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A Cross-National Comparative Policy Analysis of the Blockchain Technology Between the USA and China

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Abstract: Blockchain technology can achieve decentralization, multi-party verification, anti-tampering, anonymity, traceability of transactions, and the application of distributed ledger. Countries around the world continue to seek the blockchain business models, technologies and applications, and have different visions and policies for the development of blockchain. This study conducts a comparative policy framework of theoretical analysis of the blockchain technology between the USA and China. Using the innovative policy tools proposed by Rothwell and Zegveld, the above mentioned governments are analyzed from the viewpoint of twelve policy tools. The results show that the USA and China all prefer to use "Environmental-side" policy. The USA has paid more attention to "Legal and regulatory", "Public services" and "Procurement". China has the highest proportion of policies in "Political tools", followed by "Legal & regulatory", while "Scientific and technical", "Education" and "Overseas agent" come in third . The blockchain technology has developed vigorously among industries and its applications have gradually diversified. The results are provided to various stakeholders as a reference for policy planning.

Keywords: Blockchain; Decentralization; Innovation Policy; National Innovation Systems; Policy Tools; Legal and Regulatory

1. Introduction

A paper issued by Nakamoto called "Bitcoin: A Peer-to-Peer Electronic Cash System" which brought the concept of electronic currency and the algorithm of the bitcoin in 2008 [1]. Bitcoin was born on January 3, 2009. Unlike other currencies, Bitcoin is generated by an algorithm rather than a specific issuer. It is a decentralized digital currency. In 2016, Bitcoin has reached a great success in the capital market which reached 10 billion dollars [2]. Bitcoin's overall annual market value grew by more than 1,300% and soared to nearly $20,000 for a record highest price at the end of 2017. According to data of CoinMarketCap [3], the total market value of Bitcoin escalated from $15.6 billion in early 2017 to a record high that December of $320 billion.

The underlying key technology used by Bitcoin is blockchain technology, which is hailed as the disruptive innovation in the 21st century. Schwab [4], founder of the World Economic Forum (WEF), predicted that the blockchain technology will act as the sticking point to a movement in industrial revolution. Moreover, blockchain technology will change people's lives and have a large affect on the overall economic structure. There were a total of 682 cryptocurrencies based on blockchain technology, with a total market value of nearly $12 billion as of September 2016,. Among them, Bitcoin accounted for 79%. In just a few years, the cumulative investment in the blockchain sector has exceeded $1.4 billion USD; concurrently, more than 2,500 blockchain-related patents have been issued. With the potential value of blockchain, multinational industry giants have laid out the blockchain areas by setting up research groups, investing in blockchain startups, developing blockchain-based platforms, and researching future potential applications. Demonstration of cryptocurrencies' potential has also begun to drive a wave of entrepreneurial innovation in blockchain [5].

Blockchain was originally a bitcoin-enabling technology, but today it has evolved into a large technology ecosystem and many new organizations related to blockchain have emerged. Since blockchain technology permits paying to be settled with no intermediary, financial services can get benefits from this technology [6] [7]. In addition, blockchain technology is serving as one of the unsurpassed technologies of the next era systems, such as Internet of Things (IoT) for E-business [8], public services [9], security services [10], reputation and reward record systems [11], and privacy-preserving smart contracts [12]. For example, the Hyperledger Project was created by the Linux foundation, in which there are already hundreds of members including Accenture management consultants, IBM, and dozens of banks, with the goal to build enterprise-level blockchain technology that can be implemented in every industry [13]. Meanwhile, the Enterprise Ethereum Alliance (EEA), created by JPMorgan, Microsoft, Intel and more than 30 companies in 2017, is a member-driven enterprise Etthereum ecosystem that spurs new businesses and consumers [14]. In 2019, INATBA [15] brought diverse organizations together to assist DLT (Distributed Ledger Technology) and blockchain into the mainstream across numerous divisions.

The scope of the applications of blockchain technology ranges from the financial field (digital currency, bank cross-border payment and remittance, electronic ticket, crowdfunding) to many non-financial applications, including medicine (such as electronic medical records, pharmaceutical development), supply chain (such as logistics tracking, supply chain management), energy (such as energy trading, energy supply and demand management), agriculture (such as food production and sales, food safety resume), digital rights (such as copyright authorization, art product authenticity verification) and public management (such as electronic voting, identity verification), etc. In UK, the government has been studying blockchain technology to activate city residents to follow the trail of the government funds [23]. China has not fallen behind in the applications of blockchain, with industry leaders launching a food blockchain traceability system: OwlChain [16], sports event blockchain system: BraveLog [17], and travel management blockchain system: OwlNest [18], in which the detailed history of diet and sports information on athletes assists hoteliers to manage the reservation system. In Denmark, BEV (Blockchain-enabled e-voting) has been applied in the elections. In Estonia, BEV is utilized in shareholder votes [23]; Moreover, the government has examined to apply ID cards in daily life with blockchain implemented services. The Swedish real estate transactions on the blockchain, thus allows the parties to track the progress of the transaction, and ensures authenticity and transparency in the trading process, so that saves a lot of the transaction time and cost. Moreover, blockchain technology has been used for the payments of welfare in the UK.

This study conducts a comparative policy framework of theoretical analysis of the blockchain technology and summarizes the differences and ranks between the USA and China. The composition of this paper is as the following. In Section 2, we review the related developments of blockchain industrial policies. Innovative policy framework in blockchain is presented in Section 3. Section 4 presents the research methodology. In Section 5 discusses the compared results of innovative policies of blockchain industry employed by the USA and China. In Section 6, we present the conclusions and practical implications.

2. Development of Blockchain Industrial Policies

There are many explanations for the development of an industry or a specific industry link in a specific country. The most traditional argument is that the industry has better comparative interest conditions in that country, such as capital or human factors for national advantages. However, this basic assumption does not take into account the special technology and production differences which are not consistent with the actual situation. Therefore, many economists have proposed a number of theoretical counterexamples and amendments to this assumption. For example, Rothwell and Zegveld [19] summarized the required factors of the industrial innovation as shown in Figure 1. They also stated that countries and enterprises can use policies to change relevant factors and conditions to gain competitive advantage, and the resources required by industries will vary due to different periods and environments. After further analysis and comparison, Porter [24] found that

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the new theory of competitive advantage must not only raise the level of competition to the national level, but also must focus on technological progress and innovation.

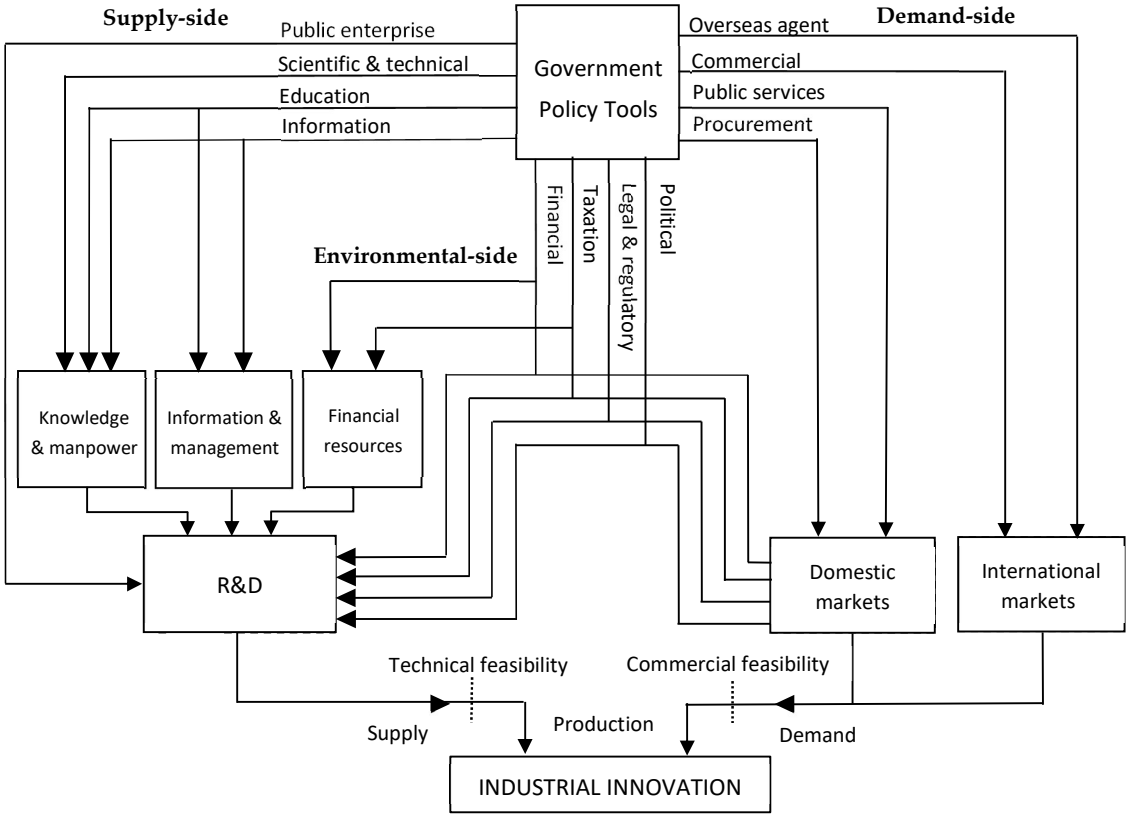

Figure 1. Inducing innovation – the required factors of the industrial innovation.

Source: Rothwell & Zegveld [19].

In the article "Government's role in innovation", Leyden and Link [25] proposed that economic growth is primarily derived from innovative technology. Without the intervention of the government, enterprises usually have insufficient investment in technology, especially in the field of basic research. Therefore, the government has the responsibility – through rewards or incentives for additional research and development – to address inadequate investment or market failure situations, which will also promote the country's economic growth. Shyu [26] concluded that industries should have different requirements in different development periods and environments; so as to master the key requirements in the process of industrial development, the government and industry can make appropriate plans based on industrial requirements. Moreover, innovation infrastructure requires a more detailed analysis and research on the industrial innovation process and structure to find the basic requirements for industrial innovation and development. Although Porter's [24] argument has clearly shown the importance of industrial technological innovation to a country's competitive advantage, Porter's theory does not clearly point out how to plan industry to achieve industrial innovation. Wang [27] pointed out that national policies, financial systems and industrial structure will profoundly affect a country's model of technology learning and innovation, but the coverage of the influencing factors is still not comprehensive. Rothwell and Zegveld [19] explained the impact of industrial innovation, stating that industrial innovation can lead to the growth of a country at all economic levels, and the requirements of industry vary in different periods and different environments.

There were more than 18,000 applications for blockchain patents globally, in which 35 countries and regions were involved as of July 25, 2019 [56]. China ranks first and the United States ranks second. Among the top 20 global blockchain agencies filing patent applications, Alibaba Network

Technology Co., Ltd. and China United Network Communications Group Co., Ltd. respectively ranked first and fifth in the world in terms of applications. Guo [32] stated in "Blockchain Finance Problems and Countermeasures" that blockchain technology is facing imperfect legal systems and high research and development costs, and proposed countermeasures for the future development of blockchain finance. Gabison [33] argued that blockchain technology increases the expenses to retain the records without enough favors, but governments could propel the aims of openness and justifiability. Mei and Liu [5] introduced the technical principles of blockchain, discussed its industry situations and existing problems, and proposed related policy suggestions for government, industry, and academic institutions. Novak [34] built a blockchain "crypto-friendliness" which could evaluate the level of policy makers enacting the policies accommodative.

In 2017, Tencent Research Institute [35] published a white paper on Tencent blockchain solutions, analyzing the globalization trajectory, development pattern and application prospects of blockchain technology; moreover, it published the 2019 Tencent Blockchain White Paper [36], focusing on the industry blockchain and explaining the breaking of ground for industry blockchains in detail. Huang [37] pointed out that the effective supervision of financial blockchain technology is a issue which has to be resolved earnestly and propose risk prevention and regulatory policy recommendations. Truby [38] explored the regulatory, legal and policy related to blockchain technology and digital currencies for sustainable environmental development. Michael et al. [39] investigated blockchain technology regulatory in financial services which counsels face lots regulatory examination with this technology evolved. Allen et al. [40] developed a new model related to innovation policy with the implications of blockchain innovation. In 2018, EU members signed a declaration to cooperate in the establishment of EBP (European Blockchain Partnership) and EBSI (European Blockchain Service Infrastructure) [57]. The European Commission stated that blockchain technology could make online transactions highly traceable and secure, and is considered a major technological breakthrough [51] [52]. This aim is to employ blockchain into the blockchain economy, with a view to gain the leading position of digital technology in the world with the powerful technical level of Europe. European Commission [60] issued a proposal about crypto-assets in 2020. In a motion [62] emphasized that the blockchain technology needed a EU level expertise and talent.

2.1. The USA's Blockchain Industry Policy

The United States has started to deploy the blockchain technology very early, and ranks as the leader of blockchain-related patent applications [41]. Although it has always pursued free economic markets, advocating that the market will be led to the most beneficial outcome for society, the United States has become more conservative with regard to cryptocurrencies. The exchanges of Cryptocurrencies and ICOs (Initial Coin Offerings) showing challenges in regulatory to prevent afoul products, a group of market participants launched an agreement of industry standard called SAFT (Simple Agreement for Future Tokens) [22]. California Governor [46] signed a law numbered AB129 to secure the legalization of California Bitcoin and other digital currency transactions in June 2014.

From 2015 to 2017, Circle in Boston, Ripple in San Francisco, and Coinbase in New York, each received a digital currency license BitLicense [47]. In terms of bitcoin attitude, the United States encourages investment and implements strict regulations. In 2017, the United States SEC (Securities and Exchange Commission) determined that the Ethereum token and DAO (Decentralized Autonomous Organization) both belong to the securities issuer and need to register as a securities issue according to law [49] [48]. Moreover, the United States CFTC (Commodity Futures Trading Commission) has permitted DCO (Derivatives Clearing Organization) registration to LedgerX, LLC (LedgerX) under the CEA (Commodity Exchange Act) [50]. In light of the regulatory uncertainty surrounding blockchain technology, the Standford CodeX Blockchain Group launched the RegTrax initiative with the goal of collecting, tracking, and disseminating regulatory developments from around the globe, to create a comprehensive repository of the current formal and developing regulatory landscape, while archiving out-of-date regulation for retrospective analysis [61].

In 2018, a report issued by the Joint Economic Committee [22], it provides an assessment of the United States economy and recommendations for the new year's economic development, and

proposes blockchain technology being the potential tool to assure digital infrastructure in the USA . Since 2014, there have been two waves of regulatory measures related to cryptocurrencies. In order to avoid the risk of crime such as money laundering or fraud affecting the development of the industry, the United States government departments focus on maintaining a good market competition order, adopting various measures to establish standards and create a good competitive environment. Many government agencies have cooperated with private enterprises to study the applications of blockchain, including the establishment of a new generation inventory platform to manage and record the health and performance of combatants throughout military operations, as well as supporting patient-level data exchange in USCIIT (United States Critical Illness and Injury Trials) Group to improve the application of social welfare and show official attention and support for blockchain industry.

2.2. China's Blockchain Industry Policy

In China's "Made in China 2025" clearly states that it is indispensable to increase the innovation, experimentation and implantation of new technologies such as blockchain [53]. China hopes to become the largest economy around the world in the future, have the ability to lead in major international economic and trade organizations, and become the leader in regulation. According to statistics, China is most active country in regard to blockchain patent applications in 2017, with a total of 225 blockchain patents, compared to 91 patents in the United States and 13 patents in Australia [43]. In fact, in the fourth part of the major tasks and key projects of the 13th five-year plan [45] issued by the State Council in 2016, which indicated that it is essential to reinforce strategic frontier technologies such as blockchain and carry out advanced layout. In 2016, China government worked with a number of well-known companies to compile a blockchain white paper (2016) [21], and then "China blockchain technology and application development white paper (2018)" [42]. The white paper pointed out the core technology path of blockchain and the future direction and process of blockchain technology standardization.

Mei et al [63] pointed out that smart contracts will change the current contract rules and the law. The expression of the meaning of the smart contract will be very different from that of the parties to the contract in the current contract law. Under what circumstances can be regarded as unanimous expressions of intent, agreement reached and other issues, the contract law needs to clarify them. In September 4, 2017, the announcement on Preventing Token Issuance and Financing Risks [64] stipulated that the tokens or virtual-currencies in the token issuance or financing shall not be distributed by the monetary authority, have no monetary attributes such as indemnity and mandatory, and shall not have the same legal status as currency and cannot and should not be used as currency. In terms of education, the China Electronics Technology Standardization Institute of Guangzhou Huangpu District and Guangzhou Development Zone jointly held the second development conference of the China Blockchain Technology and Industry Development Forum [21]. During the meeting, the supporting policy for the blockchain technology was proposed, and more application scenarios were provided so that blockchain technology could maximize its value. Moreover, China supports private industry organizations to organize industrial alliances, and demonstrates ambition to become a leader in blockchain industry.

China's current leader, Xi Jinping, first publicly mentioned "blockchain" at a event in May 2018 [44]. This statement can be said to convey the Chinese government's positive signal for blockchain technology. In the White Paper [42] provided an in-depth analysis of global blockchain applications cases and analyzed the applications scenarios that were relatively mature or had potential application value. Moreover, the China Academy of Information and Communications launched the Blockchain White Paper [54] under the Trusted Blockchain Initiatives plan in 2018 and released Blockchain White Paper [55] at the end of 2019, which shows China's ambition to actively deploy blockchain and facilitate the development of blockchain industrial innovation.

3. Innovative Policy Framework in Blockchain

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From the industrial argument, policies are the tools by which the government intervenes in the realization of the technological development system. Rothwell and Zegveld [19] [59] pointed out that government's innovation policy should comprise both technological and industrial policies. According to the terms of the role of policy in science and technology activities, policy tools fall into three categories: "Supply-side" policy, "Environment-side" policy, and "Demand-side" policy. Furthermore, government activities are composed of twelve policy tools for industrial innovation, and the policy examples of government activities are shown in Table 1.

Table 1. Policy Categories, policy tools and examples for industrial innovation.

Policy categories	Policy Tools	Policy Examples of Government Activities
Supply-side	Public enterprise	Innovation via publicly owned industries; establishment of new industries; initiating new technologies adoption; taking part in private enterprise.
	Scientific & technical	Join in research laboratories for scientific & technical development; assisting in research associations, learning societies and professional associations; grant fellowships in assistance of industrial innovation.
	Education	Education and training support at all levels, such as general education, universities, technical education, apprenticeship schemes, continuing or further education, and retraining.
	Information service	Assist in information networks and business centers development, consultancy, advisor, libraries, cloud databases, and liaison services.
Environmental-side	Financial	Providing industrial innovation allowance, financial joint investment; offering loans for equipment, buildings or services, financial loan guarantee, and export credit.
	Taxation	Industrial innovation tax exemptions and exemptions for specific projects; research and development tax credits; indirect taxes and payroll taxes; and personal allowances.
	Legal & regulatory	Patents and intellectual property management; environmental and health regulatory control; monopoly regulations, supervision of social justice; certification management; awards, prizes, and agreement standards.
	Political	Planning national innovation strategy; regional policy; innovation honor or awards; encouraging joint consortium merger; public consultation on policy development; legal and political system of investment.
Demand-side	Procurement	Procurements and pacts from government; research & development agreements; technological prototype purchases.
	Public services	Maintenance, supervision and innovation of health care services, public buildings, construction, transportation, and telecommunications.
	Commercial	Currency regulation, tariff, trade agreement, commercial, and commercialization of innovative industries.
	Overseas agent	Support innovation and development of international trade and transactions.

Source: Rothwell and Zegveld [19].

In a study, Rothwell and Zegveld [59] indicated that the constitution of technology innovation policies primarily lies in the association of tools among financial, talents and technical support.

Secondly, government research on technology contracts and public procurement respectively act on the innovation and marketing process, and serve as the policy tools for creating demand in domestic and international markets. Moreover, establishing the infrastructure for scientific and technological development, as well as various statutory and incentive measures to encourage academic and corporate efforts in the introduction and dissemination of R&D technologies, is a policy tool to provide an innovative environment [28]..

As many economists have pointed out, successful innovation comply with appropriate association factors from the technology of supply-side and the market of the demand-side (for example, Freeman [29]). In terms of the "supply-side", developing novel products and processes depend on whether there is sufficient investment in the following: (1) knowledge of scientific and technical development and talents; (2) potential market information for innovation and managing ability to conduct research, development, production and sales; (3) financial resources [30]. These three inputs are shown on the left side of Figure 1. It is clear that a government seeking to affect the innovation activities through "Supply-side" policy, can do either through direct participation in the process, or through improving the above three inputs. Or the governments can reduce intervention by trying to change the broader economic, political, and legal environment in which new products are produced. Alternatively, the government may improve the innovation activities through "demand-side" policy in the domestic or international markets. For example, to intervene more directly, a country might act as an overseas salesman for its national goods.

4. Materials and Research Methodology

This research employs the methods of content analysis and statistics to survey and compare the innovative blockchain policies between the USA and China. Weber [20] argues that content analysis uses a set of procedures to make effective reasoning from word content. Content analysis is the task to methodically present the blockchain policy tools adopted. The analysis datasets assist to acquire the superior interpretation of the innovative blockchain policies [65]. The primary properties of blockchain policies are depicted with the quantitative explanation derived from descriptive statistics.

First, we base on secondary data collected from relevant policy texts of the governments of the USA and China, followed by data including relevant reports of research institutions, journals, newspapers and magazines. Relevant industrial technology policies and the latest industry information were downloaded from official government websites. Since the USA is the main country for filing patent applications, and the patent data published in 2016 shows that Chinese layout for blockchain technology patents surpassed the number of full patent applications published in 2015 [41]. Therefore, this study takes the blockchain policy texts published from the USA [22] and China [21] as the research objects.

Second, we adopt the twelve government policy tools of Rothwell and Zegveld [19] and convert the blockchain policy texts of the USA and China to derive the government innovation activities as Table 1. According to the classification results of government activities, each proportion of twelve policy tools is calculated for the USA and China respectively.

Third, we not only compare the blockchain policy measures under the three policy categories, but also rank the weights of the policy tools to point out the differences between the USA and China.

This research assumes that when matching with innovative blockchain policies, they all have the same weight. Even if the activities of policy tools are unlikely to have the same impact, therefore, this is a research limitation. This hypothesis has two thoughts. First of all, no quantitative research of cross-national blockchain policy example found, if different weights are assigned to the blockchain policies, it may lead to research bias. Secondly, different countries have different resource conditions, political structures, and national conditions, therefore, with divergent weight of every policy tools. Thus, each policy given the same weight is appropriate.

5. Results

This study selects the blockchain policy texts published from the "2018 Joint Economic Report" [22] and "China Blockchain Technology and Application Development White Paper" [21].

5.1. The Policy Taxonomy of the USA

Based on the policy examples of government activities in Table 1, we derive the innovative blockchain policy activities from "2018 Joint Economic Report". The policy taxonomy results are shown in Table 2, with a total of 23 innovative blockchain policy activities. Furthernore, each proportion of twelve policy tools in the USA is calculated.

Table 2. "2018 Joint Economic Report" blockchain policies in the USA

Policy Categories	Policy Tools	Policy Activity Description	Q'ty	%
Supply-side	Public enterprise	Implement blockchains for private medical data (1).	1	4.3
Environmental-side	Taxation	Virtual currency s file as money transmitters (1).	1	4.3
	Legal & regulatory	Regulate and license money transmitters (2); Protect private property and contract integrity (3); Conduct regulated research (2); Actions for securities registration issues and fraud (1); Working towards cryptocurrencies and blockchains compliance standards (1).	9	39.1
	Political	Comply blockchain products with system and regulators (1); Virtual currency businesses file as money transmitters (1).	2	8.7
Demand-side	Procurement	Comply blockchain products with the current system and regulators (1); Facilitate a smarter energy grid with blockchain's use (2); Developing encryption standards for medical data protection (1);	4	17.4
	Public services	Issue the blockchain guidance documents (1); working groups on securities regulations, taxation (1); Investigate and define security regulation (1); Use blockchain in health and research (1); Regulatory agencies coordinate the need for financial products and transactions (1); Deter and prosecute fraud and abuse (1).	6	26.1

Source: Organized from this research.

5.2. The Policy Taxonomy of China

The same method as section 5.1, we derive the innovative blockchain policy activities from "China Blockchain Technology and Application Development White Paper" policy. And the policy taxonomy results are shown in Table 3, with a total of 45 innovative blockchain policy activities. Furthernore, each proportion of twelve policy tools in China is calculated.

Table 3. "China Blockchain technology and applications development white paper" policies in China

Policy Categories	Policy Tools	Policy Activity Description	Q'ty	%
Supply-side	Public enterprise	Development of blockchain technology and applications (1); Establish blockchain research working group in financial sector (1).	2	4.4
	Scientific and technical	Use information technology to enhance the digitalization (1); Combine blockchain systems and traditional business models (1); Form the requirements for the target system and the underlying technology platform (2);	4	8.9
	Education	Support key colleges and universities to set up blockchain professional courses (1); Promote the joint efforts of key enterprises and universities for blockchain talent training base (2); Strengthen the blockchain professional and technical personnel for high-end talent training (1).	4	8.9
	Information service	Support demonstration bases and public service platform construction (2); Build blockchain open source community (1);	3	6.7

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Environmental-side	Financial	Financial support related to blockchain projects (1); Establish investment funds (1); Support the development of SMEs (1).	3	6.7
	Legal and regulatory	Guide the formulation of specific standards (5); Standardize the comprehensive system listed in the framework (1); Relax market access restrictions (1).	7	15.6
	Political	Promoting the blockchain technology development and applications (1); Promote next-generation information technology (3); Establish blockchain standard system (4); Accelerate the development of international standards and reference architectures (3); Build a general development platform for blockchains (3).	14	31.1
Demand-side	Procurement	Application standards support for government procurement (1).	1	2.2
	Public services	Enhance the service to the enterprise (1); Promote the scenarios of commercial, enterprise or financial application (1); Form blockchain ecology of technical exchanges and cooperation among enterprises (1).	3	6.7
	Overseas agent	With China-US and China-Europe mechanism to support enterprises (1); Lead/participate bloakchain international standardization organization (2); Build blockchain standard to international community (1).	4	8.9

Source: Organized from this research.

5.3. Cross-national Policy tools Comparison

In this subsection, as shown in Table 4, we propose a cross-national comparison of innovative blockchain policy tools between the USA and China, where the blockchain policy measures under the three policy categories are compared. Furthermore, as shown in Table 5, we rank the weights of the policy tools of the USA and China respectively. Although cross-national blockchain policies are compared and they may not have the same impact on the development of blockchain innovation policies in the United States and China, but all policies are given the same weight. This hypothesis should be considered as limitations of the study.

Table 4. Cross-national comparison of the blockchain policy tools between the USA and China

Policy Categories	Policy Tools	China		The USA	
		Q'ty	%	Q'ty	%
Supply-side	Public enterprise	2	4.4	1	4.3
	Scientific and technical	4	8.9	0	0
	Education	4	8.9	0	0
	Information service	3	6.7	0	0
	Sub-total	13	28.9	1	4.3
Environmental-side	Financial	3	6.7	0	0
	Taxation	0	0	1	4.3
	Legal & regulatory	7	15.6	9	39.1
	Political	14	31.1	2	8.7
	Sub-total	24	53.3	12	52.2
Demand-side	Procurement	1	2.2	4	17.4

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	Public services	3	6.7	6	26.1
	Commercial	0	0	0	0
	Overseas agent	4	8.9	0	0
	Sub-total	8	17.8	10	43.5
Total		45	100	23	100

Source: Organized from this research.

Table 5. The weighting rank of each policy tools compared between the USA and China

China			The USA		
Policy Tool	Rank		Policy Tool	Rank	
Political	1	31.1%	Legal & regulatory	1	39.1%
Legal & regulatory	2	15.6%	Public services	2	26.1%
Scientific & technical	3	8.9%	Procurement	3	17.4%
Education	3	8.9%	Political	4	8.7%
Overseas agent	3	8.9%	Taxation	5	4.4%
Information	4	6.7%	Public enterprise	5	4.4%
Financial	4	6.7%			
Public services	4	6.7%			
Public enterprise	5	4.4%			
Procurement	6	2.2%			

Source: Organized from this research.

In the USA, the innovative blockchain policy activities of “the 2018 Joint Economic Report” tend to use “Environmental-side” policy category with 52.2%, where the main policy tool is “Legal & regulatory” with 39.1%. Second, the USA distributes 43.5% weighting of all policy tools to “Demand-side” policy category, and most of the resources are allocated to “Public services” with 26.1% and “Procurement” with 17.4%. Finally, there is “Supply-side” policy category with 4.3%, where “Public enterprise” with 4.3% is the only determinant policy tool. Therefore, “Legal & regulatory” is the most important policy tool in the USA, followed by “Public services“, while “Procurement“ ranked third. Since “Legal & regulatory” and “Political” are part of “Environmental-side” policy category, so this category become the most important aspect of the USA government. In addition, the USA ignores the “Scientific & technical”, “Education”, “Information service”, “Financial”, “Commercial” and “Overseas agent” policy tools.

In terms of China, the innovative blockchain policy activities of "China Blockchain Technology and Application Development White Paper" allocate most of the resources to "Environmental-side” policy category with 53.3%, followed by "Supply-side” policy category with 28.9%, and then "Demand-side” policy category with 17.8%. In addition, “Political” has the highest proportion of all policy tools with 31.1%, followed by “Legal & regulatory” with 15.6%, while “Scientific & technical”, “Education” and “Overseas agency” ranked third with 8.9. % respectively. Furthermore, China neglects the "Taxation" and "Commercial" policy tools.

Figure 2 shows the comparative scattering diagram of twelve policy tools of the USA and China to highlight the innovative blockchain policy tools applied.

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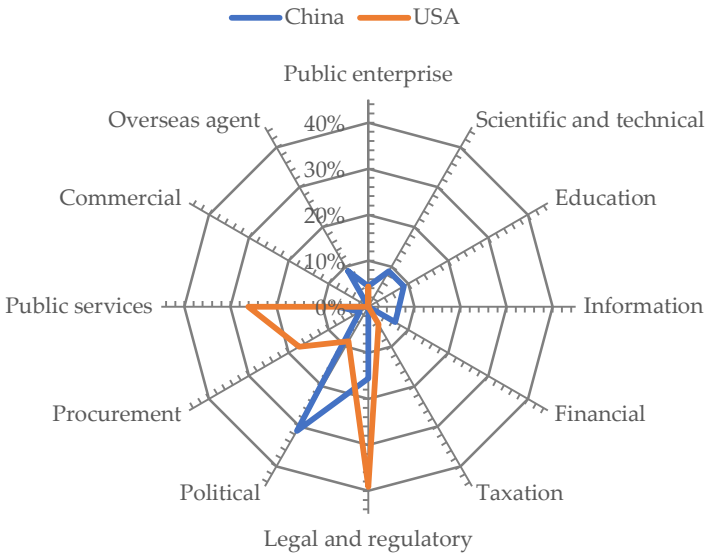

Figure 2. Comparative scattering diagram of twelve policy tools of the USA and China
Source: Organized from this research.

6. Conclusions and Implications

6.1. Finding and Discussion

Based on the policy taxonomy of twelve policy tools from the innovative blockchain policy activities of two white papers in the USA and China, "2018 Joint Economic Report" and "China Blockchain Technology and Application Development White Paper", this study summarizes the results and findings of the empirical and comparative analysis as follows.

(1) From the view in the comparison of blockchain policy categories, both the USA and China pay attention on all of the three policy categories, among which "Environmental-side" policy draws the most attention. In terms of the innovative blockchain policy categories in the USA, the 'Environmental-side" policy (52.2%) accounts for more than the "Demand-side" policy (43.5%), and both exceed the "Supply-side" policy (4.3%). Instead, the innovative blockchain policy categories in China involve more "Environmental-side" policy (53.3%) than "Supply-side" policy (28.9%), both of which overshadow "Demand-side" policy (17.8%).

(2) Figure 2 shows that the scattering diagram of twelve policy tools of the USA is not the same as China. However, "Legal & regulatory" (39.1%) of "Environmental-side" policy is the most used policy tool in the USA, followed by "Public services'" (26.1%) and "Procurement" (17.4%) of "Demand-side" policy. While in China, "Political" (31.1%) is the highest proportion policy tools, followed by "Legal & regulatory" (15.6%) of "Environmental-side" policy, then "Scientific & technical" and "Education" of "Supply-side" policy and "Overseas agent" of "Demand-side" policy come in third with 8.9% respectively.

(3) In "Supply-side" policy, the Chinese authorities draw more attention than the USA. The USA focuses on "Public enterprise" only and its specific policy activity is to implement blockchain for private medical data with portable and secure ways digitally. Clearly, the USA governments have realized this potential and has begun to implement blockchain for many purposes. However, China attaches great importance to "Scientific & technical" with the primary policy activities to form the requirements for the target system and the underlying technology platform, and "education" with the major policy activities on the joint efforts of key enterprises and universities for blockchain talents training.

(4) In "environmental-side" policy, both governments draws over 50% attention. While the USA authorities tend to "Legal & regulatory", and the primary policy activities are to regulate and license money transmitters, protect private property and contract integrity, conduct regulated

research, etc. Due to cryptocurrencies, ICOs and their exchanges face new regulatory challenges, resulting in new product cases that violate the current regulatory framework in the United States. Instead, China is inclined to "Political" more than "Legal & regulatory" in "Environmental-side" policy, and develops a number of feasible policy activities to support the program. In "Political", the primary policy activities are to promote next-generation information technology, establish blockchain standard system, accelerate the development of international standards and reference architectures, and build a general development platform for blockchains; In terms of "Legal & regulatory", the major policy activities are to guide the formulation of specific standards related to business, process, trusted and interoperable, and information security.

(5) In Demand-side" policy, the USA authorities draw much more attention than China. The USA tends to use "Public services" with the major policy activities to issue the blockchain guidance documents, tax definitions, remittance laws, investigate and define security regulation, check blockchain research in health, deter and prosecute fraud and abuse, etc. In contrast, China values "Overseas agent", whose representative policy activities are to lead and participate in

In the USA, "Legal & regulatory", "Public services" and "Procurement" policy tools account for more than 80% of innovative blockchain policy activities, while "Legal & regulatory" policy tool can strengthen the domestic markets in the process of industrial innovation and development, thereby promoting the R&D activities of the sector. In addition, "Public services" and "Procurement" policy tools ranked second and third respectively in the weightings of twelve policy tools of the USA, they can be inferred to enhance the domestic markets in the process of industrial innovation and development.

In terms of China, high proportion of '"Political" and "Legal & regulatory" policy tools adopted to develop the blockchain industry, and they can be inferred to strengthen the domestic markets in the process of industrial innovation and development, thereby promoting the R&D activities of the sector. Moreover, Scientific & technical" and "Education" of "Supply-side" policy and "Overseas agent" of "Demand-side" policy all rank third in the weightings of twelve policy tools of China, and they can be inferred not only to strengthen technical knowledge and manpower in the sector, but also to enhance the market information and management skills of the department, thereby improving R&D activities in the process of industrial innovation and development. Moreover, "Overseas agent" policy tool of China can strengthen the industry's international markets in the process of industry innovation and development.

6.2. Conclusion

This study is based on an analysis framework of national innovation systems, combined with relevant literatures and methods, and discussed at the national level, which employs the methods of content analysis and statistics to survey and compare the innovative blockchain policies between the USA and China. From a national perspective, the innovative blockchain policies adopted by the USA and China are derived to present the blockchain policy measures under the three policy categories, by means of the policy analytical framework of Rothwell and Zegveld [19]. Based on the statistical results, the USA has paid more attention to" Legal & regulatory" and "Public services"; Instead, China has the higher proportion of policies on "Political", "Legal & regulatory" and "Education. Due to the different political and economic environments, there are corresponding blockchain policy differences but both the USA and China mention the important oversight of "Legal & regulatory" policy tool.

Novak's research found beneficial policy inclination regarding blockchain technology is expounded as political efforts to evolve local, blockchain-enabled economies [58]. Policy makers in countries/regions that oppose blockchain-related activity have imposed prohibitions or strict restrictions on developers and users participating in blockchain activities. Although blockchain technology can create tremendous value and solve problems that could not be solved in the past in areas such as finance, public welfare, supervision, and fraud; however, blockchain technology still

has an impact on the traditional legal system, and it has spawned many emerging legal issues. The RegTrax initiative [61] is a response to the increasingly complex and uncertain regulatory environment in jurisdictions across the nation and the globe, particularly in the absence of any comprehensive or integrated legal frameworks to identified a critical need for a dynamic, collaborative blockchain regulatory hub to help build a shared understanding and a launch pad for efforts to advance thoughtful regulatory initiatives.

In addition, how to construct the standard of blockchain technology so that blockchain technology can maximize its value is also a problem that urgently needs to be solved. Therefore, countries that while encouraging technological innovation, and how to properly face the complex challenges of legislation and regulation posed by blockchain technology will be a future research direction.

6.3. Practical Implications

This research practically solves how to develop and formulate the innovative blockchain policies in the blockchain industry and provides a useful guidance. Moreover, this comparative research of cross-national blockchain policies also provides useful policy portfolios design guidelines for developed and developing countries. Since private companies do not have advanced technical support to create the innovative system required by the blockchain, it is very important to use "Demand-side" policies to formulate policies and conduct the path of industrial development in developing countries. On the contrary, "Environmental-side" policy may need to be emphasized in advanced economies and developed countries, where the government should fully establish blockchain service facilities and infrastructure, guide the blockchain regulations development and develop key blockchain technologies and human manpower training. In the context of different countries, this result provides practical enlightenment for policy formulation of blockchain industry development. It should be noted that the USA and China are some countries with larger blockchain cases, not only their domestic resources are abundant, but also the market demand is great. Thus, for small countries or newly industrialized economies that are oriented towards export policies, these cross-national research results and findings may not be applicable.

Besides, in the policy comparison of blockchain industrial development between the USA and China, each activity of blockchain policy may not have the same effect. However, all policy tool comparisons are given the same weight in this study. Due to the blockchain development of government policy activities in each country, it is not enough to realize the effects of blockchain technology construction and development at this stage, so this hypothesis is also a limitation of the research. It is recommended that a cross-national study on this issue be carried out in the future. Because of this limit, this search results may not be readily extended to all areas of industry, and may be subject to complementary interpretations influence [66]. Relying on the individual's blockchain knowledge and industrial application skills, the quality of this research is also easily affected by the researcher's personal views and characteristics.

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