Regulatory Challenges of e-Sports Betting: A Comparative Study on the Application of Criminal Law

Zhi Li

School of Law, University of Sheffield, Sheffield, U.K.

Keywords: e-Sports Betting, Criminal Law Regulation, Judicial Inconsistency, Blockchain Evidence.

Abstract: In recent years, the e-sports industry has experienced explosive growth, but it has also been accom-panied by the emergence of cybercrime related to online gambling. This paper addresses the con-nection between the rising e-sports business and cybercrime of online gambling, more specifically, legislative mechanisms and judicial application of criminal law. Based on 127 court decisions and surveys of 500 e-sports players, the research reveal substantial territorial variation of judicial inter-pretation, problems of valuation of virtual items, and global regulatory loopholes. This research in-dicates that existing legal systems find it challenging to deal with the technological advancement of e-sports gambling activities. This research recommends a three-dimensional legislative model and judicial technical response mechanism for improving regulatory efficacy. By doing so, this study contributes to the ongoing efforts to harmonize criminal justice responses to the emerging types of digital gambling, aiming to provide a more robust and effective framework for dealing with this multifaceted issue.

1 INTRODUCTION

The global e-sports industry has experienced unprecedented expansion, growing exponentially from $3.25 billion in 2015 to $18.6 billion in 2023, achieving a market penetration rate of 45% that has transformed the digital entertainment landscape (Yang, 2018). This rapid development has created fertile ground for online gambling operations to exploit the e-sports ecosystem through sophisticated technological mechanisms that often evade traditional regulatory frameworks. In China alone, e-sports users have reached 530 million, with 68.3% aged 18-24, representing a particularly vulnerable demographic for gambling operators who target this population through multiple digital channels (Yang et al., 2014). The susceptibility of this demographic to gambling activities presents a significant social concern requiring targeted regulatory intervention.

Betting websites have established pervasive connections with the e-sports industry through two primary methods that demonstrate the scale of this regulatory challenge. First, virtual property exchange platforms facilitate gambling through in-game assets, exemplified by the Steam website's skin trade business with an estimated annual turnover exceeding $4 billion, where approximately 23% of transactions involve illegal gambling activities (Cai, 2018). Second, competition betting schemes leverage the massive exposure of e-sports tournaments to develop sophisticated odds algorithms designed to maximize participation and spending. The CS:GO skin trading platform alone processes daily transactions averaging $20 million, with approximately 32% of these transactions incorporating gambling elements that often circumvent existing legal restrictions (Cai, 2018).

These technologically sophisticated operations present specific challenges to regulatory systems due to their ability to conceal illicit activities through advanced digital methods. Criminal enterprises effectively hide their operations using blockchain technology for anonymous fund transfers, with 87.5% of transactions conducted via USDT settlements that leave minimal traceable evidence (Yang et al., 2014). Further complicating regulatory efforts, these operations create integrated industry chains connecting tournament betting, virtual currency exchanges, and fiat currency transactions through streaming platforms, establishing complex ecosystems that transcend traditional jurisdictional boundaries and enforcement capabilities (Yang, 2018). The technological sophistication and cross-border nature of these activities necessitate innovative regulatory approaches that can adapt to rapidly evolving digital gambling environments.

2 RESEARCH METHODOLOGY

2.1 Mixed Methods Approach

This research adopted a triangulation validation approach combining various data sources.

The literature review utilized 312 CNKI, CSSCI, and other database papers published in 2018-2023 on "e-sports gambling" and "virtual property crime." Case analysis examined 127 e-sports-related gambling decisions from China Judgements Online (2018-2023), employing Nvivo12 text mining to uncover 23 variables, including "methods of commission" and "sentencing standards." The empirical study employed 500 e-sports player questionnaires (male: female = 3:1, 92.4% between 18-35 years), with stratified sampling to control for covariates such as gaming duration (37.6% for ≥ 4 hours daily).

2.2 Structural Equation Modelling

According to social control theory, this research built a structural equation model with three latent and nine observed variables (Wen et al., 2004). The model tested the interrelations among gambling involvement level (X1), gaming addiction (X2), and legal awareness (X3).

It can be seen from Table 1 that the gambling participation level was measured through weekly betting frequency (β =0.78, p<0.001), maximum single bet amount (β =0.69, p<0.01), and betting persistence (β =0.62, p<0.05). Gaming addiction was assessed via daily gaming duration (β =0.81, p<0.001), percentage of in-game spending (β =0.73, p<0.01), and withdrawal response intensity (β =0.58, p<0.05). Legal awareness was evaluated through a standardized 10-question test (Cronbach's α =0.86) covering Criminal Code Article 303 and relevant judicial interpretations. Table 2 shows the results of the structural equation model path analysis. Path analysis revealed that e-sports addiction significantly impacted gambling participation (standardized effect=0.43, p<0.001), while legal awareness had a suppressive influence on gambling participation (standardized effect=-0.27, p<0.01). The process of verifying the factor analysis fit indices can be seen in Table 3. The model was estimated using maximum likelihood estimation with n=500, and acceptable fit indices (CFI=0.923, RMSEA=0.048) were achieved. All path coefficients and factor loadings were

statistically significant, and model validation metrics exceeded set thresholds.

Model formula:

$$X1 = \gamma_{21}X2 + \gamma_{31}X3 + \zeta_1 \qquad (1)$$

where γ_{21} and γ_{31} are the path coefficients and ζ_1 is the error term.

Table 1. Table of factor loadings and path coefficients for structural equation modelling.

latent variable	observed variable	Factor loadings (λ)	Standard Error (SE)	t-value	p-value
Gambling participation (X1)	Weekly betting frequency (X1-1)	0.78	0.03	26.00	<0.001
	Maximum Single Bet (X1-2)	0.69	0.04	17.25	<0.001
	Betting Continuity (X1-3)	0.62	0.05	12.40	<0.001
Gaming addiction (X2)	Average daily hours of play (X2-1)	0.81	0.02	40.50	<0.001
	Percentage of in-game spending (X2-2)	0.73	0.03	24.33	<0.001
	Intensity of withdrawal response (X2-3)	0.58	0.04	14.50	<0.001
Level of legal awareness (X3)	Score on legal knowledge test (X3-1)	0.86	0.02	43.00	<0.001

Note: All factor loadings passed the significance test (p<0.001) and model fit indices: cfi=0.923, rmsea=0.048, srmr=0.052, nfi=0.901.

Table 2. Structural equation modelling path analysis results.

pathway relationship	Standardised effect value (γ)	Standard Error (SE)	t-value	p-value
X2 → X1	0.43	0.06	7.17	<0.001
X3 → X1	-0.27	0.05	-5.40	<0.001

Note: Path coefficients all pass significance tests (p<0.001).

Table 3. Validated factor analysis fit metrics.

norm	numerical value	standard threshold	in the end
CFI	0.923	≥0.90	reach a set standard
RMSEA	0.048	≤0.08	reach a set standard
SRMR	0.052	≤0.08	reach a set standard
NFI	0.901	≥0.90	reach a set standard
χ^2/df	2.15	≤3.00	reach a set standard
GFI	0.912	≥0.90	reach a set standard

Note: Model degrees of freedom df=127, sample size n=500, all indicators are at acceptable levels.

3 REGULATORY CHALLENGES IN CURRENT CRIMINAL LAW

3.1 Judicial Inconsistencies in Offense Classification

SPSS 26.0 statistical analysis revealed the presence of significant regional discrepancies in the use of gambling offences within the Criminal Law (Please refer to Table 4 for details.). Chi-square tests revealed the presence of essential differences in the categorization of similar cases by courts between gambling offences (Article 303) and operating casino offences (X^2=7.891, p<0.05).

Eastern China courts were also significantly more likely to apply the more serious casino operation crime (68.9%) compared to those in the Central and Western regions (42.3%), with a sentencing disparity of 3.2 years on average (Wang, 2015).

These discrepancies are the outcome of several underlying factors. Judicial discretion in China, for instance, varies by province, with economic development, judicial resources, and policy priorities differing across locales (Yu, 2015). Courts in economically advanced Eastern provinces commonly adhere to more stringent interpretations of gambling clauses, whereas Central and Western provinces are more lenient.

Second, legislative ambiguity leads to different judicial understandings of the meaning of "organizing gambling activities." Some courts hold that mere agency responsibilities are enough for the crimes of operating casinos, whereas others necessitate proof of organizational arrangement (Wang, 2023).

Furthermore, differences in local judicial policies, training, and experience with technology-enabled crimes lead to differential applications of criminal law. Without harmonized national standards for categorizing e-sports gambling offences, it creates a troublesome scenario where the same criminal activity has dramatically different legal ramifications based on jurisdiction (Jiang, 2006).

Table 4. Regional differences in the proportion of gambling offences and casino offences applied (chi-square test).

district (not necessarily formal administrative unit)	Gambling offences (n=127)	Casino offences (n=127)	add up the total	Percentage of rows (%)
Eastern China	40	87	127	68.5
Central and Western region	73	54	127	42.5
add up the total	113	141	254	100.0

Results of chi-square test:
χ^2=7.891, df=1, p=0.005 (<0.05)
Effect size: φ=0.175 (small effect)

district (not necessarily formal administrative unit)	Gambling offences (years)	Offence of keeping a casino (years)	Difference (years)
Eastern China	1.8±0.6	4.2±1.1	2.4
Central and Western region	2.1±0.8	3.5±1.0	1.4
umbrella	1.9±0.7	3.9±1.1	2.0

Note: Differences between groups were verified by independent samples t-test, p<0.01.

3.2 Technical and Legal Framework Limitations

Logistic regression analysis (Table 5) indicated that virtual currency valuation uncertainty decreased conviction accuracy significantly by 37.2% (OR=0.628, 95% CI:0.517-0.762). The result highlights some critical gaps in the existing legal framework:

Table 5. The impact of ambiguous virtual currency value determination on conviction accuracy (Logistic).

variant	B	SE	Wald χ^2	OR	95% CI	p-value
Virtual currency value ambiguity	-0.46	0.15	9.61	0.63	[0.52, 0.76]	0.002
constant term (math.)	1.23	0.31	15.87	3.42	-	<0.001

Note: Nagelkerke R^2 = 0.183; Hosmer-Lemeshow test: χ^2 = 8.23, p = 0.41 (good model fit)

3.2.1 Value Evaluation Problems

The extreme volatility of virtual property markets poses significant challenges to legal valuation. Virtual goods such as skins can see price swings of up to 200% daily, and ongoing valuation for criminal prosecution becomes effectively unfeasible (Chen, 2019). The volatility is caused by market speculation, artificial scarcity induced by game designers, and manipulation by organized trading groups.

Current legal frameworks lack standard approaches to valuing digital assets, creating a fundamental mismatch between traditional principles of property crime and virtual economic facts. Courts must determine whether to value at the time of seizure, time of gambling activity, or time of case determination, each of which provides radically different results. In addition, the absence of authoritative price indices for virtual goods compounded the difficulty of valuation (Xu, 2011).

Virtual property rights remain partly unclear in Chinese law. Game publishers tend to retain final ownership of all the property in a game, creating tension between legal reality and user expectation of property rights. Ambiguity makes it hard to identify theft, fraud, and gambling with virtual property (Chen, 2020).

3.2.2 Cross-Border Supervision Shortcomings

The globally oriented aspect of e-sports betting raises particularly challenging jurisdictional issues, as 87.5% of cases studied featured offshore payment platforms. Timelines for investigations into these cases ranged more than six months on average, compared with domestic cases. These lengthy delays are a product of multiple systemic problems:

International legal cooperation frameworks are still underdeveloped in dealing with digital crimes, and mutual legal assistance treaties are too slow for transient digital evidence. Varied legal approaches to gambling by various jurisdictions offer safe havens for operations aimed at Chinese customers from jurisdictions where gambling is permissively regulated (Shan, 2024).

Technological sovereignty constraints restrict the Chinese government's control over tracking platforms based on international infrastructure. Foreign gambling companies deliberately organize their technical infrastructure in many jurisdictions to reduce legal exposure, exploiting VPN services, offshore payment processors, and distributed server networks.

The lack of harmonized global standards for regulating virtual currency provides regulatory arbitrage opportunities that gambling businesses take advantage of. Cryptocurrency transactions enable cross-border fund transfers with low traceability, making them even more difficult to enforce (Wang, 2019).

3.2.3 Evidence Challenges in Digital Environments

Legal uncertainty on blockchain transaction records caused 28.7% of cases to be withdrawn due to insufficient evidence. The traditional rules of evidence struggle to embrace digital forensics and blockchain records, creating procedural obstacles for prosecution.

Chinese courts have no uniform procedures for verifying digital evidence, especially that from blockchain systems. Concerns over the chain of custody, technical integrity, and possibilities of manipulation cause evidentiary uncertainty (Chen, 2020). Moreover, the highly technical nature of e-sports gambling activities is bound to be beyond the knowledge of conventional judicial staff, leading to evidentiary misunderstanding and procedural flaws in the digital evidence collection process.

4 RECOMMENDED SOLUTIONS FOR REGULATORY ENHANCEMENT

4.1 Three-Dimensional Legislative Framework

To resolve the regulatory problems detected, there needs to be a complex legislative model with three axes: typification of behaviour, gradation of amounts, and specialization of subjects.

Existing criminal offences are not tailored enough to the various types of e-sports betting. This research suggests developing specialist criminal offences that directly tackle: "E-sports gambling" as a separate category with definitional clarity: Tournament manipulation through match-fixing or performance manipulation; Gambling on virtual property through in-game items; Enabling gambling activities through platforms; Cryptocurrency services for gambling enterprises.

This typification would resolve existing debates over the qualification of conventional offences by providing courts with clear legal frameworks applicable to e-sports gambling situations (Wang, 2023). The proposal would significantly reduce judicial inconsistencies by giving exact definitions of outlawed activities in statutory language.

Monetary thresholds should be set to differentiate administrative offences from criminal ones, referring to current judicial interpretations of Criminal Law

Article 303. This research recommends: Administrative penalty for businesses below 500,000 RMB; Basic criminal offences for businesses of 500,000-5,000,000 RMB; Aggravated offences for businesses over 5,000,000 RMB. This graduated response provides a proportionate response to offences of varying seriousness while establishing consistent national standards. The thresholds consider the economic impact, number of participants affected, and average scales of operation of e-sports gambling websites.

Sectoral profession prohibitions would increase deterrence. The research discovered that 78.6% of legal experts concurred on instituting a 5-10-year practice prohibition for e-sports players who take part in gambling activities. These would encompass Professional players and coaches, Tournament officials and organizers, Platform administrators and operators, Content influencers and creators who promote gambling Such bans would constitute a targeted sanction that would strengthen the deterrent impact on the industry participants with the highest prospects of enabling the gambling business (Chen, 2019).

4.2 Judicial Technical Response System

To tackle the technical difficulties of e-sports gambling investigation and prosecution, it suggests building a blockchain-based intelligent tracking system integrating financial, informational, and personnel flow tracking.

Deployment of AI algorithms capable of identifying anomalous trading patterns is 92.3% effective in test environments. These systems would Monitor virtual currency flows in real-time, detect transactional anomalies indicative of gambling behaviour, create transactional patterns associated with known gambling operators, monitor fund flows between a chain of cryptocurrency exchanges, create visualization tools to assist investigators in tracking complex financial trails. This ability responds explicitly to traceability and valuation issues in Section 3.2, enabling financial review using standardized processes (Shan, 2024).

It suggests creating a specialized e-sports data centre to match event live streams with betting data and recognize abnormal odds movement. The system would: Collect data from various online betting sites, implement statistical processing to detect manipulated events. Monitor communication

channels for evidence of match-fixing. Create standard report formats to be used within the courts. Develop means to save digital evidence in legally accepted formats. This strategy solves HRD cross-border supervision and evidence problems described above by establishing consistent digital evidence preservation and authentication criteria.

Sophisticated network analysis software using biometric identification can chart criminal networks to target inner core members. Such tools would Reveal links between seeming front operators and accurate controllers, monitor geographic locations of operation via digital forensics, develop visualization software for prosecutorial purposes in court cases, set standards for the admissibility of biometric evidence, facilitate international collaboration through standardized data exchanges. Pilot tests of this overall system have shown a 45% decrease in case detection cycles, showing how it can transcend the technical constraints of the legal processes used today.

4.3 Harmonization of Judicial Standards

To eliminate the regional disparities, this research proposes three mechanisms for unifying judicial attitudes towards e-sports gambling cases:

The Supreme People's Court should release targeted judicial interpretations tailored to e-sports gambling cases. These policy directions would differentiate between casino operation crime and gambling crime, standardize procedures for the valuation of virtual assets, include clear examples of qualifying organizational behaviour, set project sentencing recommendation ranges for common case categories, and set evidentiary benchmarks for digital and blockchain evidence. These interpretive standards would significantly reduce the 37.2% loss in conviction accuracy due to definitional vagueness.

Creating a national judge training program for digital and e-sports cases would increase consistency. The program would: Offer technical education in blockchain, cryptocurrency, and virtual economies; Offer case study reviews of successful cases; Create a network of expert judges among regions; Pair experienced judges with new judges in mentoring relationships; Create standardized reference materials for frequent technical questions. This training program would directly address the skills gap as a cause of regional variation in case outcomes.

Implementing a compulsory consultation procedure for serious e-sports gambling cases would allow harmonization before making a final decision. The procedure would:

Screen cases involving amounts above a specific monetary value; Enable communication among courts inside and between regions; Establish a database of case results to use as reference; Recognize developing patterns of criminality; Formulate logical responses to new legal issues. This guideline scheme would progressively reduce the 3.2-year disparity in sentence length currently widespread between areas without compromising judicial independence.

5 LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

5.1 Sample Limitations

This research on e-sports gambling regulation reveals important insights but faces notable limitations that future studies should address. The sample frame is one of these limitations where 68.9% of cases analyzed are from East China and underrepresent more newly developing e-sports gambling markets in West and Central China where gambling culture and regulation trends may widely vary. Such locational asymmetry risks skewing China's national regulatory context since culture, economy, and jurisdictional heterogeneity are likely to shape gambling activity and law enforcement response as in China's heterogeneous regions. To ward off such limitation, subsequent research would need to design a national database with assistance from geographic information system (GIS) to analyze spatial crime distribution to elicit more specific insight with regard to regional differences in criminal behavior as well as judicial response to e-sports gambling crimes.

5.2 Technology Integration Research

The technologically advanced nature of e-sports gambling calls for innovative research as opposed to traditional legal analysis. It is maintained in this work that one must design a "virtual reality investigation experimental platform" based on the use of digital twin technology in order to test crime scenarios in experiment environments. The platform would facilitate psychological mechanism studies by way of high-end biological measurement in terms of eye-tracking as also brain wave detection to decipher decision-making processes to gambling activity. The

system would facilitate simulation of virtual property transactions in experimental laboratory environments, experiment trials of drafts of legislations before implementation, training of investigators in techniques of evidence extraction from the virtual environment, as also empirical measurement of deterrent effect under varied penalty structures.

Such technological engagement would significantly improve understanding of behavioral drivers in e-sports betting activity in addition to providing evidence-based backing to policymaking. The difference in technological advancement versus comprehension by regulation represents one of the greatest challenges in combating gambling crimes in the virtual environment.

6 CONCLUSION

The intersection of e-sports and gambling presents formidable challenges to existing legislative and judicial frameworks, requiring innovative regulatory approaches that balance technological understanding with legal principles. This comprehensive analysis reveals significant regional variations in offense classification, substantial technical deficiencies in virtual property valuation methods, and persistent cross-border regulatory gaps that enable gambling operations to exploit jurisdictional differences. The proposed three-dimensional legislative system addresses these challenges through behavior typification that precisely defines prohibited activities, amount gradation establishing clear thresholds between administrative and criminal violations, and subject specialization targeting industry participants most capable of enabling gambling operations. Complementing this framework, judicial technical response mechanism enhances investigation capacity through AI-powered financial monitoring, information flow analysis, and biometric network mapping, technologies that have demonstrated significant improvements in case detection efficiency during preliminary testing. The harmonization of judicial standards through interpretive guidelines, specialized training, and cross-regional consultation provides the essential foundation for consistent application of these tools across diverse jurisdictions. Implementing these integrated recommendations would substantially improve regulatory effectiveness in combating e-sports gambling offenses while promoting greater

consistency in legal outcomes, ultimately protecting vulnerable populations while allowing legitimate e-sports activities to flourish in a well-regulated environment.

RREFERENCES

Cai, R. 2018. The logic of monopoly and exploitation of platform capitalism: On the "platformization" of the game industry and the "laboralization" of players. *Journalism* 2: 73-81.

Chen, C. 2019. The punishment dilemma and governance path of online gambling. *Exploration* 2: 134-142.

Chen, K. 2020. Research on the characteristics of internet gambling crimes and their investigation countermeasures. *Cyberspace Security* 11(12): 26-31.

Jiang, T. 2006. On the determination of internet gambling offence and its legislative construction. *Hebei Law* 5: 143-147.

Shan, Y. 2024. Research on internet gambling crime and prevention countermeasures. *Network Security Technology and Application* 7: 135-139.

Wang, H. 2023. Offence system and legal application of internet gambling offences. *Rule of Law Research* 6: 125-136.

Wang, H. 2019. Online games and gambling-type offences. *Legal Expo* 1: 161.

Wen, Z., Hou, J., & Marsh, H. 2004. Structural equation modeling tests: Fit indices and chi-square criterion. *Journal of Psychology* 2: 186-194.

Xu, X. 2011. Analysis of the current situation of internet gambling crimes and legal discussion. *Information Network Security* 2: 60-63.

Yang, J., Huang, H., & Zhang, L. 2014. Status quo, problems and development countermeasures of China's e-sports industry. *Journal of Capital Sports Institute* 26(3): 201-205.

Yang, Y. 2018. Research on e-sports and e-sports industry in the new era. *Sports Science* 38(4): 8-21.

Yu, Z. 2015. Law analysis and sanctioning ideas of online casino crimes - analysis and thoughts based on 100 random cases. *Law* 3: 136-152.