M C (2020). Walking soccer: a systematic review of a modified sport. Scandinavian Journal of Medicine & Science in Sports, 30(12): 2282–2290.
53. O'Connor J, Penney D (2021). Informal sport and curriculum futures: an investigation of the knowledge, skills and understandings for participation and the possibilities for physical education. European Physical Education Review, 27(1): 3–26.
54. Jeanes R, Spaaij R, Penney D, O'Connor J (2019). Managing informal sport participation: tensions and opportunities. International Journal of Sport Policy and Politics, 11(1): 79–95.
55. Richards R, May C (2022). Modified sports. Canberra: Clearinghouse for Sport.
56. Elnour M, Himeur Y, Fadli F, Mohammedsherif H, Meskin N, Ahmad A M, Petri I, Rezguy Y, Hodorog A (2022). Neural network-based model predictive control system for optimizing building automation and management systems of sports facilities. Applied Energy, 318: 119153.

57. Yi Y, Zhang S, Han T, Liu J, Xing Z (2022). Design of stadium lighting energy control system based on intelligent technology. *Third International Conference on Artificial Intelligence and Electromechanical Automation (AIEA 2022)*. SPIE, 808–813.
58. Chauhan A, Bhatia V (2020). Cricket activity detection using computer vision. *2020 Sixth International Conference on Parallel, Distributed and Grid Computing (PDGC)*. IEEE, 428–433.
59. Mallen C (2019). 'Artificial intelligence and implications for sport officiating'. In: *Emerging technologies in sport*. Routledge.
60. Maida J (2020). Smart stadium market – Roadmap for recovery from COVID-19 | Improved operational efficiency to boost the market growth | Technavio. [businesswire.com](https://www.businesswire.com).
61. Bret M, Prisbell E (2021). In-venue tech: experience is everything. Future venues will rely on connectivity, artificial intelligence and a blending of realities to create personal encounters for fans while retaining a sense of community. 17 May 2021, *Sports Business Journal*.
62. Sampedro A C (2021). The case of AI in sport: some ethical concerns at play. *Diagoras: International Academic Journal on Olympic Studies*, 5: 18–29.
63. Jiang D, Shi G (2021). Research on data security and privacy protection of wearable equipment in healthcare. *Journal of Healthcare Engineering*, 2021: 6656204.
64. MacLean E (2021). The case of tracking athletes' every move: biometrics in professional sports and the legal and ethical implications of data collection. *Sports Lawyers Journal*, 28: 49.
65. Osborne B, Cunningham J L (2017). Legal and ethical implications of athletes' biometric data collection in professional sport. *Marquette Sports Law Review*, 28: 37.
66. Torchinsky R (2022). How period tracking apps and data privacy fit into a post-Roe v. Wade climate. 24 June, *National Public Radio (US)*.
67. Naraine M L, Wanless L (2020). Going all in on AI: examining the value proposition of and integration challenges with one branch of artificial intelligence in sport management. *Sports Innovation Journal*, 1: 49–61.
68. Gruettner A (2019). What we know and what we do not know about digital technologies in the sports industry. *Americas Conference on Information Systems (AMCIS)*.
69. Tu R, Hsieh P, Feng W (2019). Walking for fun or for "likes"? The impacts of different gamification orientations of fitness apps on consumers' physical activities. *Sport Management Review*, 22(5): 682–693.
70. Rondina R, Hong M, Sarma S, Mitchell M (2021). Is it worth it? Cost-effectiveness analysis of a commercial physical activity app. *BMC Public Health*, 21(1): 1–10.
71. Ratten V (2020). Sport technology: a commentary. *The Journal of High Technology Management Research*, 31(1): 100383.
72. Ratten V (2020). 'Sport start-ups: the role of networking' In: *Sport entrepreneurship*. Emerald Publishing Limited.
73. Australian Sports Technology Network (2022). *Australian Sports Innovation Centre of Excellence (ASICE)*.
74. Department of Health (2019). *Sports diplomacy 2030*. Canberra: Commonwealth of Australia.
75. Pinder R, Dehghansai N, Baker J (2023). 'Talent development opportunities and challenges in Paralympic sport: an introduction'. In: *Talent development in Paralympic sport: researcher and practitioner perspectives*. Dehghansai N, Pinder R A, Baker J (eds). New York and London: Routledge.
76. Dehghansai N, Pinder R A, Baker J (2022). Talent identification and development in Paralympic contexts: current challenges. *Frontiers in Sports and Active Living*, 4.
77. Pyne D, Goldsmith C, Mitchell L, McGibbon K, Govus A, Lawler N (2022). The swimmer's metabolome project: characterising the metabolic responses to swimming sessions of different exercise intensities. Canberra: University of Canberra.
78. National Institute of Biomedical Imaging and Bioengineering (2019). A painless skin patch simplifies diagnostic tests [Media Release]. Bethesda, MD: National Institute of Biomedical Imaging and Bioengineering, 16 August.
79. Nuzzo J (2021). Volunteer bias and female participation in exercise and sports science research. *Quest*, 73(1): 82–101.
80. May C (2021). *Women in sport: Female performance and health*. Canberra: Clearinghouse for Sport.
81. Australian Institute of Sport (2022). *Female performance and health initiative*. Canberra: Australian Institute of Sport.
82. Elliott-Sale K J, Minahan C L, de Jonge X A, Ackerman K E, Sipilä S, Constantini N W, Lebrun C M, Hackney A C (2021). Methodological considerations for studies in sport and exercise science with women as participants: a working guide for standards of practice for research on women. *Sports Medicine*, 51(5): 843–861.
83. International Olympic Committee (2022). IOC confirms new partnerships with 11 research centres specialising in athlete health and injury prevention [Media Release]. Lausanne: IOC, 25 October.
84. Roeger M (2020). *Sports biomechanics*. Canberra: Clearinghouse for Sport.



85. Soltani P, Morice A H (2020). Augmented reality tools for sports education and training. *Computers & Education*, 155: 103923.
86. Lee H T, Kim Y S (2018). The effect of sports VR training for improving human body composition. *EURASIP Journal on Image and Video Processing*, 2018(1): 1–5.
87. Le Noury P, Polman R, Maloney M, Gorman A (2022). A narrative review of the current state of extended reality technology and how it can be utilised in sport. *Sports Medicine*, 52(7): 1473–1489.
88. Union Cycliste Internationale (UCI) (2022). UCI cycling esports world championships [Available from: <https://www.uci.org/competition-hub/2022-uci-cycling-esports-world-championships/6jCV1YA66FTSFh5TqwUjPWe>].
89. Searle A, Ranger E, Zahra J, Tibbitts B, Page A, Cooper A (2019). Engagement in e-cycling and the self-management of type 2 diabetes: a qualitative study in primary care. *BJGP Open*, 3(2): bjgpopen18X101638.
90. Tabacof L, Dewil S, Herrera J, Cortes M, Putrino D (2021). Adaptive Esports for People With Spinal Cord Injury: New Frontiers for Inclusion in Mainstream Sports Performance. *Frontiers in Psychology*, 12:612350.
91. Everesting(TM). Fiendishly simple, yet brutally hard. Everesting is the most difficult climbing challenge in the world [Available from: <https://everesting.cc/virtual/>].
92. Tuyls K, Omidshafiei S, Muller P, Wang Z, Connor J, Hennes D, Graham I, Spearman W, Waskett T, Steel D (2021). Game plan: what AI can do for football, and what football can do for AI. *Journal of Artificial Intelligence Research*, 71: 41–88.
93. Mordor Intelligence. Sports analytics market – Growth, trends, covid-19 impact, and forecasts (2022–2027) [Available from: <https://www.mordorintelligence.com/industry-reports/sports-analytics-market>].
94. Brady C, Tuyls K, Omidshafiei S (2021). *AI for sports*. Milton: CRC Press.
95. Robertson C (2022). How artificial intelligence ‘blew up’ tennis. 1 June, BBC News.
96. Bai Z, Bai X (2021). Sports big data: management, analysis, applications, and challenges. *Complexity*, 2021: 6676297.
97. Foster G, O’Reilly N, Naidu Z (2021). Playing-side analytics in team sports: multiple directions, opportunities, and challenges. *Frontiers in Sports and Active Living*, 3 :671601.
98. Abbas N M (2019). NBA data analytics: changing the game. *Towards Data Science*, 14 August.
99. Ajadi T, Ambler T, Dhillon S, Hanson C, Udawadia Z, Wray I (2022). *Riding the challenge: annual review of football finance 2021*. Manchester: Deloitte – Sports Business Group.
100. Fonseca N, Marques M C, Esteves D (2022). Data ownership in individual sports: narrative review. *Journal of Physical Education and Sport*, 22(5): 1214–1218.
101. Patel D, Shah D, Shah M (2020). The intertwine of brain and body: a quantitative analysis on how big data influences the system of sports. *Annals of Data Science*, 7(1): 1–16.
102. Luczak T, Burch R, Lewis E, Chander H, Ball J (2020). State-of-the-art review of athletic wearable technology: what 113 strength and conditioning coaches and athletic trainers from the USA said about technology in sports. *International Journal of Sports Science & Coaching*, 15(1): 26–40.
103. Paul G, Irvine J (2014). Privacy implications of wearable health devices. *Proceedings of the 7th International Conference on Security of Information and Networks*, 117–121.
104. Casto K V (2022). Tracking women’s reproductive data in sport: practical limitations, perils and pitfalls. *Sports Medicine*, 52: 1723–1727.
105. Göbel F, Kurzhals K, Raubal M, Schinazi V R (2020). Gaze-aware mixed-reality: addressing privacy issues with eye tracking. *CHI 2020 Workshop on Exploring Potentially Abusive Ethical, Social and Political Implications of Mixed Reality in HCI (CHI 2020)*.
106. Lidynia C, Brauner P, Ziefle M (2017). A step in the right direction – understanding privacy concerns and perceived sensitivity of fitness trackers. *International Conference on Applied Human Factors and Ergonomics*. Springer, 42–53.
107. Dietrick T A (2020). Biometric monitoring devices: modern solutions to protecting athletes’ data privacy. *Pittsburgh Journal of Technology Law & Policy*, 21: 61.
108. Australian Academy of Science (2022). *Getting ahead of the game: athlete data in professional sport*. Canberra: Australian Academy of Science.
109. Roy E (2015). *When we design for disability, we all benefit*. TEDx Mid Atlantic.
110. Grobler L, Ferreira S, Terblanche E (2015). Paralympic sprint performance between 1992 and 2012. *International Journal of Sports Physiology and Performance*, 10(8): 1052–1054.
111. The Netherlands Sports Council (2022). *Equivalent and inclusive – Advice on the continued development of Paralympic sport*. Den Haag: The Netherlands Sports Council.
112. Evans Ogden L (2016). *Reverse integration – Doing disability sport differently*. Canberra: The Inclusion Club.
113. Pokrywka A, Kaliszewski P, Majorczyk E, Zembroń-Łacny A (2014). Review GENES IN SPORT AND DOPING. *Biology of Sport*, 30(3): 155–161.

114. Joyner M J (2019). Genetic approaches for sports performance: how far away are we? *Sports Medicine*, 49(2): 199–204.
115. Naureen Z, Perrone M, Paolacci S, Maltese P E, Dhuli K, Kurti D, Dautaj A, Miotto R, Casadei A, Fioretti B (2020). Genetic test for the personalization of sport training. *Acta Bio Medica: Atenei Parmensis*, 91(Suppl 13).
116. Vlahovich N, Hughes D C, Griffiths L R, Wang G, Pitsiladis Y P, Pigozzi F, Bachl N, Eynon N (2017). Genetic testing for exercise prescription and injury prevention: AIS-Athlome consortium-FIMS joint statement. *BMC Genomics*, 18(8): 5–13.
117. Varley I, Patel S, Williams A G, Hennis P J (2018). The current use, and opinions of elite athletes and support staff in relation to genetic testing in elite sport within the UK. *Biology of Sport*, 35(1): 13–19.
118. Vlahovich N, Fricker P A, Brown M A, Hughes D (2017). Ethics of genetic testing and research in sport: a position statement from the Australian Institute of Sport. *British Journal of Sports Medicine*, 51(1): 5–11.
119. Australian Media and Communications Authority (2022). Trends and developments in viewing and listening 2020–21. Canberra: Australian Media and Communications Authority.
120. Australian Media and Communications Authority (2022). What audiences want – Audience expectations for content safeguards. A position paper for professional content providers. Canberra: Australian Media and Communications Authority .
121. Chan C (2022). Fox Sports extend deal with Twitter for FIFA World Cups. 11 January, Hollywood Reporter.
122. Hutchins B, Li B, Rowe D (2019). Over-the-top sport: live streaming services, changing coverage rights markets and the growth of media sport portals. *Media, Culture & Society*, 41(7): 975–994.
123. Okast blog (2018). How OTT platforms and livestreaming are changing the sport industry. Paris: Okast.
124. Vann P, Bruns A, Harrington S (2019). 'Transmedia social platforms: livestreaming and transmedia sports'. In: *The Routledge Companion to transmedia studies*. Routledge.
125. Australian Open (2022). Fortnite returns to the Australian Open. Competitive gaming event to kick off AO men's finals day [Media Release]. Melbourne: Australian Open, 20 January.
126. World Intellectual Property Organization (2022). Broadcasting & media rights in sport. Geneva: World Intellectual Property Organization.
127. Play by the Rules (2016). Gambling on sport – Is it a problem? Canberra: Play by the Rules.
128. Sport Integrity Australia (2020). Statement of intent. Canberra: Sport Integrity Australia.
129. Hing N (2014). Sports betting and advertising. Melbourne: Australian Gambling Research Centre.
130. Australian Sports Commission (2021). AusPlay Focus: Ongoing impact of COVID-19 on sport and physical activity participation. Canberra: Australian Sports Commission
131. Rosly M M, Jai N A M, Abd Razak N A, Dewitt D (2022). Exergaming training experience for children: a systematic review of qualitative assessments with meta-synthesis. *IEEE Transactions on Games*.
132. Benzing V, Spitzhüttl J, Siegwart V, Schmid J, Grotzer M, Heinks T, Roebbers C M, Steinlin M, Leibundgut K, Schmidt M (2020). Effects of cognitive training and exergaming in pediatric cancer survivors – A randomized clinical trial. *Medicine and Science in Sports and Exercise*, 52(11): 2293.
133. Guo G, Segal J, Zhang H, Xu W (2019). ARMove: a smartphone augmented reality exergaming system for upper and lower extremities stroke rehabilitation: demo abstract. *Proceedings of the 17th Conference on Embedded Networked Sensor Systems*, 384–385.
134. da Silva Alves R, Lunes D H, de Carvalho J M, Menezes F d S, Silva A M, Borges J B C, Carvalho L C (2018). Effects of exergaming on quality of life in cancer patients. *Games for Health Journal*, 7(6): 385–392.
135. Fister Jr I, Salcedo-Sanz S, Iglesias A, Fister D, Gálvez A, Fister I (2021). New perspectives in the development of the artificial sport trainer. *Applied Sciences*, 11(23): 11452.
136. International Olympic Committee (2021). IOC makes landmark move into virtual sports by announcing first-ever Olympic Virtual Series. Lausanne: International Olympic Committee.
137. Nicolliello M (2021). The new agenda 2020+ 5 and the future challenges for the Olympic movement. *Athens Journal of Sports*, 8(2): 121–140.
138. International Olympic Committee (2020). Olympic Agenda 2020+5. International Olympic Committee.
139. Action Audio. Making sports broadcasts accessible to people living with blindness or low vision (cited Available from: <https://action-audio.com/>).
140. Cambridge Dictionary (2022). Esports. Cambridge Dictionary Online (www.dictionary.cambridge.online).
141. Burgin N (2021). Esports. What are esports? Canberra: Clearinghouse for Sport.
142. Esports.net. Is esports a sport? Countries where sports is considered a sport (Available from: <https://www.esports.net/wiki/guides/is-esports-a-sport/>).



143. Parry J (2019). E-sports are not sports. *Sport, Ethics and Philosophy*, 13(1): 3–18.
144. Tarrant J (2018). E-sports in talks with Paris 2024 over demonstration event. Tokyo: Reuters.
145. Hawthorne M (2019). Esports are up high, down under in Australia! 14 March, Esports.net.
146. Australian Esports Association. Australian Esports Association supporting esports in Australia [Available from: <http://www.aesa.org.au/>].
147. Australian Esports League. AEL – Community focused esports [Available from: <https://ael.org.au/>].
148. PwC (2021). Australian entertainment and media outlook 2022–2026. Sydney: PwC.
149. KEEPU (2022). The E-League is back and wants you to be its next big sports star. 17 March, [Available from: <https://keepup.com.au/news/the-e-league-is-back-and-wants-you-to-be-its-next-big-esports-star/>].
150. NewZoo (2022). Global esports and live streaming market report 2022: key trends, market sizing and forecasts. Amsterdam: NewZoo.
151. esports.net. Esports crypto: everything you need to know [Available from: <https://www.esports.net/crypto/>].
152. Ausgabe. Urban sports – areas designed to get people active and make exercise fun [cited Available from: <https://playground-landscape.com/en/article/2649-urban-sports-areas-designed-to-get-people-active-make-exercise-fun.html>].
153. Kidder J L (2017). Parkour and the city: risk, masculinity, and meaning in a postmodern sport. Rutgers University Press.
154. Højbjerg Larsen S (2021). Parkour: playing the modern, accelerated city. *Journal of the Philosophy of Sport*, 48(1): 26–44.
155. Kilberth V, Schwier J (2019). Skateboarding between subculture and the Olympics: a youth culture under pressure from commercialization and sportification. transcript Verlag.
156. Astell-Burt T, Hartig T, Eckermann S, Nieuwenhuijsen M, McMunn A, Frumkin H, Feng X (2021). More green, less lonely? A longitudinal cohort study. *International Journal of Epidemiology*, 51(1): 99–110.
157. Astell-Burt T, Feng X (2021). Time for 'Green' during COVID-19? Inequities in green and blue space access, visitation and felt benefits. *International Journal of Environmental Research and Public Health*, 18(5): 2757.
158. Australian Sports Commission (2022). AusPlay survey [Participation by activity]. [Dataset] 29 April.
159. Sherifi M (2022). The BEST adventure races in the world. 21 March, An Adventurous World.
160. Davis J (2020). 5 awesome first time adventure races in the US. 8 December, Rad Season.
161. Cater C, Funk D, Low T (2018). Adventure racing and active lifestyles. *Annals of Leisure Research*, 21(5): 605–611.
162. Havas Australia and YouGov (2022). National values in 2022: a Havas Australia and YouGov research report into the nation's evolving perspective on Australian values. Sydney: Havas Labs and YouGov.
163. Australian Bureau of Statistics (2022). Australian Census. Canberra: Australian Bureau of Statistics.
164. Australian Bureau of Statistics (2022). Estimates and projections of the Aboriginal and Torres Strait Islander population for 2006 to 2031. Canberra: Australian Bureau of Statistics.
165. Australian Government (2021). Intergenerational report. Canberra: Treasury Australian Government.
166. Gibbs L, Block K (2017). Promoting social inclusion through sport for refugee-background youth in Australia: analysing different participation models. *Social Inclusion*, 5(2): 91–100.
167. Connect UNE (2020). Grant to boost migrant and refugee participation in sport [Media Release]. Armidale University of New England, 2 July.
168. Football Australia (2021). Culturally and linguistically diverse communities: factsheet. Melbourne: Football Australia.
169. Brettig D (2022). 'Look around you': cricket's leadership too white, too male. 6 September, The Age.
170. ORC International (2018). Indigenous Australians' participation in sports and physical activities Part 2 Qualitative research (ACT Report). Melbourne: ORC International
171. Péloquin C, Doering T, Alley S, Rebar A J A, Health N Z J O P (2017). The facilitators and barriers of physical activity among Aboriginal and Torres Strait Islander regional sport participants. *Australian and New Zealand Journal of Public Health*, 41(5): 474–479.
172. Fox Sports (2022). Huge growth of Aussie love for women's sport revealed in new research. 7 March, Fox Sports News.
173. International Olympic Committee (2022). Gender equality and inclusion report 2021. Lausanne: International Olympic Committee.
174. May C (2019). Women in sport. Media coverage and representation. Canberra: Clearinghouse for Sport.
175. May C (2021). Women in sport. Professionalisation and pay equity. Canberra: Clearinghouse for Sport.

176. Football Australia [2021]. Matildas bring in largest TV audience of women's team sport in Australian history. Football Australia Media.
177. Fox Sports [2022]. Huge growth of Aussie love for women's sport revealed in new research. Fox Sports News.
178. Harrison R (2019). Women's sport coverage - are we there yet? 25 September, BroadAgenda.
179. Carman M, Farrugia C, Bourne A, Power J, Rosenberg S (2020). Research matters: how many people are LGBTIQ?: a fact sheet by Rainbow Health Victoria. Melbourne: La Trobe University.
180. Drummond M, Elliot S, Drummond C, Lewis L, Prichard I, Bevan N, Pennesi J (2019). Inclusive sport practices: a report for Inclusive Sport SA. Adelaide: SHAPE Research Centre, Flinders University.
181. Pride in Sports [2022]. Current members – Pride in Sports. Surry Hills: Pride in Sports.
182. Australian Institute of Health and Welfare [2022]. People with disability in Australia 2022. Canberra: Australian Institute of Health and Welfare Australian Government.
183. Aitchison B, Rushton A B, Martin P, Barr M, Soundy A, Heneghan N R (2021). The experiences and perceived health benefits of individuals with a disability participating in sport: a systematic review and narrative synthesis. *Disability and Health Journal* 15(1): 101164.
184. Activity Alliance [2021]. Annual disability and activity survey 2020–2021. Full report – February 2021.
185. Deghansai N, Lemez S, Wattie N, Pinder R A, Baker J (2020). Understanding the development of elite parasport athletes using a constraint-led approach: considerations for coaches and practitioners. *Frontiers in Psychology*, 11: 502981.
186. Jewell C (2008). Technology, innovation and grit: faster, higher, stronger in disabled sports. *World Intellectual Property Organization (WIPO) Magazine*, August 2008.
187. Price J (2021). Can Paralympic long jumpers break Olympic world records. Team USA: U.S. Paralympic Track & Field, 20 January 2021.
188. Mauerberg-deCastro E, Campbell D F, Tavares C P (2016). The global reality of the Paralympic movement: challenges and opportunities in disability sports. *Motriz: Revista de Educação Física*, 22: 111–123.
189. International Paralympic Committee [2022]. The first paralympics [Available from: <https://www.paralympic.org/ipc/history>].
190. International Paralympic Committee [2022]. Double duty: athletes who competed at both the Olympic and Paralympic Games. International Paralympic Committee, 23 June 2022.
191. Gentina E, Parry E (2021). Generation Z: when it comes to behaviour, not all digital natives look alike. 12 April, *The Conversation*.
192. Australian Institute of Health and Welfare [2022]. Australia's children. Canberra: Australian Institute of Health and Welfare Australian Government.
193. McCarthy N, Hall A, Shoesmith A, Sutherland R, Hodder R, Campbell E, Nathan N (2021). Australian children are not meeting recommended physical activity levels at school: analysis of objectively measured physical activity data from a cross sectional study. *Preventive Medicine Reports*, 23: 101418.
194. Department of Health and Aged Care [2021]. About physical activity and exercise. Canberra: Australian Government.
195. Rudd J (2015). Can't throw, can't catch: Australian kids are losing that sporting edge. 29 January, *The Conversation*.
196. Barnett L, Hardy L, Lubans D, Cliff D, Okely A, Hills A, Morgan P, Activity P, Child S B S o t A, Network A O R (2013). Australian children lack the basic movement skills to be active and healthy. *Health Promotion Journal of Australia*, 24(2): 82–84.
197. Tester G, Ackland T R, Houghton L (2014). A 30-year journey of monitoring fitness and skill outcomes in physical education: lessons learned and a focus on the future. *Advances in Physical Education*, 4: 127–137.
198. American Physical Therapy Association (2017). Physical literacy decline in children leads to adverse effects in adults. 30 June, APTA.
199. Australian Bureau of Statistics [2016]. Historical population: a product containing a wide range of historical demographic data going back as far, where possible, to the beginnings of European colonisation. Canberra: Australian Bureau of Statistics
200. Australian Bureau of Statistics [2017]. 2071.0 – Census of Population and Housing: reflecting Australia - Stories from the Census, 2016. Canberra: Australian Bureau of Statistics.
201. Riazi N, Faulkner G (2020). Free-range kids: why a child's freedom to travel and play without adult supervision matters. 30 June, *The Conversation*.
202. Outdoor Play Canada [2022]. The position statement on active outdoor play. Ottawa, Canada: Outdoor Play Canada.
203. Australian Sports Commission (2017). Addressing the decline in sport participation in secondary schools. Canberra: Australian Sports Commission.



204. Boston Consulting Group (2017). Intergenerational review of Australian sport. Canberra: Australian Sports Commission.
205. Doré I, Sabiston C M, Sylvestre M-P, Brunet J, O'Loughlin J, Abi Nader P, Gallant F, Bélanger M (2019). Years participating in sports during childhood predicts mental health in adolescence: a 5-year longitudinal study. *Journal of Adolescent Health*, 64(6): 790–796.
206. Ishihara T, Nakajima T, Yamatsu K, Okita K, Sagawa M, Morita N (2020). Relationship of participation in specific sports to academic performance in adolescents: a 2-year longitudinal study. *Scandinavian Journal of Medicine*, 30(8): 1471–1482.
207. Warburton D E, Nicol C W, Bredin S S (2006). Health benefits of physical activity: the evidence. *Canadian Medical Association Journal*, 174(6): 801–809.
208. Scott R, Cause Integration (2016). Get ready for Generation Z. 28 November, Forbes.
209. Singleton A, Rasmussen M L, Halafoff A, Bouma G D (2019). Australia's Generation Z study: project report. Melbourne: Deakin University and Monash University.
210. Coldwell-Neilson J (2022). Generation Z: getting ready for the future of work. Deakin University.
211. Smith R, Spaaij R, McDonald B (2019). Migrant integration and cultural capital in the context of sport and physical activity: a systematic review. *Journal of International Migration and Integration*, 20(3): 851–868.
212. Ferdinand A, Kelaher M, Paradies Y (2013). Mental health impacts of racial discrimination in Victorian culturally and linguistically diverse communities: full report of the localities embracing and accepting diversity (LEAD) experiences of racism survey. Foundation Victorian Health Promotion.
213. Farquharson K, Spaaij R, Gorman S, Jeanes R, Lusher D, Magee J (2019). 'Managing racism on the field in Australian junior sport'. In: *Relating worlds of racism*. Palgrave Macmillan, 165–190.
214. Gardiner G (2020). 'Black' bodies — 'white' codes: Indigenous footballers, racism and the Australian Football League's racial and religious vilification code'. In: *Sport and Postcolonialism*. Routledge.
215. Storr R (2021). 'The poor cousin of inclusion': Australian sporting organisations and LGBT+ diversity and inclusion. *Sport Management Review*, 24(3): 410–420.
216. Sukkar J (2021). Racism in sport: so where to from here? *Dungala Kaiela Oration*, University of Melbourne.
217. O'Shea M, Mazxwell H, Newitt R, Pearce S (2022). You can't be what you can't see: the benefits for and the pressures on First Nations sportswomen. 11 August, *The Conversation*.
218. Majendie M (2015). 'Sunshine super girl' Goolagong Cawley defied prejudice to become a star. 30 January, CNN
219. Australian Human Rights Commission (2021). Racism. Nobody wins. Guide to addressing spectator racism in sports (2021). Sydney: Australian Human Rights Commission.
220. Gardiner G (1997). Racial abuse and football: the Australian Football League's racial vilification rule in review. *Sporting Traditions*, 14(1): 3–25.
221. Australian Sports Commission (2022). Participation Design Toolkit. Drivers and barriers of participation: framework of key elements organisations can address to overcome barriers to participation. Canberra: Australian Sports Commission.
222. Wells K R, Jeacocke N A, Appaneal R, Smith H D, Vlahovich N, Burke L M, Hughes D (2020). The Australian Institute of Sport (AIS) and National Eating Disorders Collaboration (NEDC) position statement on disordered eating in high performance sport. *British Journal of Sports Medicine*, 54(21): 1247–1258.
223. Wood J, Howman D, Murrhy R (2018). Report of the review of Australia's sports integrity arrangements. Canberra: Commonwealth of Australia.
224. Queensland Government Statistician's Office. Australian gambling statistics: total gambling expenditure (nominal value) by state and territory 1975–2019 (table) (Available from: <https://www.qgso.qld.gov.au/statistics/theme/society/gambling/australian-gambling-statistics>).
225. Nair A, Tetrault-Farber G, Mulvenney N (2022). ISU to raise minimum age for senior competitions to 17. 7 June, Reuters.
226. Adair D (2015). Athletes of influence – The reality of sports role models. UTS- Media Release.
227. International Olympic Committee (2021). IOC extends opportunities for athlete expression during the Olympic Games Tokyo 2020. 2 July, International Olympic Committee.
228. Global Athlete. Global athlete – By athletes, for athletes (Available from: <https://globalathlete.org/>).
229. Nguyen S. (2018) Australian sports stars – the next eco-warriors? Deakin University. (Available from: <https://this.deakin.edu.au/society/australian-sports-stars-the-next-eco-warriors>).
230. International Olympic Committee (2020). Olympic movement accelerates transition to sustainability. 30 November, IOC News.
231. International Olympic Committee (2022). IOC approves strategic framework on human rights. 14 September, sportanddev.org.

232. Nichol M, Kawai K (2021). The regulatory space of collective labour relations in Australian team sports. *Australian and New Zealand Sports Law Journal*, 14(1): 83–107.
233. Dingle G, Dickson G, Stewart B (2022). Major sport stadia, water resources and climate change: impacts and adaptation. *European Sport Management Quarterly*: 1–23.
234. Marcellin F (2022). This new club is automated, staffless, climate neutral and only offers self-powered equipment. 18 July, *Sports Management*.
235. International Olympic Committee (2021). Olympic agenda 2020 highlights. Lausanne: International Olympic Committee.
236. United Nations (2018). UN and Tokyo 2020, leverage power of Olympic Games in global sustainable development race. 14 November, *United Nations News*.
237. Halog A (2022). In a year of sporting mega-events, the Brisbane Olympics can learn a lot from the ones that fail their host cities. 15 August, *The Conversation*.
238. Zahir A (2021). Militarization, power projection, and territorial disputes in the South China Sea. *CGS Issue Brief*, (1).
239. Gleditsch N P, Wallensteen P, Eriksson M, Sollenberg M, Strand H (2002). Armed conflict 1946–2001: a new dataset. *Journal of Peace Research*, 39(5): 615–637.
240. Davies S, Pettersson T, Öberg M (2022). Organized violence 1989–2021 and drone warfare. *Journal of Peace Research*, 59(4): 593–610.
241. Institute for Economics and Peace (2022). *Global Terrorism Index 2022: measuring the impact of terrorism*. Sydney: Institute for Economics and Peace.
242. International Olympic Committee (2022). Tokyo 2020 Organising Committee publishes final balanced budget. Lausanne: International Olympic Committee.
243. Friedmann R R (2017). How can we better protect crowds from terrorism? 2 June, *The Conversation*.
244. Dubinsky Y (2019). From soft power to sports diplomacy: a theoretical and conceptual discussion. *Place Branding and Public Diplomacy*, 15(3): 156–164.
245. Raeissadat S M T, Mottaghi A, Sajjadi S N, Rabiei H (2021). The geopolitics of sport and diplomacy of neighborhood relations in the 2022 World Cup in Qatar [Case study: Iran and the Persian Gulf Arab States]. *International Quarterly of Geopolitics*, 17(64): 352–334.
246. English P, Murray R (2022). North Korea and the ‘Peace Games’: media representations of sport and politics at the 2018 winter olympics. *Continuum*, 36(1): 117–134.
247. Bureau of Meteorology (2022). *Climate change – Trends and extremes: Australian climate variability & change – Time series graphs*. Canberra: Bureau of Meteorology.
248. CSIRO, Bureau of Meteorology (2020). *The State of the Climate 2020*. Canberra: CSIRO & Bureau of Meteorology.
249. Schneider S, Mücke H-G (2021). Sport and climate change – How will climate change affect sport? *German Journal of Exercise and Sport Research*.
250. The Climate Institute (2015). *Sport and climate impacts: how much heat can sport handle?* The Climate Insitute.
251. World Health Organization (2011). *Public health advice on preventing health effects of heat. New and updated information for different audiences*. Geneva: World Health Organization.
252. Henriques-Gomes L (2020). Sports matches and festivals cancelled: the impact of Australia’s bushfire smoke on its major events. 7 January, *The Guardian*.
253. Rice M, Weisbrot E, Bradshaw S, Steffen W, Hughes L, Bambrick H, Charlesworth K, Hutley N, Upton L (2021). *Game, set match: calling time on climate inaction*. Canberra: Climate Council of Australia.
254. Australian Conservation Foundation, Monash Climate Change Communication Research Hub (2020). *Love 40 degrees? Climate change, extreme heat and the Australian Open*. Melbourne: Monash University
255. Hytner M, Howcroft J (2020). Smoke plays havoc as Australian Open qualifier suffers coughing fit. 14 January, *The Guardian – Australia*.
256. Fox Sports (2020). The Australian Open has released its new air quality policy. The GOAT backs it. 18 January, *Fox Sports*.
257. Murfree J, Brison N (2022). Heat risk and young athletes — Rising temperatures lead to lawsuits and environmental injustice. 19 July, *The Conversation*.
258. Nicholls N (2005). Climate variability, climate change and the Australian snow season. *Australian Meteorological Magazine*, 54(3): 177–185.
259. Pepler A S, Trewin B, Ganter C (2015). The influences of climate drivers on the Australian snow season. *Australian Meteorological and Oceanographic Journal*, 65(2): 195–205.
260. Hannam P (2017). Australia’s ski industry on a downhill slope. August 5, *Sydney Morning Herald*.
261. Macleod K (2016). *Snow fall at Spencers Creek, 1954–2016*. SBS Interactive.

262. Australian Sports Foundation (2020). Impact of COVID-19 on community sport. Canberra: Australian Sports Foundation.
263. Elliott S, Drummond M J, Prichard I, Eime R, Drummond C, Mason R (2021). Understanding the impact of COVID-19 on youth sport in Australia and consequences for future participation and retention. *BMC Public Health*, 21(1): 448–448.
264. Smith K F, Goldberg M, Rosenthal S, Carlson L, Chen J, Chen C, Ramachandran S (2014). Global rise in human infectious disease outbreaks. *Journal of the Royal Society Interface*, 11(101): 20140950.
265. Marani M, Katul G G, Pan W K, Parolari A J (2021). Intensity and frequency of extreme novel epidemics. *Proceedings of the National Academy of Sciences*, 118(35): e2105482118.





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