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4IR AND THE CURRENT AND FUTURE REGULATION OF GAMBLING IN SOUTH AFRICA

The Fourth Industrial Revolution (4IR) is having, and will continue to have, a significant and multi-faceted impact on the gambling industry in South Africa, raising a wide scope of new challenges and demands for regulators. Our assessment of these impacts includes a scoping of the legal, policy, and regulatory environments, a scan of the technological dynamics of the 4IR and how these impact on the gambling sector, and in-depth interviews with a wide range of stakeholders. From a synthesis of these core knowledge resources, we have identified key issues for regulators.

The 4IR paradigm is dynamic, and at its conceptual core is the notion of change – the interplay between technological change, economic change, social changes, and political change. The exponential growth of computing power and internet connectivity continues to drive rapid global technological development, which in turn acts as a driver of social and economic change. The overarching implication for regulators, including policy makers and legislators, is that change is becoming more rapid, and regulation needs to become more adaptable.

With respect to the regulation of the gambling sector, the advancement of 4IR technologies raises multiple issues. These include, amongst others, the regulation of data processing and the protection of data privacy; the appropriate and ethical use of technology by players, gambling providers and regulators; the collection of revenue from gambling services and systems; and jurisdictional extra-territoriality for regulating and enforcing online interactive gambling.

One of the concerns regarding the penetration of 4IR-related technologies on gambling in South Africa is that online technologies are available through mobile and tablet devices, effectively promoting access to gambling services anywhere within South Africa. The key implications of the 4IR on the regulation of gambling in South Africa are: one, its impact on the destination model and the role of the NGB in protecting society from the stimulation of demand for gambling; two, preventing illegal online gambling; and three, controlling and responding to problem gambling as a result of the use of such technologies. To this end, the NGB conducted a study to understand the current and potential future penetration of 4IR technologies on gambling in South Africa, and the effect on the regulation of the sector therein. The analysis presents a set of key issues and recommendations based on a synthesis of the desktop study and interview data analysis, focussing on the primary aim of the report, i.e. to understand the potential impact of the fourth industrial revolution on the gambling products and services offered in the gambling industry in South Africa, and whether this impacts on the current South African regulatory model, and if so, what that impact would be.

The regulation of gambling in the Fourth Industrial Revolution

It is broadly recognised that the 4IR is set to have a major impact on every sector of the economy and of society. In South Africa, industries across the country are considering the ways in which new technological developments may both improve business practice and require new regulatory responses to ensure the use of technology is fair, responsible and takes into account South Africa's broader socio-economic objectives. The gambling industry, both in South Africa and globally, is no stranger to technological innovation. Indeed, the development and use of new technologies to enhance player experience is a key driver of competition and growth in the sector.

However, these new technologies also create new regulatory challenges. One of the major challenges in this regard is to mitigate the over-stimulation of the latent demand for gambling which is, in many respects, inherent in technologies that seek to create immersive player experiences, such with augmented reality and virtual reality technologies. In addition, high-end gambling products and activities tend to involve multiple technologies, designed and produced by various companies, which come together to create a single player experience.

Within such contexts, differentiating the various hardware and software products and systems at play in any one gambling activity in order to monitor their use in national systems or to undertake standardisation and quality assessments, becomes much more complex. As with other sectors, an agile and future-proof regulatory response to the changes that the 4IR is having, and will continue to have, on the gambling sector will need to be developed.

Historically, the South African gambling sector has adopted a destination and sumptuary regulatory model which seeks to prevent overstimulation and mitigate the negative social impacts of gambling, for example by limiting the number of casino licenses that can be granted (GRC, 2010). With the adoption of increasingly more sophisticated gaming technologies in South Africa, various regulatory measures have been considered, including licensing for certain interactive gambling activities (National Gambling Amendment Act 2008) and the roll out of a digital monitoring system to track such activities nationally (National Gambling Amendment Bill 2018).

These efforts to modernise the regulatory framework of the gambling sector have been met with various pushbacks, resulting in a piecemeal approach to regulation. The 2008 National Gambling Amendment Act which sought to regulate interactive gambling, for example, has not come into effect or been implemented. According to the National Gambling Policy of 2016 this is because the Amendment Act does not provide adequate provisions to protect minors from the over-stimulation of the latent demand for gambling.

Other pushbacks to modernising the regulation of gambling in South Africa have come from the provinces and the lack of effective co-ordination between the various national and provincial regulatory authorities. Under Schedule 4 of the Constitution of the Republic of South Africa (Act 108 of 1996), gambling is listed as a functional area of both national and provincial competence, meaning that both national and provincial legislatures have powers to legislate and regulate gambling within their respective jurisdictions.

The development of new laws and policies to regulate emerging and advanced technologies, such as those of the 4IR, often falls behind the pace at which these new technologies are developed. One of the ways in which regulators have sought to overcome this is by looking at existing legal provisions which may support conducting a social impact assessment of new technologies before they are deployed in society.

4IR technologies in the gambling sector

The Fourth Industrial Revolution, and the multiple technology platforms that act as its main drivers, are generating rapid and fundamental changes within the gambling sector in South Africa, many of which require regulatory responses. Our review of 4IR technologies in the gambling sector covers the major technological platforms that are driving these changes, including artificial intelligence, blockchain, virtual reality, and social media, amongst others.

Did you know that gambling is a game of chance? Sometimes you win, sometimes you don't.

Artificial intelligence

'Artificial Intelligence' (AI) refers to digital systems that display intelligent behaviour by responding, with some degree to autonomy, to inputs (whether data, sensory or otherwise), in working to achieve specific goals. AI systems can be embedded in both software (such as facial recognition technology) and hardware (such as self-driving cars and robotics).

Operationally casinos could potentially introduce greater efficiency through the use of AI technologies. These include better customer service based on AI technologies making customer interaction automated but more human-like, through the use of big data to make personalized service offerings to potential clients. Consequently, this also creates the potential for job-losses, with machine based dealers and security operators potentially proving to be more efficient and attentive than their human counterparts. This ultimately cuts long terms human resource costs, drives profit and makes the business of operating a casino more efficient and highly attractive to investors.

The addictive nature of gambling could be exploited through the use of big data to understand user behaviour and design gaming and algorithms to shift the odds in the favour of casinos and against users. This would lead to an increase in profits for operators, implying a greater sense of responsibility on regulators to enforce standards against the unfair practice and opportunity

AI systems can be trained to develop facial recognition capabilities that far exceed those on non-AI based systems. Facial recognition is one of the most widely used applications of AI globally, largely integrated into CCTV cameras. There is little information in the literature on the extent to which casinos in South Africa utilise AI-powered facial recognition technologies. A key stakeholder indicated that casinos in South Africa are monitoring the potential of AI technologies for facial recognition in casinos, and was aware of only one casino where such technology was in use – in particular to link facial recognition to the casino's security data system and security management system.

Another stakeholder reflected on the technical role of AI for bookmakers, centred on the need to develop more advanced gaming intelligence than punters (or risk systematically losing bets and going out of business). More broadly, AI has the potential to initiate a fundamental shift in the market dynamics, culture, and practices of gambling.

This signals a type of escalating technological competition in the relationship between gambling operators and punters, in a manner similar to the role that AI has played in the financial trading sector. Like financial trading, gambling involves the prediction of risk and the investment of resources in response to risk predictions. Advanced AI systems can, in narrow applications, out-perform human assessments of risk, and allocate resources more effectively. The growth of similar applications in the gambling sector would initiate an escalation of the computational powers available to both punters and operators. For operators, such technologies may open up opportunities to become more profitable. For punters, it may become possible to identify weaknesses within gambling systems that may be exploited. This may be particularly pronounced in the area of sports betting, where real-world data may be effectively processed by AI systems to reach more accurate sporting odds than bookmakers who do not use AI systems to determine their own odds portfolios. However, the use of such AI technologies may be difficult to regulate.

Augmented reality and virtual reality

Virtual games, and even virtual casinos, are made possible by virtual reality (VR). Advancements in software and hardware capabilities have led to the rise of VR games such as slots, blackjack, and roulette. The advantages to gamblers include the potential to have a gambling experience from any online point, to participate in real-time multiplayer games, to choose avatars or characters in virtual worlds, and to integrate chat and voice functionalities with gaming. For operators, it is possible to modify or improve games without investing in physical infrastructure. It may be the case that virtual reality grows as a gambling modality in future. Stakeholder interview participants reported that AR has not been utilised in the gambling sector in South Africa, although its future potential was highlighted as significant.

Augmented reality (AR) uses similar technology to virtual reality, but overlays virtual reality sensory information (audio and video) over the real world. This could make it possible to sit at a table opposite a number of other real human players, in realistic virtual casino environment, with an augmented reality dealer. However, the technology for augmented reality is still developing, and is not yet widely used in the gambling sector. Given further technological development, AR might also be a growing modality for gambling.

However, the regulation of VR and AR in gambling faces several technology-specific challenges, and regulators require time,

research, and consultation before approving new VR and AR applications. Such applications are distinct from live gambling, in that different components of the game can potentially take place in different jurisdictions, and may operate in a grey area between live gambling and online gambling that challenges regulators to become more definitive in their responses. In VR applications it becomes necessary to verify to regulators that it is a live game taking place – otherwise the application could be abused to provide illegal 'online' gambling rather than a virtual version of legal 'live' gambling. The distinctions between these modalities are fine, and challenge regulators to be more specific in the parameters under which VR and AR are legal in South Africa.

Block-chain and transactions

'Block-chain' technology uses cryptography and a distributed ledger to act as decentralised digital archive to record and verify online transactions and events while storing them in a secure global database. Blockchain technology, particularly in its manifestation as crypto assets, makes secure transactions possible without the need for banks or other third parties. One example in the gambling sector is Bitbook, a platform based on the Ethereum blockchain that allows the use of different cryptocurrencies on gambling sites.

The use of crypto assets for gambling has several advantages for players. Crypto assets are difficult for financial authorities to trace, and thus may offer advantages in terms of tax and international transfers. They provide anonymity for users and transactions. There is no transaction delay or transaction cost. These advantages may see increased use of crypto assets in future online gambling. One of the major challenges raised by the use of crypto-assets in gambling is that of financial regulation. Crypto-asset transactions are difficult to trace, monitor, regulate, or tax. Crypto assets are not currently recognised by the South African state as being legal tender. Yet, at the same time, they are increasingly used for financial transactions. The response of the Reserve Bank and other institutions towards this tension between regulation and usage will impact on the gambling sector.

Data management

Data management is one of the core functions of the NGB, and one in which the 4IR creates both potential solutions and new challenges. From an industry perspective, the degree to which information about clients is leveraged and put to use within service offerings is critical for improving customer experience and attitudinal equity associated to the brand or business. Real-time responsiveness is a critical factor within the gaming industry, not only delivering a better user experience, but also opening additional revenue streams through leveraging user information to deliver value added services to a relatively captured audience.

With the data-intensification of gambling, issues of data privacy become increasingly important. Key issues affecting regulation include the need for boundaries with respect to the ways in which consumer data can be collected and processed, means for consent for data gathering and processes, and clear guidelines for the application of national data regulations to the gambling sector, in line with the provisions of POPIA.

Online Gambling

Online gambling, with the exception of licenced online sports betting, is a statutory offence in terms of sections 11 and 15 of the NGA 2004. However, regulators are under increasing pressure to a) define online gambling and b) enforce the prevention of online gambling. This is due to the rapid growth and diversification of online technologies and offerings.

Firms in the gambling sector largely perceived increased demand for online gambling to be closely related to the broader global move towards online platforms and business models. This perception underscores the important role of regulators in constraining access to online gambling and the high social costs associated with it. On the other hand, the state has clearly articulated a position against online gambling, on the basis of potential loss of employment. Moreover, online gambling has a high social cost, and greater potential for addictive behaviour than destination-based gambling.

Some of the concerns that have been raised regarding online gambling – particularly important from a regulatory perspective – include that the identification of problem gamblers becomes far harder. Best practice for identifying problem gamblers in casinos relies, in part, on well trained staff who are able to spot problem gamblers and have a range of mechanisms at their disposal with which to deal with the case on the spot. The challenges raised with regard to problem gamblers is exacerbated by the fact that online gambling encourages more frequent use, given that it is more accessible than land-based gambling facilities. In short, online gambling could be readily identified as more addictive than many other forms of gambling.

The shift toward the provision of gambling services within the online sphere constitutes a critical element of the transformation being wrought by the 4IR on the sector. However, the regulatory reviews and reforms which sought to strengthen the governance of online gambling in South Africa have, to date, not come into effect or been implemented.

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Online gambling threatens the current policy position on the regulation of gambling in South Africa which has been framed around the destination approach. As a borderless mechanism for engagement, transactions and communication, online gambling poses an immediate risk to the sovereign regulation of gambling, as evidenced by the fact that the NGA 2004, like many South African laws, does not have extra-territorial application. Addressing this regulatory vacuum will be a critical aspect of the review of the regulation of the gambling sector in light of the impacts of the 4IR.

The enforcement of regulations prohibiting online gambling presents many challenges. Challenges include issues related to detection and monitoring, tracing financial flows, the characteristics of cloud-based data, jurisdiction, and taxation. One clearly-identified solution for more effective enforcement is that of greater co-operation with Internet Service Providers (ISPs). Such co-operation has the potential to prevent consumer access to identified gambling sites, or to run heuristics within ISPs that flag and block such sites.

Promotion of Gambling

Since the NGB is mandated to prevent the over-stimulation of gambling, an assessment of the impact of new technologies for the advertising of gambling is salient to the broader re-assessment of gambling regulation. In other jurisdictions, measures have been implemented to strengthen the regulation of gambling advertisement in response to the impact of 4IR technologies on the industry, particularly the proliferation of advertising on social media. Given the high usage of socio-media across South Africa, consideration will need to be given to strengthening the framework governing gambling advertisement, and enforcement thereof, in line with the policy positions of the National Gambling Policy 2015, and in line with the provisions of POPIA which will be valuable in addressing personalised micro targeted messaging.

The combination of geo-location technologies, artificial intelligence systems, and social media systems creates an environment in which personal data is harvested by firms and processed in order to generate micro-targeted advertising messages. Gambling firms, whether operating legally or illegally, have such technologies at their disposal, and are actively using them.

New technologies also provide new tools for regulators to provide positive messages about gambling. One stakeholder reflected on dynamics in the area of advertising for gambling. Their overall message was that, in order to meet the NGBs mandate of preventing the over-stimulation of gambling, more effective messaging and more effective controls over advertising are required.

Another option for constraining the over-stimulation of gambling would be closer collaboration with South African sports betting operators who are seeking to restrict advertising by international competitors in the South African media. By reporting unlicensed international competitors to major advertising and social media multinationals such as Google and Facebook, local operators have acted to constrain the extent of gambling advertising. Closer collaboration between regulators and South Africana operators in this regard has the potential to reduce the potential to incite problem gamblers and underage gamblers to gamble, and provide a market advantage to South African operators in comparison to international operators.

Another stakeholder highlighted the role of AI in processing consumer data in order to generate targeted advertising across multiple media and platforms. Through this function, AI plays a critical and growing role in the promotion of gambling.

Prevention of problem gambling

Traditional methods of identifying problem gambling behaviour rely on self-driven or peer / family pressure to self-identify as a problem gambler and placing ones' name on an exclusionary list. AI technology allows for the identification and communication about potential problem gambling behaviours directly to users and taking action based on gambling behaviour rather than relying on social support networks identifying behaviours around particular individuals.

Around the world, regulatory enjoinments are shifting and adapting enhanced technology bases solution in both physical and online gaming areas to prevent and reduce problem-gambling behaviours. AI company Human has developed facial recognition technologies to make active assessments on player anxiety and affective state to make decisions related to potential gambling behaviours issues. This highlights a significant social responsibility issue within the industry globally, and respond to this need from both the perspective of this responsibility as well as the commercial interests of its clients. The regulatory

environment in Japan has responded to these technological shifts, considering the implementation of these technologies within domestic casinos. At a slightly lower technological level, the Canadian government has in discussion with gaming operators to leverage data from within loyalty programmes to isolate and identify problem gambling behaviours earlier and support gamblers with addictive tendencies.

Robotics, Automation and manufacturing

Robotics is a key driver of the Fourth Industrial Revolution, but doesn't currently play a major role in the gambling sector in South Africa. However, in the imagination of some of the interview participants, robotics may have a role to play.

The 'internet of things' (IOT) is the extension of the internet to sensors and wireless tags that make it possible to keep track of objects and processes, like parcels in transit or monitoring household items such as geysers and lights. IOT is already widely used in the international gambling sector, in which gambling machines feed data back to central servers, whether on site or cloud based, which process data in real time to provide diagnostics and management information. If the South African gambling sector is to move in line with global trends, the use of IOT will become more deeply embedded, leading to the use of sensors and networked systems throughout physical gambling infrastructures, including the increased development of linkages to AI systems. However, none of the stakeholders interviewed reported a significant role for IOT in the gambling sector at present, suggesting that IOT isn't at this stage a significant driver of technological change in the sector.

Horseracing and Sports betting

Many of the technological dynamics of online gambling also apply to sports betting, with the primary distinction being that for sports betting, the challenges relate to the regulation of a legal activity, while for other forms of online gambling the challenges relate to the detection and prevention of illegal activity. South African online gambling operators reported that their international competitors are technologically more advanced, which gives them a competitive edge over local firms, as well as provides access to a much broader range of sports on which to bet.

Horse racing has a long history in South Africa. However, since the promulgation of the National Gambling Act of 1996, the development of casinos in South Africa, together with forms of online gambling, have led to a decline in the popularity horse racing and betting on horse racing. The market shift away from horse racing, towards other forms of gambling, represents cultural and technological changes that are occurring as a result of the choices made by the public.

One exception here is the issue of virtual horse-racing. In the 2010 Gambling Review Commission report, virtual racing was included within its ambit and considered an interactive gambling game. To this end, the report recommended that virtual racing be regulated accordingly. However, there is little information regarding the prevalence of virtual racing in South Africa. In addition, while online wagering on horse racing is permitted – where licensed – in South Africa, whether the law extends to when the odds are stimulated in a virtual environment is yet to be circumscribed.

Following stakeholder interviews, it appears that the similarities between live horse-racing and virtual horse-racing are superficial. Live horse-racing has more in common with a sporting event – the outcome of which is determined by real-world events. Virtual horse-racing – while it might visually appear to be similar to live horse-racing, has more in common with online gambling, since the outcome is defined by randomly generated numbers. As such, the recommendation is that virtual horse-racing be subject to regulatory restrictions and controls as other forms of online gambling that depend on randomly generated numbers.

Under Age Gambling

The NGB has a mandate to minimise the social impact and negative impact of gambling on vulnerable groups, including children. Section 12 of the NGA 2004 provides for certain protection for minors against the negative effects of gambling. These provisions are based on the destination model of gambling, and therefore require that licensees ensure that minors do not have access into designated gambling areas.

However, online technologies increase access to gambling services for children. In addition, because online gambling is easier to access and less regulated, it is a broadly more acceptable form of gambling for children and youth. Evidence suggests that increased access to online gambling stimulates gambling among children and youth. Alongside these concerns is the fact that gambling advertising is also more available

to children in the online space. In the UK, the Gambling Commission is developing recommendations to curb child gambling, including by providing advice and education in schools, and engaging with the local advertising authority to ensure that 'the design, content and imagery used in gambling marketing, advertising and products [does] not have the effect of creating a particular appeal to children and young people'.

Items in gaming platforms regularly referred to as loot boxes open one avenues for gambling risky behaviours to take hold. Due to the nature of loot boxes, where real currency is used to buy an item for which the user has no real sense of its utility value in the game - essentially represents a gamble. Research has found a significant correlation between purchasing in-app loot boxes and gambling behaviours. This highlights the tremendous risk posed to youth within these mobile and social media spaces when related to development and future risk potential as adolescents and later adults. Companies such as PayPal have responded to this risk by ensuring strengthened processes in preventing underage use and particularly gambling. One potential tool for regulators is closer alignment with major online actors, such as Google, Facebook, and Apple. These actors have established safeguards against the promotion of gambling to minors. Operators are aware of these constraints, since they have a direct impact on business models and promotion strategies.

Key Issues and Recommendations for Regulators

The increased use of 4IR related technologies in the gambling sector raises new ethical challenges which regulation must seek to address. These are: the blurring of the boundary between "gaming" and "gambling"; the effect on children and minors of increased and unregulated access to gambling services; increased gambling addiction and the latent stimulation to gamble from immersive gambling services and products – whether online or at land casinos. A distinction between online games that are appropriate for minors, and online games that are sufficiently similar to gambling games that are therefore not appropriate for minors needs to be made.

Some of the concerns regarding the relevance of the current regulatory framework of the gambling industry for responding to the 4IR can be addressed through ensuring better alignment between gambling laws and other legislative frameworks that address 4IR related issues directly. In particular, gambling law must be aligned to the provisions of the Protection of Personal Information Act, 4 of 2013, particularly given the extent to which personal data is gathered and extracted in 4IR related gambling services. In addition, there must be alignment between gambling law and the Financial Intelligence Centre Act of 2001, in order to better protect again illicit money flows that can arise in gambling in the 4IR era.

From the research undertaken it is evident that the effect of the 4IR on the gambling industry will be more pronounced in future, as technologies like virtual reality and augmented reality become more widespread. In terms of key regulatory challenges in the foreseeable future, the research has ascertained that issues around intellectual property, particularly in terms of algorithmic propriety, will need to be addressed, as well as the regulation of crypto-assets and crypto-currency.

Artificial intelligence

For regulators, AI has the potential to assist with data analytics and policy decision making. In the private sector, particularly amongst operators, including casinos, AI technologies should only be approved for security purposes, and should not be used for tracking or nudging player behaviour. Their use should only be permitted following regulatory approval. Any application of AI that uses consumer data in the gambling sector must be proceeded by the provision of evidence to regulators that data privacy is protected.

Augmented reality and virtual reality

Specific protocols should be developed to provide guidance to regulators considering VR and AR applications for regulatory approval – including clear boundaries regarding what kinds of applications of VR and AR are legal in the South African context, and which are not. Key questions to be considered include whether VR applications can be verified as live games, whether they can be verified as taking place in a South African jurisdiction or not, whether they protect the data privacy of consumers, and whether they have the potential to over-stimulate gambling demand through their appeal to younger consumers.

Blockchain and financial transactions

Develop a strategy to address the use of crypto-assets, including mechanisms to detect its use, and tools to enforce the controls and regulations that may emerge from the South African Reserve Bank. Cooperation with the FIC should be deepened in order to combat the illegal use of crypto-assets.

Data management

The data management capabilities of the NGB need to be considerably strengthened in order to meet the challenges posed by an increasingly data-intensive gambling sector.

In order to enforce compliance with the POPI Act, there need to be clear guidelines for the application of national data regulations to the gambling sector. This should include protocols for the protection of the privacy of players, for the collection and retention of personal information, and for the registration of players and the establishment of national databases to track player activity. AI systems have the potential to assist in this endeavour. This effort will require further research, as well as collaboration with the South African Information Regulator. The potential for automated technological solutions for data management challenges should also be explored.

Online gambling

Stronger mechanisms and processes should be developed for:

- Growing public awareness about the risks of online gambling
- Detecting online gambling and intervening where it is detected
- Blocking access to online gambling

The mechanisms by which South African consumers interact with online gambling operators outside of South Africa must be regulated and restricted. The financial constraints to online gambling should be further strengthened through dialogue with banks and internet service providers.

Promotion of gambling

The framework governing gambling advertisement, and the enforcement thereof, should be strengthened in order to more effectively align with the positions of the National Gambling Policy 2015. Online communication platforms and AI technologies have created an unprecedented escalation in the potential for both legal and illegal promotion of gambling, with the potential for significant social impacts. A dedicated regulatory body for monitoring gambling and casino advertising should be established – such monitoring requires a distinct set of capabilities and independent authority to detect the illegal promotion of gambling and respond accordingly.

Tighter monitoring and control over the use of geolocation technologies, micro-targeted messaging, and social media to advertise gambling are required. The NGB should engage directly with social media providers regarding online advertising of illegal forms of gambling.

Prevention of problem gambling

The adoption of emerging technologies focussed on the prevention and mitigation of problem gambling should be supported.

Robotics, automation and manufacturing

At present, due the functional structure of the gambling sector, automation is not having as large an impact as in other sectors. In the long term, possible uses of robotics to automate tasks in the casino environment may lead to unemployment, or other unanticipated consequences – such applications should be monitored by regulators on an ongoing basis.

Sports betting

Regulators should review the conditions under which international firms enter the South African sports betting market. Higher licencing fees and a requirement for investment in local physical betting sites may provide leverage to create local jobs, and also create more even market conditions for local firms to compete. Virtual horse-racing is a form of online gambling that should not be permitted in South Africa under current law.

Underage gambling

More effective mechanisms for detecting the advertising of gambling to minors need to be developed. Closer collaboration between South African gambling regulators and international social media firms may assist in this regard.

Conclusion

The recommendations emerging from this research analysis fall into four broad areas, each of which address different modalities of adaptation to the changes brought about by the 4IR. Firstly, there are broad regulatory strategies that can be implemented in order to make regulation more responsive to technological change and to shorten the policy cycle. Secondly, there are strategies to adapt to broad global technological changes, such as digitalisation, automation and data-intensification. Thirdly, there is the need to respond to technological changes being brought about by specific technological platforms, such as AI, blockchain, and virtual reality. Finally, we reflect on the use of regulation that addresses the impact of technological change for meeting the core social mandates, for example the prevention of problem gambling and the prevention of gambling by minors.