AI Regulation for Sustainable Business: Legal Challenges in Eastern and Central Asian Emerging Economies

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Abstract. This study examines the regulatory challenges of artificial intelligence for business sustainability in Central and Eastern Asian emerging economies. Artificial intelligence has faced significant legal hurdles in developing a robust framework that supports innovation and promotes sustainability.

The paper employed key constructs, including technological readiness, regulatory maturity, institutional capacity, and ethical considerations, to test the relationship between these factors using structural equation modelling to confirm the relationships between the hypotheses. 250 respondents were surveyed using questionnaires using a 5-point Likert scale. This approach assesses the direct impacts on business practice and sustainable artificial intelligence in Eastern and Central Asian Emerging Economies. The study collected data from the views and perspectives of experts from Eastern and Central Asian emerging economies from different fields of study. The respondents consist of AI, business and economics experts for the survey across the emerging economies of Eastern and Central Asia.

The findings indicated that institutional capacity and regulatory maturity significantly influence technological readiness, ethical considerations, and business sustainability, which in turn affect the effectiveness of sustainable business practices. However, the inconsistency in policy enforcement and regulations regarding artificial intelligence impacts the institutional and business framework.

The implications include promoting legal reforms, fostering cross-border cooperation, and strengthening institutional frameworks to ensure an efficient contribution from artificial intelligence in the Eastern and Central Asian regions.

This study provides valuable insights by shaping the regulatory challenges towards sustainable business in the Eastern and Central Asia regions.

Keywords: Artificial intelligence, regulation, sustainable business, challenges, Eastern and Central Asia region, economics

INTRODUCTION

Artificial Intelligence (AI) is considered a transformative innovation that the world has never experienced, which transforms a variety of sectors, enhancing efficiency and productivity through revolutionising industries and fostering initiatives across the globe (Wamba-Taguimdje et al.,2020). The developments of AI and challenges have been rapidly growing, particularly in emerging economies such as Kazakhstan, Tajikistan, Turkmenistan and China to synchronise the technological balance advancement (Feijóo et al., 2020). However, in Central and Eastern Asia countries, for instance, Mongolia, Kazakhstan, Kyrgyzstan, and China, an increase in Artificial intelligence necessitates a regulatory framework that regulates the activities

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of the system and ensures the system aligns with socioeconomic sustainability (Dremliuga, 2022). As rapid growth and development of artificial intelligence are experienced in emerging economies, digital revaluation faced significant legal issues through regulatory challenges, unlike developed regions where their regulatory frameworks were standard and established (De Almeida et al., 2021). The system exposed the associated risk of misusing artificial intelligence through ethical dilemmas, violation of individual or organisational privacy, or socioeconomic disparities (Sanchez et al., 2024). The technological changes and legal regulations create a pace that outpaces legal regulation and hides unregulated activities of innovation and adverse consequences (Walter, 2024).

The vital stage of the effect of artificial intelligence in Central and Eastern Asia underscores a huge potential contribution to sustainable development through different ways, including the healthcare system, economic diversification, and environmental protection and management (Arfanuzzaman, 2021). Achieving such a stage requires multifarious regulation and legal challenges, including data protection, accountability, and transparency in AI-driven operations and decisions, to foster regional establishment cooperation with Central and Eastern Asia (Abbas Khan et al., 2024). However, the absence of clear guidelines within the region will raise huge concerns regarding ethical considerations, human rights, and community and societal impacts within the region.

The framework of artificial intelligence in Central Asia consist of Kazakhstan, Turkmenistan, Kyrgyzstan and Tajikistan considered the local AI framework that also supported by governments of the regions where the collaboration, innovation and transforming of the AI has been their focus to foster digital development based on the regional focus which majority adapted cybersecurity and Artificial intelligence infrastructure growth (Sanchez et al., 2024). However, the institutional framework in Kazakhstan focuses on government-led innovation based on regional collaboration to address artificial intelligence business practices with a clear policy. The level of regulatory maturity in Eastern Asia, particularly in China, is still in development, whereas China has established a comprehensive regulatory system in practice. In addition, technological readiness is improving significantly in Kazakhstan through infrastructure investment and innovation development, while maintaining a steady pace in China. Moreover, ethical considerations are crucial in dealing with data privacy, while China has a robust and mature technical infrastructure and regulatory framework (Arfanuzzaman, 2021).

Furthermore, the integrated ethical standard enhances AI business practices and large-scale business ecosystems, while China's advanced framework allows Artificial Intelligence to embrace emerging systems in Kazakhstan. The challenges of business in Central Asia have various dimensions, including legal challenges and unclear regulations on intellectual property and data privacy, which create uncertainty in multiple aspects of AI advancements. Similarly, adhering to compliance and addressing ethical considerations necessitates a robust framework for innovation and responsive AI adoption (Walter, 2024).

Benchmarking between Central and Eastern Asia reveals a strong relationship and a vital regulatory framework that China and Kazakhstan must adhere to promote sustainable growth through technological investment (Dremliuga, 2022). China, with its strong regulations and comprehensive approach, stabilises the activity of AI in business innovation. At the same time, Kazakhstan learn from policy adoption and innovation, and enhances institutional capacity and efficiency of the ecosystem (Feijóo et al., 2020).

In the AI regulation in China, the step has been taken to comprehensively regulate guidelines and policies emphasising the New Generation Artificial Intelligence Development Plan (NGAIP), which primarily targets government frameworks and ethical standards (Roberts et al., 2021). Still, the Cyber Administration of China issued a statement expressing concern about technical companies' requirements, indicating that artificial intelligence is not a threat to the community or society, nor does it interrupt social stability or privacy (Qiao-Franco & Zhu, 2024). In Kazakhstan, as a developing country, AI regulation has been established through government regulations and standards-based considerations (Inshakova et al., 2024). Kazakhstan has adopted digital innovations to enhance technological transformation through the integration of artificial intelligence. The government of Kazakhstan has developed a program to establish ethical and legal guidelines

for technological growth, with a focus on data security and transparency.

Furthermore, China recently launched a control mechanism to maintain AI content and deep fakes by avoiding misinformation and promoting social harmony, strict oversight, and national security. The Kazakhstan government is collaborating with international agencies to strengthen its policies in line with international standards. One of the crucial areas of innovation in Kazakhstan is enhancing technology to safeguard the nation through privacy and data security using AI integration (Azanbay, 2024).

The study investigates regulatory challenges using the different regional emerging economies in central and eastern Asia, specifying the robust need to access the context-specific framework for better regulations (Liang, 2024). Structural equation modelling is an approach to assessing the relationship between various legal and technological factors that enhance the comprehensive regulatory landscape in identifying the gap opportunities to pave the way towards ethical artificial intelligence deployment and sustainability (De Almeida et al., 2021). The study's significance lies in its contribution to the discourse of the regulatory aspect of artificial intelligence in emerging economies, indicating the significant role of regulatory frameworks in fostering innovation, while addressing and preserving societal standards and ethical values. In other directions, artificial intelligence continues to grow, and the regulatory system in the region must also evolve to tie together the benefits of sustainable development in the sector through environmental protection and social inclusion (Fu et al., 2023). Eventually, inventing valuable artificial intelligence serves as a regional catalyst for cooperation, which shares knowledge integration and development strategy towards socio-economic development based on business sustainability. The paper reviews the related literature on AI regulation for sustainable business in Eastern and Central Asia's emerging economies.

The advanced progression of AI innovations has sparked a wide-ranging discussion on the expansion and refinement of legal frameworks to ensure their safety, ethical operation, and equitable application. Regulatory maturity in AI refers to the extent to which regulatory, institutional, and effective structures are established to manage AI systems efficiently (Zhou & Kankanhalli, 2021). This assessment combines key subject matter and results from recent literature, emphasising the progression, challenges, and potential directions of AI regulation.

Early deliberations about AI regulation were categorised by a hasty approach, which mainly paid attention to tackling immediate safety apprehension and avoiding misuse of artificial intelligence regulation. Piekarczyk et al. (2022) stress the call for a regulatory framework that could adapt to fast-developing AI capabilities, promoting a flexible set of laws that could keep pace with technological growth. As AI relevance stretched into crucial sectors such as the transport sector, healthcare, and finance, policymakers documented the essential requirement for developing more inclusive and practical regulatory frameworks. The European Union's planned Artificial Intelligence Act demonstrates efforts to establish a synchronised regulatory framework that categorises AI systems based on threat and imposes parallel obligations (Cath et al., 2018).

Experts have proposed models to evaluate the growth of AI regulation, frequently classifying it into phases such as emerging, rising, and mature (Larson et al., 2021). Emerging establishments are characterised by minimal regulation and significant uncertainty, whereas mature regimes are marked by well-established standards, implemented mechanisms, and established consents (Young et al., 2018). The United States, for instance, presents a reasonably promising regulatory environment with sector-specific procedures and ongoing discussions about federal lapses (Schmidt-Kessen et al., 2022). On the other hand, the European Union displays a more mature framework with wide-ranging legislation designed for high-risk AI systems (Nikolinakos, 2023). Numerous blockages hinder the development of mature AI regulation. The main challenge, however, is the technological complexity and opacity of the AI structure, often portrayed as vital and "black boxes" (Brozek et al., 2024). Such a formulation is complex for regulators to comprehend, appraise, and effectively monitor AI activities (Clarke, 2019). Moreover, rapid regulatory growth and novelty in innovation cycles lead to a robust legal framework and ethical deliberation, such as equality and privacy, which can obscure the regulatory landscape (Lescrauwaet et al., 2022). Gao and McDonald (2022) heated the discussion that regulatory advances must balance innovation with maintenance, necessitating adaptive and

competitor frameworks. Current literature campaigns for energetic, principles-based regulation to become accustomed to technological changes (Zelenika et al., 2020). The perception of "regulatory sandboxes," which are rented from financial innovational skills, is gaining traction as a means to encourage technologies while preserving lapses (Todaro, 2024). International coordination acknowledged AI's cross-border allegations (Ala-Pietila & Smuha, 2021). Achieving regulatory maturity involves a combination of technological standards, ethical strategies, and regulatory reforms, as well as the ongoing engagement of stakeholders (Pólvora et al., 2020).

Therefore, the literature indicates that while noteworthy trends have been made toward instituting regulatory frameworks for AI, achieving regulatory maturity requires ongoing employment in growth (Bonfield et al., 2020). The intricacy and express progression of AI technology demand flexible, mutual, and advanced approaches. As AI continues to permeate various aspects of the general public, the development of mature, effective regulatory systems is crucial to harness its benefits while mitigating risks (Zhou & Kankanhalli, 2021).

H1: There is a need for Regulatory Maturity towards Artificial Intelligence for sustainable business in Central and Eastern Asia's emerging economies

Institutional Capacity

The flourishing incorporation of governance of artificial intelligence (AI) and industries that surround societies depends greatly on the institutional capacity of governments or private institutions, and regulatory organisations (Bloom, 2020). Institutional capacity encompasses the ability and expertise of institutions to implement, apply, and effectively manage policies and regulatory frameworks that efficiently leverage AI innovations (De Almeida et al., 2021). The current situation of institutional capacity related to AI considers human capital, government structures, and managerial readiness in building capacity within any organisation (Socol & Iuga, 2024). Institutional capacity refers to the joint capacities of institutions to execute tasks effectively, adjust to scientific and innovational changes, and sustain ethical values (Ortiz-Avram et al., 2024) from the perspective of AI, which involves setting up regulatory agencies, mounting technical expertise, promoting technological ecosystems, and ensuring ethical oversight specifically in emerging economies region (Díaz-Rodríguez et al., 2023). Olan et al. (2022) state that institutional capacity is an essential determinant in enhancing an organisation's achievement and in how the nation or region can harness the benefits of Artificial Intelligence and address the associated risks.

The study suggests that organisational readiness has a significant impact on an institution's capacity for AI. The association and organisation require robust infrastructure, including computational data resources, management systems, and secure networks, to support the deployment of AI (Socol & Iuga, 2024). However, government institutions and private organisations with technological infrastructure positions promote efficient artificial intelligence policies. They may also face challenges in developing innovative solutions based on technical frameworks that impede their capacity to oversee AI innovation responsibly. A recurring topic in the literature is the significance of human capital. Establishing institutional ability necessitates specialised skills in AI based on ethics, data science, and law (Saputra et al., 2024). Numerous studies highlight a global skills gap, with institutions struggling to engage and retain qualified personnel capable of effectively managing AI systems. Promoting interdisciplinary partnerships and rising in educational programs are recognised as crucial, and such improved strategies enhance institutional capacity and capability (Trajkovski, 2024).

Government structures indicate the efficiency of institutional capacity (Imran et al., 2022). However, creating relevant units or agencies in charge of artificial intelligence is crucial to ensure coordination within agencies and the clear creation of policies that guide institutions (Li et al., 2025). The study indicates that the adoption of a flexible governance model is essential to maintain the stability of the AI technological model. For instance, the AI governance framework for Singapore demonstrates the proactive method of overseeing the ethics and standards of AI as a specialised and independent body (Stahl et al., 2022). Despite the identification and vital creation of institutional capacity, the building of such recognised institutions remains a key challenge due to the obstacles of resources,

institution disintegration, and technical expertise (Trivedi & Khadem, 2022). In addition, the innovative policy changes are driven, leading to uncertainty and regulatory gaps, which influence the capability and capacity development to prioritise institutional struggles in AI governance and to balance other agendas with competing organisations or institutions for the betterment of innovation (Zhang et al., 2023).

Emerging strategies advocate for collaboration in knowledge sharing to foster institutional capacity for better innovation (Al-Husseini et al., 2021). Building cross-sector partnerships and collaboration, providing capacity-building programs, and promoting innovation hubs are seen as promising strategies. Moreover, embedding ethical considerations and public participation into institutional frameworks can enhance the legitimacy and societal acceptance of AI initiatives (Yang et al., 2025). Therefore, Institutional capacity is a decisive determinant of effective regulation and the advantages of Artificial Intelligence. While important developments have been made in some regions, extensive defiance remains. Strengthening institutional capacity necessitates a wide-ranging advance that comprises improving infrastructure and human skills, establishing acclimatising governance mechanisms, and promoting international cooperation. As AI continues to progress and grow, institutions must remain agile and dedicated to ongoing learning to maximise benefits and minimise risks.

H2: There is a need for Institutional capacity towards Artificial Intelligence for sustainable business in Central and Eastern Asia's emerging economies

Ethical Consideration

Ethical considerations towards artificial intelligence (AI) innovation are highly significant to each other and become increasingly integrated across various aspects of society (Du & Xie, 2021). Ethical considerations have been identified as a crucial part, with most scholars being very concerned towards highlighting areas that need improvement. In some developing and developed countries, policymakers and scholars are deeply concerned about the ethical considerations of AI to ensure that society benefits from the deployment of artificial intelligence and reduces the related harm of the technologies through the application of accountability, transparency, privacy, and the mitigation of biases (Camilleri, 2024). One of the most challenging and notable issues with artificial intelligence is the concern for fairness and bias, driven by ethical considerations. The AI innovation utilises data that is sometimes biased or incorrect, which ethically leads to biased results; such activities contradict the ethical standard and are unrepresentative of the data, perpetuating inequalities (Modi, 2023). Rising concerns about data discrimination due to incorrect data representation underscore the importance of considering ethical aspects of data presentation and diverse data collection in addressing data bias. The collection of data is considered essential in promoting ethical standards and equality in AI applications (Martin et al., 2022).

Transparency elucidates the significance of developing trust and accountability using artificial intelligence (Eke & Shuib, 2024). The black-box model proffers imminent insight based on processes of decision-making, which ethically indicates the ethical challenges (Hassija et al., 2024). Orlova et al. (2023) opined that artificial intelligence provides a solution to existing issues, developing a clear output for trust and accurate, interpretable consent based on transparency and accountability.

Privacy and data protection are considered one of the most significant aspects of artificial intelligence, which heavily relies on data and raises concerns that extend beyond data privacy. However, the demands for personal data should be highly protected from illegal usage (Martin & Zimmermann, 2024). The practices of data protection should strictly adhere to the basic guidelines to protect against data misuse and wrongful applications, which will lead to ethical issues between AI and individual data control and privacy (Renuka et al., 2024).

Societal and ethical influences raise questions about their impact based on power dynamics, ethical restrictions, and social cohesion. Such exacerbating activities, which lead to inequality and alter societal views, threaten the system's ethical credibility in terms of societal value (Spiekermann et al., 2022). The development of AI necessitates an ethical framework that aligns with the country's values and operations. However, failure to attend to such ideas and involvement can lead to stakeholder marginalisation, which may hinder the adequate distribution of AI's societal impact and value (Bhatt, 2022). The review highlights

the importance of integrating artificial intelligence in addressing privacy protection, transparency, accountability, and societal influence, which necessitates the advancement of related ethical systems. The AI framework, based on ethical considerations, suggests that it influences the impact of innovation (Saurabh et al., 2022).

H3: There is a need for Ethical consideration towards Artificial Intelligence for sustainable business in Central and Eastern Asia's emerging economies

Technological readiness

Technological readiness and advancements in artificial intelligence have changed various areas of technology and non-technology sectors, such as finance, transportation, and healthcare (Vo et al., 2024). The readiness of the innovation context in which organisations and government agencies are ready to leverage the efficiency and effectiveness of artificial intelligence (Alhosani & Alhashmi, 2024). The core understanding of technological readiness refers to the level of attentiveness and preparedness of the organisation toward the adoption of new technologies (Kaushik & Agrawal, 2021). NASA has developed a Technology Readiness Level (TRL) widely used to evaluate the level of maturity of any developed innovation to ensure effectiveness and efficiency for full deployment of the technology through regulatory environment, data accessibility, infrastructural development, and technical expertise (Harfouche et al., 2024).

Amongst the influencing factors that indicate several technological readiness, such as performance computing, innovative infrastructures and essential data robust storage (Kaushik & Agrawal, 2021). However, demonstrating technological advancement indicates the level of readiness of the technologies (Alharbi & Sohaib, 2021). The availability of data qualified the dependency and an accurate dataset with higher credibility. Wang (2022) highlights the accuracy of the data ecosystems, enhances the innovative mine, and addresses the scarcity of retrogressing artificial intelligence in developing emerging economies (da Silva, 2024). Technical expertise and innovational human capital increasingly enhanced the efficiency and effectiveness of technological readiness, significantly influencing the readiness of the technological system. The literacy of Artificial Intelligence is considered vital and promotes educational system readiness for AI (Vo et al., 2024). Therefore, the technological readiness towards artificial intelligence significantly influenced the multifaceted factors through the use of different constructs to justify the relationship between the study variables. The constructs comprise human expertise, infrastructure, regulatory environment, and data ecosystem.

H4: There is a need for technological readiness towards artificial intelligence for sustainable business in the emerging economies of Central and Eastern Asia.

Business sustainability

Sustainable business practices towards artificial intelligence are considered transformative business practices with enormous opportunities for sustainable development. AI has rapidly expanded its potential through the application of appropriate regulations in other regions (Goralski & Tan, 2020). However, Effective regulation ensures enhanced development and sustainable business (Rakhmawati et al., 2020). Effective regulations for business sustainability enhance accountability and transparency, which enable businesses to operate openly (Efunniyi et al., 2024). The effective guideline indicates the efficiency of data quality and privacy, which reduces the risk of misuse (Rizi & Seno, 2022). In addition, business regulations towards artificial intelligence enhance innovation related to business activities and encourage sustainable data management (Zhao & Gómez Fariñas, 2023).

International cooperation is essential for business sustainability through harmonised standards, which help avoid unethical activities and ensure regulatory framework compliance. However, business sustainability using AI cannot be efficient until they collaborate to create a technological framework (Chowdhury et al., 2022). Moreover, business regulation drives technological business solutions, which can enhance business potential and regulatory guidelines for business sustainability.

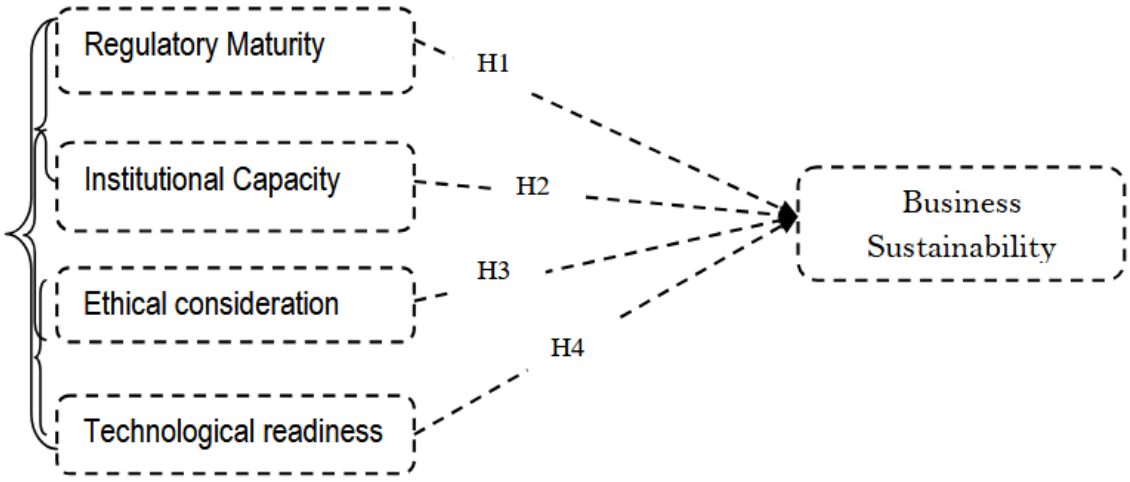

Figure 1. Research Model
Source: Designed by the author

Prior studies indicate the focus on Institutional capacity toward artificial intelligence (AI), ethical considerations toward AI, regulatory maturity (Costa & Mendonça, 2024), and technological readiness toward artificial intelligence (Falebita & Kok, 2024). However, the new gap needs to be investigated using regulatory business sustainability, focusing on regulatory maturity, institutional capacity, ethical consideration, and technological readiness. There is a need to examine the relationship between various variables related to AI regulation and a sustainable business framework using the research model in Figure 1. Such technological innovation will enhance business efficiency and effectiveness through the use of artificial intelligence. Drawing on regulatory maturity, institutional capacity, ethical considerations, and technological readiness will surely address business sustainability and enhance AI technology.

RESEARCH METHODOLOGY

General Background

The study examines the AI Regulation for Sustainable Business through legal challenges in Eastern and Central Asian Emerging Economies. This study employed quantitative data using Structural Equation Modelling and analysed the views and perspectives of experts from Eastern and Central Asian emerging economies from different fields of study. The respondents consist of AI, business and economics experts for the survey. The research used a convenience approach for data collection; the participants were invited through a survey questionnaire using a 5-point Likert scale measurement. The measurement adopted confirmatory analysis using Structural Equation Modelling and ensured that the validity and reliability were considered for accuracy. In addition, the survey respondents were volunteers, with 250 respondents. Ethical standards in Kazakhstan are centred on infrastructure and regulatory development, with sound regional cooperation. At the same time, China has comprehensive policies and regulations, as well as advanced technological equipment that support its technology-driven and sustainable development. China adopts a proactive approach and measures towards AI integration, based on regulatory strategies, to enhance innovation. Therefore, Kazakhstan encourages ethical regional guidelines for the growth of AI and infrastructure policy.

Table 1: Variables Description

Variables	Construct (s)	Number of items	Sources

Regulatory Maturity	1. Progression of AI to regulatory maturity towards business sustainability. 2. Flexible AI regulatory demand enhances business sustainability 3. Mutual enhancement between stakeholders and operators promotes business sustainability 4. Advancement approaches rapidly enhance grow business sustainability 5. Effective regulation stable the system and enhances business sustainability	5	Zhou & Kankanhalli, 2021 Piekarczyk et al. (2022 Larson et al., 2021). Young et al., 2018 Schmidt-Kessen et al., 2022 Nikolinakos, 2023
Institutional capacity	1. Incorporation of government agencies towards AI significantly enhances business suitability 2. Organizational readiness shows the capacity of the organization towards AI and promotes business sustainability 3. Government structure enhances the capacity of the organization 4. Newly developed AI innovation to emerging strategies promote business sustainability 5. Effective regulation increases institutional capacity towards business sustainability	5	Bloom, 2020 De Almeida et al., 2021 Ortiz-Avram et al., 2024 Socol & Iuga, 2024 Saputra et al., 2024 Imran et al., 2022 Al-Husseini et al., 2021 Zhang et al., 2023
Ethical consideration	1. AI real-time accountability is considered significant for enhancing business sustainability 2. Transparency under ethical consideration simplifies helps business initiatives 3. AI should be Fairness and free of bias towards development activities, which influences business sustainability 4. Privacy is considered vital towards AI, and embedding it in technologies assists the business sustainability 5. Societal and ethical influences enhance trust in business sustainability.	5	Du & Xie, 2021 Camilleri, 2024 Martin et al., 2022 Hassija et al., 2024 Spiekermann et al., 2022
Technological readiness	1. Having fast innovational technology for performance computing enhances business sustainability. 2. Innovational structures using different technologies to enhance business sustainability 3. Robust data enhance technological development using business sustainability	5	Vo et al., 2024 Alhosani & Alhashmi, 2024 Kaushik & Agrawal, 2021 Harfouche, et al., 2024) da Silva, 2024 Alharbi & Sohaib, 2021

	4. Storage systems are vital to any technological innovation and business sustainability 5. Human experts are part and parcel of AI technology and business sustainability		
Business sustainability	1. Regulatory maturity on business innovation synchronizes the impact on business sustainability 2. Capacity of organization strategies the business sustainability for long-term innovation and standard innovation 3. Building trust based on regulation enhances stability and sustainability 4. Innovation enablement bust the business environment 5. Competitive advantage in innovation contributes to business sustainability.		Rakhmawati et al., 2020 Efunniyi et al., 2024 Rizi & Seno, 2022 Zhao & Gómez Fariñas, 2023 Chowdhury et al., 2022

Source: Designed by authors

Table 1 indicates the constructs related to each variable. The study consists of the defined variables, including regulatory maturity (Zhou & Kankanhalli, 2021). For the institutional capacity of government agencies, organizational readiness, and effective regulation (Zhang et al., 2023). Ethical considerations emphasize the importance of real-time accountability and transparency, informed by ethical principles. Technology readiness is also considered for innovative structures, storage systems, and human experts (Alhosani & Alhashmi, 2024). In contrast, business sustainability testing involves assessing regulatory maturity in innovative business sustainability through capacity and organisation, building trust, and fostering a competitive advantage through innovation.

Table 2. Normality assessment

VARIABLE	Item (s)	SKEW	KURTOSIS
Regulatory Maturity	RM 1	-1.214	0.755
	RM 2	-0.749	0.923
	RM 3	-1.243	0.848
	RM 4	-1.245	1.328
	RM 5	-0.819	0.326
Institutional capacity	IC1	-0.823	0.422
	IC 2	-1.432	0.550
	IC 3	-0.900	0.354
	IC 4	-0.701	0.861
	IC 5	-0.752	-0.567
Ethical consideration	EC1	-0.832	0.322

	EC2	-0.635	-0.471
	EC3	-0.891	0.576
	EC4	-0.788	0.465
	EC5	-0.839	0.555
Technological readiness	TR1	-1.523	0.467
	TR2	-0.681	0.544
	TR3	-0.743	0.892
	TR4	-0.881	0.497
	TR5	-0.671	0.522
Business sustainability	BS1	-1.648	0.900
	BS2	-0.863	0.851
	BS3	-0.733	0.154
	BS 4	-0.619	0.533
	BS 5	-0.347	0.545

Source: Designed by Authors

Table 2 shows that the model constructs require a normality assessment for the modeled distribution. The Kurtosis and skewness are placed within ±2 and ±9, respectively. The analysis was conducted using descriptive statistics. However, argued that the accepted kurtosis value ranges from ±10 to ±10, and the proper skew ranges from ±3 to ±3, as shown in Table II of the Assessment of Normality.

RESULTS

The section discusses the results of testing Structural Equation Modelling (SEM), examining the complex relationship between variables and their impact on AI regulatory business sustainability in emerging economies.

Table 3 Profile of the respondents

Demography	Frequency	Percentage
Gender		
Male	162	65%
Female	88	35%
Age		
18-25	35	14%
26-35	50	20%
36-45	100	40%
46-above	65	26%
Marriage status		
Married	150	60%
Single	100	40%
Education		
Primary	0	0%

Secondary	5	2%
Diploma/NCE	43	17%
Degree	115	46%
Masters – above	87	35%
Employment		
Government worker	50	20%
Private worker	200	80%

Source: Designed by authors

The research's respondents were mainly married men, 65, while 40% were carriers. Some respondents have attended some level of education. 17% hold diplomas, whereas secondary school education is held by 2%, and degrees are held by 41%. Of the respondents working in the public or government sector, 20% earned a monthly salary. While 80% of the respondents are from private organisations working for companies, as their monthly earnings are attractive. Therefore, the distribution of data was reflected in the respondents' profiles.

Table 4: Standardised Factor loadings

Constructs	Code	Factor Loadings	Composite reliability	AVE	Cronbach Alpha
Regulation Maturity					
	RM 1	0.855	0.870	0.788	0.876
	RM 2	0.923			
	RM 3	0.791			
	RM 4	0.812			
	RM 5	0.563			
Institutional Capacity					
	IC1	0.671	0.840	0.741	0.845
	IC 2	0.717			
	IC 3	0.730			
	IC 4	0.749			
	IC 5	0.838			
Ethical Consideration					
	EC1	0.811	0.851	0.748	0.850
	EC2	0.589			
	EC3	0.791			
	EC4	0.808			
	EC5	0.744			
Technological Readiness					
	TR1	0.687	0.865	0767	0.861
	TR2	0.891			
	TR3	0.811			

	TR4	0.720			
	TR5	0.727			
Business Sustainability	BS 1	0.763	0.869	0.780	0.869
	BS 2	0.833			
	BS 3	0.721			
	BS 4	0.762			
	BS 5	0.822			

Source: Designed by authors

Table 4 displays the outcome analyses of the factor loadings; the standard loadings were perfectly loaded using the different variables indicated in the research, and no factor was identified with poor loading. All factor loadings were above 0.5, as indicated by Awang et al. (2015).

In the subsequent columns, the validity and reliability were tested for each variable, internal consistency was assessed, and the outcome of the analyses indicates that composite reliability ranged between 0.840 to 0.870, indicating the absolute loading with more than 0.7 as justified by (Kim et al., 2016) the same scenario to Cronbach alpha where the range between 0.845 to 0.876. At the same time, the Average Variance Extraction (AVE) also meets the initial threshold of 0.5 (Awang et al., 2015).

Table 5: Discriminant validity

Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	
RM	**0.620**					
IC	0.382	**0.549**				
EC	0.335	0.421	0.**559**			
TR	0.438	0.538	0.750	**0.588**		
BS	0.594	0.653	0.726	0.650	**0.608**	

Source: Designed by authors

Table 5 illustrates that a discriminant test was employed, utilising a validity assessment based on the selected variables. The variable thresholds were assessed based on the square root of AVE, and therefore, the discriminant ranged between 0.335 and 0.650, which is relevant as the scores are below 0.85. At the same time, the AVE is greater than the discriminant correlation (Rönkkö & Cho, 2022).

Table 6: Goodness of fit and measurement model

Variable	**Modified Model**	**Acceptable Value**	**Recommended Value**	**Source**
X^2/df	2.213	>0.5	<3.0	Bagozzi (2022)
p-value	0.000	<0.005	0.000	Hair et al., (2021)
GFI	0.916	>0.9	>0.8	Kline (2023)
AGFI	0.905	>0.9	>0.8	Chao et al., (2023)

IFI	0.962	>0.9	>0.8	Chao et al., (2023)
TLI	0.915	>0.9	>0.8	Kline (2023)
CFI	0.980	>0.9	>0.8	Hair et al., (2021)
RMSEA	0.042	<0.05-0.08	<0.1	Bagozzi (2022)

Source: Designed by authors

Table 6 demonstrates the fit of the model. The chi-square indicates 2.213, which is less than <5.0. Kline (2023) suggested that the GFI value is 0.916. Similarly, the AGFI value is 0.905. Furthermore, the model demonstrated its ability to forecast the variance and covariance of the survey data. As advised by Chao et al. (2023) and Hair et al. (2021), the CFI, TLI, and IFI index scores are above 0.9, respectively. In addition, the RMSEA is 0.042. Therefore, the findings above demonstrate that the model's measures are appropriately modified and supported by several theories.

Table 7: Hypothesis test

Path	**Estimate**	**Beta**	**Critical Ratio**	**P-value**	**Decision**
RM -> BS	0.200	0.049	4.081	.***	supported (H1)
IC -> BS	0.258	0.070	3.685	.004	Accept (H2)
EC -> BS	0.240	0.062	3.870	.002	Accept (H3)
TR -> BS	0.220	0.053	4.150	.***	Accept (H4)

Source: Designed by authors

Table 7 shows that all tested variables were accepted. The hypotheses tested, from Regulation Maturity (RM), Institutional Capacity (IC), Ethical Consideration (EC), and Technological Readiness (TR) to Business Sustainability (BS), were statistically significant, as measured by the appropriate p-values, which were all below the significant level of 0.05. The hypotheses (H1, H2, H3, and H4). Therefore, the section explained the path analyses of the structural model as indicated in the results table above. The results of the hypothesis testing from H1 to H4 are interpreted using the p-value and its critical values. However, the p-value mentioned frequently in the reports indicates the results of the hypothesis at a significant level of less than <5%.

DISCUSSION

To summarise the study, the variable definitions in the studies indicate that the variable's activities are covered in Table 1. The constructs used in the table were defined for both measurement and structural models. Table 2 was based on the assessment of the Normality of each item used in the study construct, examining the normality of the data distribution. The demographic analysis of the respondents is shown in Table 3. The items that make up the factor loading that creates the construct factor loading are indicated in Table 4. According to Bagozzi (2022), factors with loadings greater than 0.5 indicate that the measurement model's construction is more favourable than the factor loadings. Construct reliability and validity show that the theories' threshold was satisfied in the absolute measurement assessment (Hair et al., 2021); composite reliability was found to be above 0.7, and the threshold of 0.7 and above was taken into consideration by Cronbach's alpha (Hair et al., 2021). The discriminant validity results for Table 6 Average Variance

Extraction (AVE) above 0.5 (Hair et al., 2021) indicated that the square root of AVE was more than off-diagonal across rows and columns, which was below the suggested threshold of 0.85 (Chao et al., 2023). Furthermore, as indicated by Bagozzi (2022), Table 7 details the measurement of the model and presents the fit statistics for each model, including GFI, AGFI, IFI, CFI, TLI, and RMSEA. The study highlights the connection between artificial intelligence regulation and sustainable business practices for addressing the challenges faced by emerging economies in the Eastern and Central Asian regions, including regulatory maturity, institutional capacity, ethical considerations, and technological readiness for business sustainability. Every scenario demonstrated a favourable correlation between the variables. The findings validated the claim (Nikolinakos, 2023). The most critical component of sustaining a competitive advantage in utilising artificial intelligence (AI) is its innovative capabilities (Bloom, 2020; Schmidt-Kessen et al., 2022; Zhang et al., 2023). According to the study, AI can help maintain and sustain business regulations by enabling organisations to address the challenges of AI through the use of artificial intelligence for improved operations. To address fundamental difficulties, the study concludes by emphasising the importance of implementing AI challenges for business sustainability.

The findings of the study indicates the regulatory challenges exist in the Central Asia despite the achievement and acceleration of the AI in the region, it highlighted that lack of clear policy and limited enforcement drives back the credibility of the AI operation and affect directly the AI business sustainability through blocking innovations and creativity, unlike Eastern region whereby the comprehensive regulatory framework exist to support the growth of AI business sustainability in the area. Therefore, an extensive regulatory system is highly needed to support the betterment of the AI business in Central Asia for sustainable economic growth.

In the Eastern region, such as China, regulatory practices are widely utilised and centralised through government regulations to control innovation growth and mitigate risk-related issues. While in Central Asia, the method and approach are relatively decentralised, and further establishing rules to enhance the sound development and innovation through collaboration within the region. Similarly, for the Eastern Asia region, countries like China adhere to the control and regulation of the system. At the same time, Central Asia, including Kazakhstan, is focusing on enhancing its system through ethical considerations and maturity, which can be achieved through balanced growth and the development of artificial intelligence. In summary, Kazakhstan suffered from limited regulations and infrastructural capacity, while China has sound and comprehensive regulations. Despite both countries' struggles with technological enhancement and aligning policies on security and ethical concerns, China has made significant progress. In Kazakhstan, as a developing country, AI regulation has been established through government regulations and standards-based considerations (Inshakova et al., 2024). Kazakhstan has adopted digital innovations to enhance technological transformation through the integration of artificial intelligence. The government of Kazakhstan has developed a program to establish ethical and legal guidelines for technological growth, with a focus on data security and transparency.

Furthermore, China recently launched a control mechanism to maintain AI content and deep fakes by avoiding misinformation and promoting social harmony, strict oversight, and national security. The Kazakhstan government is collaborating with international agencies to strengthen its policies in line with international standards. One of the crucial areas of innovation in Kazakhstan is enhancing technology to safeguard the nation through privacy and data security using AI integration (Azanbay, 2024).

Moreover, Central and Eastern Asia face similar regulatory uncertainty in business implications.

1. Compliance costs increment allows companies to operate based on principles, as substantial resources are allocated to complying with unpredictable regulations and extensive requirements based on essential services.
2. A slowdown in the growth of technology is confirmed by an uncertain situation in which industries and companies are avoiding regulatory breaches, such as delaying innovations, product development, and technological advancements.
3. Reputational risks are sensitive, particularly when firms unintentionally

violate developing regulations, consequently injuring the brand's trust and losing stakeholder trust and confidence.

4. Ambiguity in regulation results in the market crumbling in different regions due to the incoherent regulations conflicting with cross-border strategic operational planning

These factors discourage economic integration and deter foreign investors from the region, significantly affecting the economic prospects through increased compliance costs, regulatory uncertainty, declining market stability, heightened operational risk, and constricted innovation in the region. Business risk exposure shows Eastern Asia faces moderate risks due to mature regulations, but benefits from clarity and support for innovation. While in Central Asia, regulatory uncertainties and weak institutional capacity heighten risks, including legal ambiguities and compliance challenges, which deter investment and the adoption of AI

Therefore, addressing the factors (regulatory maturity, institutional capacity, technological readiness, and ethical considerations) will enhance the sustainability of AI businesses in these emerging economies. This approach helps policymakers, stakeholders, and managers visualise the effectiveness of AI business regulation in addressing targeted policies and related needs, thereby enhancing the suitability and sustainability of AI innovations. The study recommends applied comparative studies for a better understanding and regional growth in technology

Table 8: Summary of Comparative Analysis of AI Regulatory Maturity in Central Asia and Eastern Asia

Dimensional comparison	**Eastern Asia (e.g China)**	**Central Asia (e.g., Kazakhstan)**
Regulatory Framework	Eastern Asia, particularly countries like China, has established comprehensive AI regulations and policies, reflecting proactive governance.	Central Asia's frameworks are nascent or evolving, with many countries still developing foundational policies, leading to a lower maturity level.
Institutional Capacity	Eastern Asian nations possess robust institutional structures and dedicated agencies overseeing AI development, enforcement, and oversight.	Central Asia faces limited institutional capacity, often lacking specialized bodies, which hampers effective regulation and coordination.
Ethical Standards	Eastern Asia emphasizes ethical standards, with guidelines on privacy, transparency, and AI fairness integrated into policies.	Central Asia is in the early stages of adopting ethical frameworks, with minimal enforcement mechanisms, which increases the risks of misuse or bias.
Technological Readiness	Eastern Asia demonstrates high technological readiness, supported by advanced infrastructure, research, and innovation ecosystems.	Central Asia lags behind, with limited technological infrastructure and slower adoption rates, which hinder the deployment of AI.
Business Risk Exposure	Businesses in Eastern Asia face moderate risks due to mature regulations, but benefit from clarity and support for innovation.	In Central Asia, regulatory uncertainties and weak institutional capacity heighten risks, including legal ambiguities and compliance challenges, which deter investment and the adoption of AI.

Source: Designed by Author

Table 8 illustrates the level of development in both Eastern Asia and Central Asia, based on their respective regulatory frameworks. Eastern Asia has established comprehensive AI regulations and policies, whereas Central Asia has a system still under development. At the same time, Institutional capacity in Eastern Asia indicates robust institutional structures and dedicated AI agencies, whereas in Central Asia, there are no specialised bodies towards AI. Ethical standards are being integrated under transparency and AI fairness policies in Eastern Asia, while Central Asia is in the process of adopting these policies

and moral frameworks. The same applies to technological readiness, where it is supported by advanced technological infrastructure in Eastern regions, while the central region has limited technological infrastructure.

Furthermore, business risk exposure in the Eastern region is moderate, with mature regulations for innovation. In contrast, the Central region exhibits uncertainties, weak institutional capacity, and ambiguities in legal and regulatory compliance. Therefore, the comparative analysis indicates that Eastern Asia has developed a structural framework and capacity to enhance AI innovation and regulatory maturity. In contrast, Central Asia is still in the early stages of developing AI regulation and regulatory maturity.

CONCLUSIONS

Therefore, promoting regulation for sustainable business by adopting artificial intelligence factors enhances the operational area in terms of regulatory maturity, institutional capacity, ethical considerations, technological readiness, and business sustainability. The findings support a direct relationship between the variables in the study. Furthermore, Findings indicated that institutional capacity and regulatory maturity have a significant impact on technological readiness, ethical consideration, and socioeconomic and policy adoption, which influence sustainable business effectiveness. However, the inconsistency in policy enforcement and regulation of artificial intelligence poses challenges to the institutional and business framework. In addition, the research further examined the relationship between AI regulations and business sustainability. The research provides valuable insights into the various factors that can enhance the AI regulatory framework for sustainable business development in emerging economies. Therefore, addressing the factors (regulatory maturity, institutional capacity, technological readiness, and ethical considerations) will enhance the sustainability of AI businesses in these emerging economies. This approach helps policymakers, stakeholders, and managers visualise the effectiveness of AI business regulation in addressing targeted policies and related needs, thereby enhancing the suitability and sustainability of AI innovations.

Limitations of the study

The limitations of the study highlight the relationship between variables such as regulatory maturity, institutional capacity, ethical considerations, and technological readiness within a sustainable business ecosystem. Future research could expand this investigation to cover the entire Asian region for better outcomes and growth.

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Conflict of Interest

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