

ADVANCED LAND TITLE REGISTRATION SYSTEM BASED ON BLOCKCHAIN TECHNOLOGY

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Abstract

All countries around the world have accepted that corruption and bribery are the root of an unequal distribution of political power and social wealth. Therefore, corruption in land management negatively impacts on the household livelihoods, people's behavior, public health, city plan and development, environment, bureaucracy in related institutions, trust between citizen and government, and public service quality.

In the last decades, The United Nations (UN) declare that Information and Communication Technology (ICT) is one of the effective anti-corruption instrument. Recently, Blockchain technology has gotten a lot of attention and widely discussed as it has potential to eliminate current issues of government registration system such as identity management, license management, and land title registration to prevent any types of manipulation through its trustful conceptual framework.

The study uses both Qualitative and Quantitative data and some chosen approaches for the data collection including a survey questionnaire, customer opinion interview, expert interview, case study of international practice and previous research works.

The study would suggest and recommend advanced land title registration system based on permissions-blockchain technology which shall improve quality of government service, equal benefits of citizens, destroy bureaucracy system, ensure transparency among related parties as well as prevent corruption. However, the technology is still immature that needs to be further developed and understood to bring out its real potential and risk.

Keywords: Blockchain, Land title register, Corruption, Prevent corruption, Decentralized database

INTRODUCTION

Countries of the world have accepted that corruption exists in their society[1]. The corruption creates an unequal distribution of political power and social wealth. People's lack of knowledge, lack of involvement in political decisions, weakness of public accountability, the uncertainty of government or public services or activities, dependent judicial system, non-transparent information in public expenditure, and unstandardized public formal promotion procedures are challenging the people to face various types of corruption in their daily life[1-3].

In the last some decades, ICT is overgrowing, and it has transformed society. Public services converged with ICT and introduced a new service to our life[4]. And the UN declare that ICT is one of the analytical anti-corruption instrument[3]. Mongolia highlighted as an e-ready country by UN's EGDI survey in 2012 due to its nationwide hardware infrastructure and quantity and quality of end-user devices[5]. Unfortunately, software infrastructure of the nation

has been abandoned and still in the infant phase[6]. Fortunately, government and public recognize that ICT is a huge potential for extend service delivery channels. Nowadays, E-government index is an essential criterion of a nation's social and economic development. E-government index identified by infrastructure, online service, and human resource three significant consists. In mainly, ICT usage is overgrowing in Mongolia following by global ICT development trend[7].

Same as other developed and developing countries, the Mongolian government and public-sector organizations intention to disseminate their services to consumers equally through this ultimate ICT environment[8]. However, ICT convergence in Mongolia public and government sector has the challenge of the plan, policy, investment, security, legal framework, professionalized human resource, clear action plan, public education, confidentiality of information and general information technology literacy[3, 6].

One of the vulnerable sector of adopting ICT convergence in Mongolia is land administration and its ecosystem. The organization plays a crucial role in city plan, public health, citizen and legal entity's financial self-sufficient, public corruption level, administrative crime, and integrity. According to the judicial report 16.7 percent of the complaints related to land and its dispute between citizens and legal entities in Mongolia[9-11].

Land use cases are resolved about the life style, traditions, levels of development, and other characteristics of the country's economy[12]. People need to consider ecological categories just same as economical categories[13]. Public should understand, monitor and claim for proper use of land and it's the environment condition[8, 14]. Our land reform has not been completed, and after the market has begun to change some of the land legislation in the social system, the implementation of reform. The government is undergoing land reform through land management, but land management is weak in Mongolia. The study shall identify the current situation of land administration's service and its significant problem.

A technology that recently has gotten a lot of attention is the Blockchain technology[15, 16]. It can be described as a distributed database which was created as an enabler for the cryptocurrency Bitcoin by person or group of people Satoshi Nakamoto[17]. The majority part of the world has the problem of land register system. Pioneer project implementers view that blockchain technology has the potential to eliminate current issues of government register system such as identity management, license register as well as land title register. Therefore, this study has been investigating if the blockchain technology can enhance transparently, trusted land title register system within the land administration and its ecosystem[18, 19]. The study gathers data from the literature, survey, interviews as well as benchmarking of existing blockchain solutions in the related field. The issues found in the desktop research which consist of corruption issue in Mongolia.

Finally, the research suggests the proposed solution based on permissioned blockchain technology. However, the technology is still immature that needs to be further developed and understood to bring out its real potential and risk. Several of these issues can be prevented, or mitigated, by the similar kind of blockchain pioneer projects, which makes it to more practical and positive confidence to the project development.

Also, the study shall aim to suggest and recommendation for better e-government service implementation plan in land administration using of blockchain technology which shall improve quality of government service, equal benefits of citizens, destroy bureaucracy system, ensure transparency among related parties as well as prevent corruption.

1. LITERATURE REVIEW

The study suggests permissioned Blockchain solution in land title register system in Mongolia for improving the current situation and solves the problems. The problems include a group of public and private entities like a buyer, seller, bank, tax office, land authority, insurance company, public service providers, and public or social groups. The system ensures transparency among the parties, increase trust, fight with corruption or abuse in land authority, encourage responsibility of public.

Also, the system will help preclude the risk of such authoritative documents being lost, stolen, or tampered. Because every change would be recorded in the order and no one could not edit or erase the data which stored in the blockchain. Data is only updatable by the concept of technology. Therefore, everything will be saved permanently. The feature of the blockchain makes an obvious solution in the land-related ecosystem. However, Identity management system is one of the essential parts in the blockchain based land register system. The role is critical in identifying the owner of the land. It does not matter the type of owner; the only person will represent behalf of the legal entity owner like corporate and public organization. The only way to steal property is through entering a new real estate transaction process with stolen or forged identification. The security of the ID solution can be improved according to the requirements of the system and technology development. The validation process is getting more serious, and the technology can check double of those criteria like photos of physical ID cards, biometric identification, signatures, etc.

The block will contain all necessary information of land title registration including cadastral mapping, survey information, legal description of the owner and tenure information. The block will contain the following information partly or fully.

The content of the block in the proposed system including permanent address, total size of the land, type of ownership, identity card or the birth certificate of the owners, certificate of legal entity (only for a corporation), decision on allocation of land, cadastral information (cadastral ma, land cadastral research, land quality, economic inventory (Land value), tomographic image, service type, service price, signed by digital signature of authority staffs.

2. RESEARCH METHODS

The study uses both Qualitative and Quantitative data and the some chosen approaches for the data collection including a survey questionnaire, customer opinion interview, expert interview, case study of international practice and previous research works.

Qualitative data has a primary two source primary (survey questionnaire) and secondary (statistic information or report of government, International organization's survey and research work result). Quantity data widely uses an explanation of the qualitative and finding logic of the processes and phenomena. However, the study has 3 main phases; data collection, data analysis and finally conceptual framework development. Figure1, shows research design of the study.

RESEARCH DESIGN

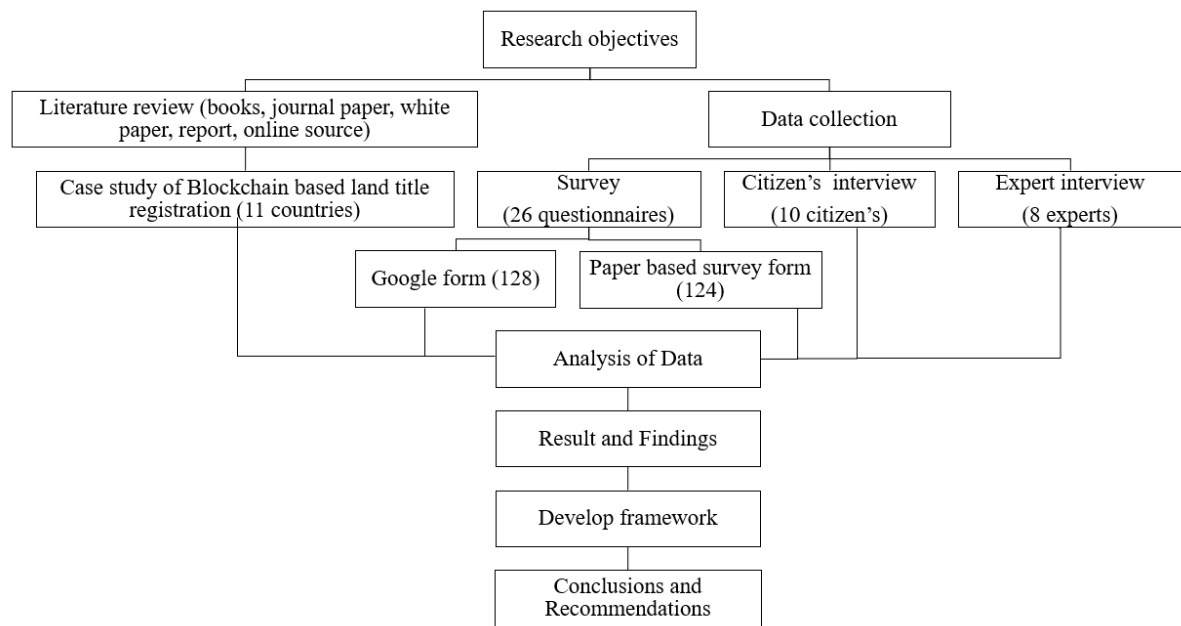


Figure.1 Research Design

2.1 Data collection

The study investigates theoretical and practical fields. Data collection occur mainly four fields including land administration (1), ICT convergence in government (2) socioeconomic life in Mongolia (3) and blockchain technology evolution (4) in global.

In these areas, a study will be conducted to case study research, identify problems and the relevance of causes and consequences which examine the following approaches:

Document collection and comparison methods: Data collected from online sources which are related to e-government, the blockchain, and corruption, land registration, and database are keyword and its principles. Some research approach is used for defining blockchain and general e-government trends and compares international e-government service coverage to the Mongolian e-government status. However, there are a limited number and content of e-government study in Mongolia. The expert interview would explain tightly about the current situation and future expectation of ICT development in Mongolia especially in ICT implementation in the public sector.

Observation and interview methods: to research quantitative and qualitative data related to government service activities and challenges or benefits of ICT project implementation from specialists, ICT expert and CEO, ICT entrepreneurs, government project advisor, and government administration people.

Graphics and Quantitative Analysis: those approaches used for data processing, show results, and detect interdependencies.

2.2 The survey questionnaire

The survey investigates public opinion, addressed problems, and challenges citizens faced when they receive the service from land authority. The study of 252 adults across Mongolia including residents of cities, capital of provinces, Soum, and nomadic livestock holders from 18th August to 6th September in 2018.

Regarding the report of the Land authority office statistic 2017, total 570,771 citizens have acquired a total of 57767.26 hectares of land ownership which nominal in law. The number of

the people those who registered and verified their land is about 18 percent of the Mongolian population. 82 percent of the population still did not register and confirm their private property.

2.3 Expert interview

The blockchain is one of the ICT solutions. The implementation of the project will be similar to other centralized database-based solution. The only difference is the architecture of the system and used platform. So, the current ICT evolution stage and situation of Mongolia would help in defining the background of the project and seek the possibility of the proposed plan.

There are two purposes to conduct the interview discussion from experts. It is an essential tool to find the practical information within the context of the topic from a targeted group or person.

In this study chooses eight expert in ICT sector and government administration including all the parties and positions those who contribute all the phase of the project from the preparation phase (1), project planning phase (2), investment phase (3), development phase (4), testing phase (5), correction phase (6), implementation phase (7), evolution phase (8), and finally maintenance phase (9). All the period of the project is equally significant for the result of the project.

At first, the research needs to clarify the representer of all the parts of government ICT project from customer to system architecture who draw all concept of the system in reality from the initial idea. The research chooses the expert in the interview, who primarily considers their experience, background, implemented project, failure and success of the ICT project, product, and solutions.

Secondly, the research develops and designs the structure, content, question, ethical principles, related to an interview and personal interview technical. Based on desktop research about ICT and blockchain project in the government sector and interview technical, research prepares the questions for four different categories including ICT professional (1), ICT service, product provider (2), ICT project or division administrator (3), government administration (4).

3. RESULT

The study found some findings from each section of the research. The findings of the survey suggest that the following three main issues can be addressed regarding citizens' access to land privatization and other land-related services.

3.1 Survey Questioners Result

The findings of the survey suggest that the following three main issues can be addressed regarding citizens' access to land privatization and other land-related services.

Land office staff are inadequate to monitor the use of land. Citizens and business entities are insufficient to use area, use the property for others, disrupt the quality of soil, fraud, and alteration without permission. There is a constant controversy surrounding the issue. Land disputes are about 30 percent of the administrative court, indicating that citizens and entities do not sufficiently provide the lack of control and the enforcement of laws.

Experience from other countries demonstrates that land use is not only for the economy but ecology and the general population, but also for those who are residents of the land, monitoring land use, rehabilitation, and ownership activities. The issue of public control is a significant issue in our country. Federal oversight is essential for the improvement of land use, quality, and ownership of land. It also helps to minimize the impact of social and ecological

implications. Therefore, it is imperative to make public control over and take action on the exploitation of land in Mongolia and citizens of arbitrary institutions.

The uncertainty of the information on all types of services related to land ownership, possession, and use, is common amongst consumers when they are dissatisfied with their services and have repeatedly returned to the service. Citizens believe that dissemination of information is not sufficient.

For example, in a community interview

It is therefore desirable for the public to communicate information and services to the public, and it is crucial to develop and facilitate the processing of various information channels. Citizens of the Land Agency and other government agencies are also considering introducing new generation technologies in their day-to-day operations and providing citizens with a non-staged, fast-paced service.

Citizens have a wide range of steps to ensure that information sharing and lack of coordination among government agencies are by Land Registration Law. As a result of sampling, it is necessary to pre-service the public and private sectors to get a service from the land office. If people do not know the list of required documents to get the service, it requires to register or submit their application for two or more visits to land departments. Once the request has been made, monitoring and information access are so scarce that it creates an attempt to minimize the quality of service and the time spent on the services provided by citizens to the public service.

The survey questionnaire conducted age group, participants classified following graphics. About 8 percent of total participants are over 60 years old. It may identify, elder citizens use internet much less than younger age groups. The majority of participants belongs active working aged people from 25 to 59 years old. 79% or 200 citizens are belongs to the age group. The level of education is classified as four groups such as incomplete secondary school, secondary school, bachelor and above master. According to the survey analysis, 119 subjects have a bachelor degree, 7 have incomplete secondary school, 71 have a secondary school, 50 have a master's or higher education. Five people refused to fill out educational level. Employment was classified as a public servant, unemployed, student, self-employed, a private company employee and others. The table below shows the information covered by the survey. According to the Law on Allocation of Land to Mongolian Citizens, the number of people owning land free of charge 316321 at the end of 2017 is about 10 percent of the total population. These citizens have a right to hold their place of residence legally and to invest their long-term investments, to register with the State Registration Office and land affairs department and to secure their right to own land. 144 or 58.78% of the surveyed residents owned land for family purposes, and 101 or 41.22% of them did not own the property in table 1.

Table1. Survey responder's statistic of land ownership information

Row Labels	Registration of the land title	Percentage
Yes	144	58.78%
No	101	41.22%
Grand Total	245	100.00%

Where did you know required document list? Most of the participants answered 217 questions of the question, and most of them received a list of required documents from the service staff.

11.52% of 25 participants responded that the information they received was not enough. The list of documents necessary to get the services is not required by citizens, but also by the land office

and the website of the land office, which can not be time-consuming and difficult to obtain services. Citizens' opinion polls are often available from districts, soums, and bagh. Also, we are exchanging information with others who have been contacted by the office and have the tendency to clarify the location of the service staff, related documents and operating order at the time. Detailed information of the response is listed below table 2.

Table2. Information source

Row Labels	Where did you know required document list?	Percentage
A. Information board	25	11.52%
B. Service Staff	82	37.79%
C. Website and online source	28	12.90%
D. Family, friends and other people	59	27.19%
E. Guidebook	5	2.30%
F. Other	18	8.29%
Grand Total	217	100.00%

Participants reported that 79.44% of the participants (170 people) did not have enough information, which resulted in difficulties in obtaining services, delayed delivery of services, and two or more departments. Distributing information efficiently to citizens gives citizens the opportunity to get quick service and same time land office has benefit of reduced work load. Detailed information is provided in table 3.

Table3. Information barrier statistic

Row Labels	Did you face any difficulty while you receive service which related to lack of information?	Percentages
Yes	170	79.44%
No	44	20.56%
Grand Total	214	100.00%

To underline, there is not much impact on the gap of information related with the age, education level, and employment status.

Exposure to information sharing between government agencies is lagging behind. The question of whether the land office needs to be served by the land department is answered by the following: Of the 241 participants, 22% responded that they had one service, 17% responded that they had two organizations, and 18% responded that they had three organizations. However, a significant proportion (42%) provides services after 4 or more organizations. For the average facility, 2.7 organizations and services are required. Response detailed in table 4.

Table4. Necessary organizations information

Row Labels	How many organizations did you visit and take service before taking service from land office?	Percentages
1	53	22%
2	42	17.42%
3	45	18.66%
More than 4	101	41.9%

Grand Total	241	100.00%
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It is required to obtain a service from the following agencies. Following organizations are related organizations to get the service from the land office. There is a need to exchange data between government organizations. The result of the questionnaire will help the new concept of the system in the land management ecosystem. 10 to 30 percent of surveyed participants said that there was a double need for a gracious service from a single agency and 70 to 90 percent of survey responders answered they have to do paperwork with two or more organizations. Detail is listed below table 5.

Table5. Related organizations list

Organization name	Answer quantity	Percentages
Local administration office	155	61.50794
Notary	148	58.73016
Bank	154	61.11111
Real state registration office	76	30.15873
State registration office	79	31.34921
Cadastral company	82	32.53968
Tax office	31	12.30159
Police	35	13.88889
Other land authority	38	15.07937
Other organizations	22	8.730159
Grand Total	252	

Also, study found that land offices have bureaucracy and multiple stage service that makes inconvenience to take service. 38.5 percent of survey responders meet one staff, 72.6 percent of survey responders meet two to three staffs, and 23.8 percent of the survey responders meet more than four staffs to accomplish the needed service. Response is detailed in following figure 2.

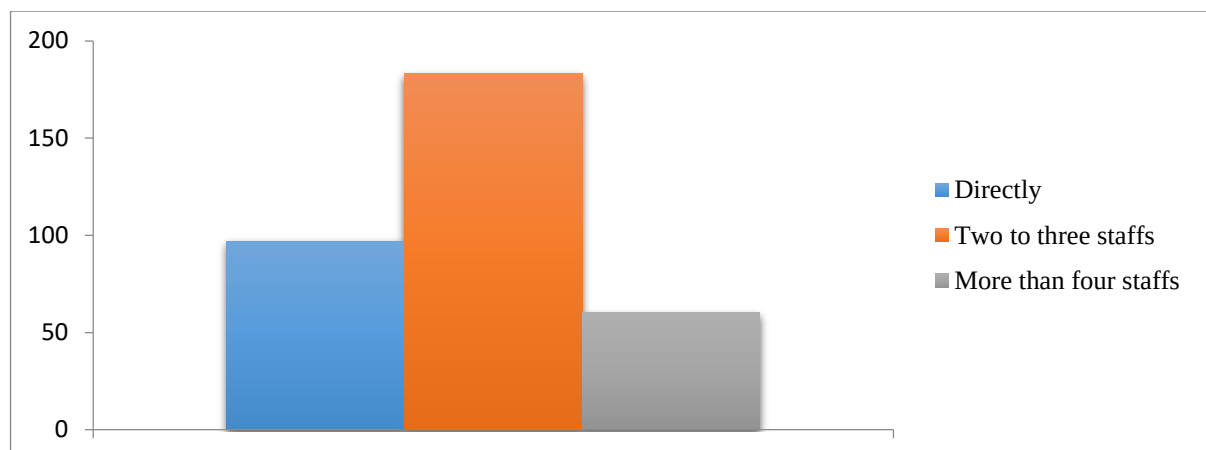


Figure2. Chart of Land authority inside operational stages

People want to take service from one staff. For citizens, It is challenging to meet inside officers in office by themselves. Also, interview responders said that management of operation is not efficient enough. The unbalanced working load often occurs in the office.

The survey observes the barrier of land management. Figure 3. shows the significant barrier of taking service from land authority.

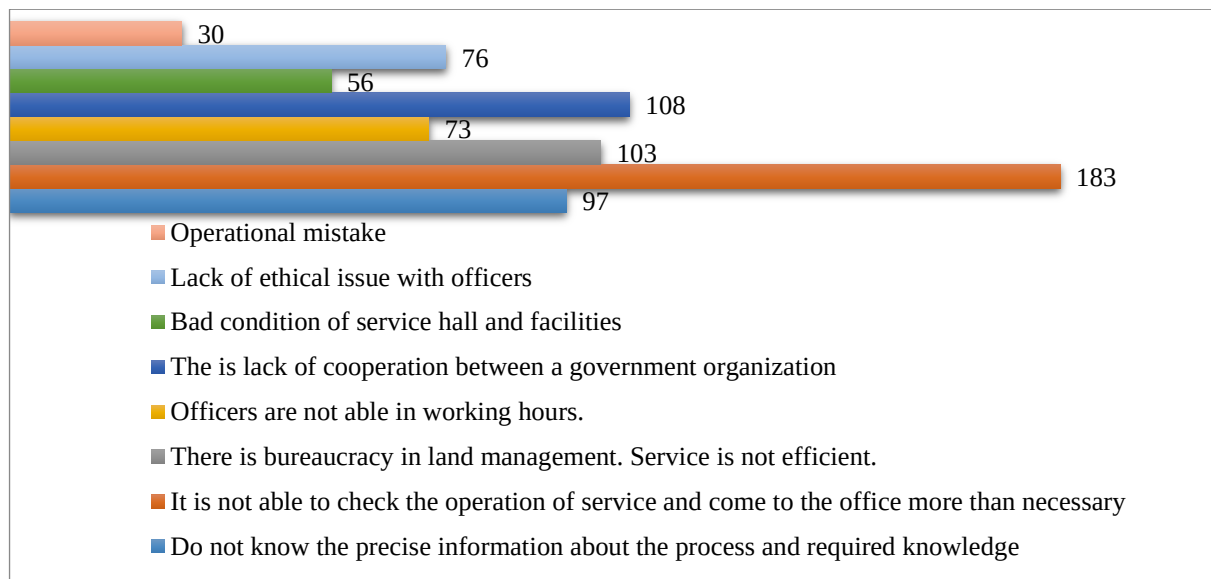


Figure3. The conventional barrier of land authority service

Majority of the responders 153 people had corruption or bribery experiences with land authority which is 60.7% of the responders. It shows the bureaucracy exists in Land authority. Also, 14.3 percent of responders had experience of exchange money with staffs. An unofficial source said that corruption is equal to 10% of the market price of the land nearby capital city of Mongolia and another economically advanced land. Corruption type and its quantity described in table6, below.

Table6. Corruption and bribery details by the survey

	Quantity	Percentage
Use relatives	133	52.8
Bribery	36	14.3
Offer service	42	16.7
Exchange gift	25	9.9
Car service	46	18.3
Other	27	10.8

Corruption is often used by citizens to get quick service from land offices. Take targeted service and save time are the main reason for the corruption and bribery.

Table7. The reason for corruption and bribery

	Quantity	Percentage
Taking service	86	49.1%
Save time	106	60.6%
People's suggestion	27	15.4%
Other	43	24.6%

Additionally, people send the comment about current system issue and expected service.

1. People do not want additional verification like notaries and another government statement. They want government organizations should have the right to access data

when the people request the service. On time, staff or system should check and validate information.

2. Land authority should ensure transparency of information. Empowered government officers and land authority's officer owned the beneficial lands. Public need information on available land.
3. Land management process takes a long time. The process needs to adopt modern technology and send notice immediately about the customer's property and continuing service status.
4. There are a lot of governmental organizations use the integrated land cadastral information. However, they record the data individually. It is the main reason for debate.

DISCUSSION

The study identifies four major problems for taking service from the land authority and implementation of the land title registration based on blockchain technology: Information distribution and preparation, lack of information exchange government institutions, corruption, and trust.

Mongolia have several law related with citizens information right. Currently, most of government organizations including land office have lack of public information preparation and distribution method. Due to lack of information delivery process, citizens are burdened with government agencies. On the other hand, government have ineffective human resource usage. Good information and digital service delivery management have potential to reduce workload and expense of service.

Some organizations actively provide their information through online channel like a official website, television program and social media. Their information quality and content are not well organized sometime. Citizens have complain and suggestion that government organizations should prepare the information easy to understand. Some information from some government agencies are simply general and old-fashioned. It is just poor law enforcement, such as the Law on Information Transparency and the Law on Glass Account.

Government organization does not have real time data exchange system. Some organizations exchange data in digital form. Most of those solutions have problem of time delay and data integrity. Because, most organizations process the data before it transfer to the other organizations. Those mechanisms are relying on professional's skill and technical capability.

Last decades, government organizations aimed to contribute E-government national program and develop their own digital service individually. According to expert interview and citizens' survey response, most of those services are not good enough to use for long term. Also, they change the system frequently. It makes difficult to user adopt the system and could not give change to mature the system completely. One of main reason of weak system development made in plan and design stage of the ICT project. System designer who represents the sector are not common in Mongolia. Most of those experts do not have solid knowledge of ICT convergence. Also, majority of the experts said that ICT service development stage in Mongolia is early. Managers, architectures and system designers do not have experience of comprehensive ICT convergence in government sector. Within five years of time, managers are going to be mature case they are practicing and gaining knowledge from their current successful and unsuccessful projects.

If we implement the blockchain technology based land title registration system inside the land office, it could not effective or efficient. Government will receive the potential benefits of the technology when the system involves the complete ecosystem of the land matter. Therefore, central government support and legal framework update are needed.

Trust is principle of government service. Trust issues are often rising. We do not have trusted database solution. Most of government organizations use database management solution of Oracle, Microsoft and other well-known vendor's product. Case of, their product is developed and tested by global costumers. Currently, there are optional matured centralized database solutions available in market. However, no one guarantee the data integrity. So, it makes government data security is strongly rely on their chosen vendor. Many government pay attention to development of the blockchain technology. People consider blockchain is technology of establish secure database system for government as well as business too. Developing country's government invests for development of its own blockchain platform which helps them to release vendor factor. A blockchain moreover provides integrity protected data storage and allows providing process transparency. [20]However, technology benefit and risk have not yet certain. Blockchain technology could not solve the problem alone. It has only potential to solve the problems. Without well design of the digital service concept, the project may be failure just same as other ICT project.

CONCLUSIONS

The study proposes an advanced land title registration system based on blockchain technology which would reduce the gap between the developed and developing world, initiate effective monitoring mechanism in land management with public and government participation and contribute national economic development.

1. Unfortunately, Mongolia does not have specific research on the impact of land management. Because of that it is undoubtedly clear that current land management system could not solve correctly provide a solution for protecting owners right, resolve disputes, prevent all types of manipulation including sale fraud, corruption, and bribe.
2. Information security and privacy issue would be more considered in the future. The people, corporate and government need a secure data storage system. Data inside a block of blockchain is not able to erase or modify. The feature of the Blockchain technology specializes trustful database management solution in the public and private sector. However, the technology is still immature that needs to be further developed and understood to bring out its real potential and risk. Several of these issues can be prevented, or mitigated, by the similar kind of blockchain pioneer projects, which makes it to more practical and positive confidence to the project.
3. People have a limited understanding of the tangible and intangible asset. Only twelve percent of the population verified their private land ownership within the last fifteen years in Mongolia

In case scenario of the intangible asset, ICT budget and investment is a vulnerable component of the annual budget of the private and public sector excluding banking sector in Mongolia. ICT investment, especially software infrastructure investment has been eliminated firstly by the economic crisis and less productive phases. The condition and common understandings are changed smoothly.

Cadastral process and its information are not formulated as well as developed countries. People and executive companies do not pay vital attention to primary and particular cadastral process. It is essential to building an integrated cadastral database before introducing the blockchain based land title registration system.

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