МАТЕМАТИЧЕСКОЕ МОДЕЛИРОВАНИЕ, СИСТЕМНЫЙ АНАЛИЗ
MATHEMATICAL MODELING, SYSTEMS ANALYSIS

INFORMATION SERVICE DEVELOPMENT
AND IMPACTS OF INFORMATION SECURITY ON IT

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Abstract

This research paper aims to identify potential opportunities to institute a centralized information service, review legal environment and conditions for current information sources and, moreover, it tries to present impacts of information security regarding this issue. The research findings are as follows: most of the respondents consider it is necessary to establish legally authorized commercial information sources providing true, timely and accurately processed valid information. As for legal environment regarding commercial information sources, we found out that there is a law on information transparency, however, it relates only to government organizations. Consequently, there is a real demand for legalizing commercial information sources run by an individual or a legal entity. Although there are a number of effective standards, documents and research materials relevant to information security, they are not in a comprehensive state. Present legal environment for information security is poor; the sector lacks comprehensive laws adequate to regulate e-business relations.

РАЗВИТИЕ ИНФОРМАЦИОННЫХ УСЛУГ
И ВОЗДЕЙСТВИЕ ИНФОРМАЦИОННОЙ БЕЗОПАСНОСТИ
НА ЭТОТ ПРОЦЕСС

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Аннотация

Цель данной статьи — выявление потенциальных возможностей формирования централизованной системы информационных услуг, создание обзора нормативной базы и определенных условий для современных источников информации, анализ влияния на это информационной безопасности. В результате исследования были сделаны следующие выводы: большинство респондентов считают, что необходимо создать уполномоченные законом коммерческие источники информации, быстро предоставляющие правдивую и точно обработанную информацию. Обнаружено, что есть закон об информационной прозрачности, который, однако, относится только к государственным организациям. Следовательно, существует насущная потребность в узаконивании коммерческих источников информации, принадлежащих частным лицам или организациям. Имеющиеся эффективные стандарты, документы и исследовательские материалы, относящиеся к информационной безопасности, не являются полными. Сегодняшняя нормативная база для информационной безопасности неудовлетворительна; в данном секторе не хватает всеохватывающих законов, которые могли бы эффективно регулировать отношения в электронном бизнесе.

INTRODUCTION

The paper aims to identify needs for information services development, reveal potential opportunities for such a service, review fundamental concepts of information security and based on the findings of the survey, intends to make conclusions and recommendations on the development of information service in the country. The following research methods are used in the research: document research method, questionnaire survey, observation and comparison method. In order to identify the needs for establishment of information service providers, both the target and random samples of respondents were chosen from Ulaanbaatar city. The target group was chosen at financial organizations and universities which prepare financial professionals and economists and employees at financial organizations as well as students majoring in finance and economics were chosen as random samples in the survey. As for the target group «Institutes involved in the survey» — a total of 9 436 employees working at financial organizations were involved in the survey and for the target population «students» — a total of 5 725 students majoring in finance and economics participated in the survey. The samples of the survey were calculated using the multiple step, random sampling formula[1] with the minimum rate of error $p = 0,05$ and confidence interval of 95 % probability. As the result, for the set institutes «involved», n equals 370, for the set «students», n was 360, and total samples equal 730.

To identify if there exists appropriate legal environment for developing information service, the Constitution, Law on Information Transparency and Right to Information, Mongolian Law on State Secrets[2], Law on Individual's Privacy[3], Law on Organization's Secret[4], Civil Code of Mongolia[5], Law of Mongolia on Electronic Signatures and other legal documents were reviewed.

The research consists of five parts which include theoretical part, survey, conclusion, references and appendices. Theoretical part covers definitions for and fundamental concepts of information service. The survey section consists of two parts which cover the demands for

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[1] Random sampling formula

$$n_p = \frac{t^2 p(1-p)N}{N\Delta^2 p + t^2 p(1-p)}.$$

[2] Law of Mongolia: State secrets. 1995. URL: http://www.legalinfo.mn/law/details/498.

[3] Law of Mongolia: Individual's private secret.1995. URL: http://www.legalinfo.mn/law/details/537.

[4] Law of Mongolia: Organization's secret. 1995. URL: http://www.legalinfo.mn/law/details/102?lawid=102.

[5] Law of Mongolia: Civil. 2002. URL: http://www.legalinfo.mn/law/details/299.

developing financial information service and the information service practice in the country.

THEORETICAL SECTION

There have been different definitions for the word «information», and still there has not been a common definition established for the term. Philosophers believe that information is a tool to cognize the real world with the help of knowledge. Knowledge is a form of presenting information such as speech, textual description, digital data, drawings and tables. However, according to the information science, «Information is a concept which derives as a result of collecting, storing, processing and transmitting data» [1]. In information security sector, information is considered as a valuable asset and resource like money, capital and labour resource. Since information is a valuable asset, it must be protected. That is why information security issues are one of the urgent issues in the sector. It is clear that the more the value of information people need, the more people are interested in the information. Consequently, the notion of information has a wide range of meanings and can be defined differently in different scientific fields. On the other hand, trade is a notion which determines a process of selling an item to others and buying an item from others. Nowadays people are using the term trade in their everyday life such as security trade, electronic trade and bank trade. However, the term information trade has recently become a new concept for us.

Basically, the concept «freedom of information» has already been declared in the human rights sphere. 59th resolution of United Nations first General Assembly declares that «Freedom of information is a basic human right... primary measurement of other human rights which UN prioritizes» [2]. Thus, the concept of information service must be based on the notion of freedom of information. As it is written in Wikipedia, «Information trade is a trade carried out on the particular market by a particular organization and based on the internet»[6]. According to this definition, if there exists a particular customer and then a specific supplier of information service, information can be traded.

SURVEY SECTION

The demands for developing information service in the country. The consumer market survey was conducted among the researchers, employees at insurance companies, banks, non-banking financial organizations and stu-

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[6] URL: http://en.wikipedia.org/wiki/Commercial_Information_Exchange.

dents at six major universities to identify if there is a demand for developing information service in the country. The first samples include 370 employees of 26 different qualifications at target institutions, second samples include 360 students specializing in 31 majors at target universities, out of which 131 are male, 239 are female workers, as well as 120 are male and 240 are female students. As for the age segment, while the students aged up to 25 account for 84,7 %, the employees aged between 21 and 40 account for 93 % of the total employees (Table 1–2).

Table 1

Professional structure of employees

Profession	Number	%
Accountant	71	19,2
Journalist	4	1,1
Insurance officer	16	4,3
Manager	21	5,7
Economist	75	20,3
Lawyer	10	2,7
Dealer	1	0,3
Information system engineer	7	1,9
Applied mathematician	4	1,1
Financial manager	13	3,5
Business manager	25	6,8
Actuary	2	0,5
Banking manager	14	3,8
International trade manager	2	0,5
Software engineer	2	0,5
Assessment officer / assessor	5	1,4
Marketing manager	3	0,8
Insurance economist	2	0,5
Cooperative teller	24	6,5
Loan officer	2	0,5
Broker	18	4,9
Finance officer	24	6,5
Statistician	1	0,3
Business economist	4	1,1
Banking economist	17	4,6
Other	3	0,8
Total	370	100,0

When we asked the students «How often do you need information?», we got the following results: 1,7 % answered that «they never have the need for getting information», 41,9 % responded that they «have high demand for getting information». However, 1,4 % of total employees responded that «they never have demands for information» while 60,5 % of them responded that «they have high demand for information». Accordingly, compared to the students, employees have more demand for information. As for the question «For what purpose do you use information?», 58,6 % of the employees and 72,4 % of the students responded they use information for professional development, 45,8 %

of the employees and 37 % of the students responded they use information for research purposes. 23,4 % of the employees and only 5,1 % of the students responded they use information to study their rivals. However, 16,3 % of the employees and 10,8 % of the students responded they use the information they obtained for investment purpose. Capital market information was considered one of the most important kinds of information for the respondents when they responded to the question «What sort of information do you need?» (Table 3). It is supposed to be associated with the shares offered by the government to the citizens as social benefits. Moreover, while employees need macro financial information, students need more information on tax and micro level firms or banks.

Table 2

Students majoring structure

Training direction	Number	%
Business management	35	9,7
Marketing	7	1,9
Business management / economics	13	3,6
Accounting	111	30,8
Computer, graphic design	5	1,4
English teaching	11	3,1
Tourism management	4	1,1
lawyer	7	1,9
Journalist	4	1,1
Finance management	26	7,2
Accounting economics	1	0,3
Business Economics	4	1,1
Economics	17	4,7
Banking economist	10	2,8
Financier	3	0,8
Economics, Mathematical modeling	1	0,3
Statistician	5	1,4
Financial economist	12	3,3
Insurance	12	3,3
Financial informatics	1	0,3
International Economics	7	1,9
Banking	30	8,3
International Trade	6	1,7
Economics	4	1,1
Psychologist	4	1,1
Hotel management	1	0,3
Art studies	3	0,8
Accounting informatics	8	2,2
Behaviorist	3	0,8
Nature protection, ecological management	2	0,6
English translator	3	0,8
Total	360	100

Ironically, micro financial information was not in much demand as we expected.

The question «Which of the following categories including location, authoritative po-

wer / relationship, bureaucracy, knowledge of the officer in charge cause the most difficulty to obtain information» was responded «bureau-cracy» by most of the respondents (38,3 % of the employees and 52,3 % of the students). In addition, 36,1 % of the employees and 32,4 % of the students responded that knowledge of the officer in charge also causes difficulties in obtaining information. Indeed, if an employee who is in charge of providing information lacks knowledge and skill of processing information, they might not meet the demands of the cus-tomers. Authoritative power / relationship might also, to a certain extent, cause problems in getting necessary information according to the respondents. As 37–38 respondents circled the category «other», we conclude there were some other problems we had not included in the questionnaire. As for the question «How much time do you spend for obtaining information?» respondents said they usually spend 1–4 days to get information they need, which is quite satis-fying. However, we need to carefully consider the information source, from which they get information. According to the responses to the question «How do you usually get information?», they responded they usually get information from TV, media, Internet or the employer's of-fice or educational organization of the customer. Therefore, since customers cannot usually obtain information from overseas information providers or from the officer in charge of providing informa-tion, the information they obtain cannot be accu-rate or valid. The question «Does the information

you get meet your need?» was responded «no» by 59,2 % of the employees and 53,1 % of the students. Most of the respondents say they usually cannot obtain the complete information they want. Besides, they mentioned some other problems they encounter such as inaccuracy, organizational confidentiality and inadequacy of yearly information. Therefore, according to the survey, we conclude that the less time you spend in getting information, the less accurate the information you get (Figure).

48,6 % of the employees and 50,3 % of the students responded «yes» to the question if the information they obtained was invalid. The question «If you get the wrong information, what do you do?» was mainly responded they search other information sources. However, others responded that they do not use the in-formation and get stressed or they correct the information themselves. Regarding the ques-tion «What information sources do you prefer using?» the respondents believe that the inter-net sites serve as the most appropriate sources of information, which also demonstrates their mastery of modern tools of information. They also showed interest in obtaining information in print which is a quite traditional way of delivering information. They do not, however, want to get information through a network or copied it in a disc. 94,3 % of the employees and 90,3 % of the students responded they support establishment of information service providers. Only 2,7 % of the employees and 4,2 % of the students did not respond to this question. Consequently,

Table 3

Information categories

Information categories	Employees			Students		
	Responses		Percent of cases	Responses		Percent of cases
	Number	%		Number	%	
At micro level of bank	122	13,0	33,1	120	14,7	33,6
At macro level of bank	118	12,6	32,0	77	9,4	21,6
Macro financial	137	14,6	37,1	114	13,9	31,9
Capital market	179	19,1	48,5	166	20,3	46,5
Tax	128	13,7	34,7	125	15,3	35,0
Insurance	129	13,8	35,0	112	13,7	31,4
Other	33	3,5	8,9	14	1,7	3,9
Total	937	100	253,9	819	100	229,4
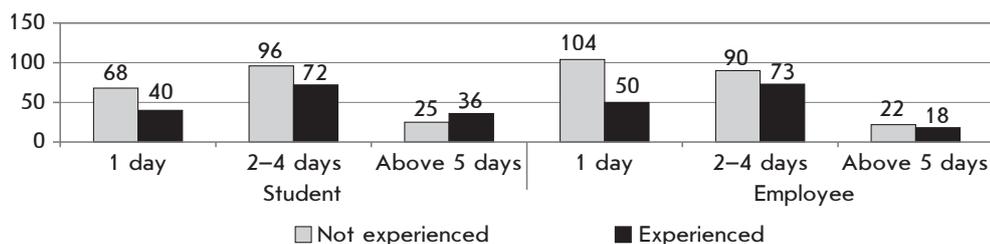
The relationship between the time spent on getting information and the satisfaction of the customer, number

the percentage illustrates that there is a real demand for information service development.

As for the question «What requirements should be applied for information service providers?» respondents' priority was accurate, valid, prompt and timely information. They did not consider confidentiality and information processing very important, however. With respect to professionals and students responding to the previous question, 89,2 % of the employees and 91,7 % of the students responded they need processed information. In addition, students responded they would prefer reliable information sources, employees — prioritize whether the information was processed properly and most of the customers — focus on accuracy and validity of the information according to the findings of the survey.

In relation to the question whether they are ready to pay for the information they want, 51,6 %, of the employees and 50,3 % of the students responded «yes».

Information service development practice: nationwide and worldwide. Nowadays people in Mongolia use not only statistical data which are processed nationwide, but also information provided by international information agencies. Data at world information market including stock exchange information, market information and business news have become vital for our everyday life. The largest financial information sources such as Reuters and Bloomberg have become our main information sources. World market information mainly attracts specific industries only and these information suppliers provide their customers with opportunities for electronic signatures. While the internet contributes largely to the delivery of information worldwide, databases can still be traditionally delivered using compact discs. Regardless of whatever means of delivering information is used, financial data bases are easy for both access and use because they are written in tables and contains a great number of data and indicators. Information agencies such as Reuters and Bloomberg have still been well recognized internationally. These agencies provide timely and accurate information including security, foreign exchange market, commodity market, political and business news and information provided by other international sources of information. The other largest information source is Dow Jones Telerate which provides financial market information widely. The company provides information some of which are electronic dealing, data transmission, electronic postage, media features, access to databases, provision of information and stock exchanges operating software. Widely recognized media periodicals play an important role for delivering business news. The most recognized daily periodicals are Financial Times, Wall Street Journal, Daily Commerce, weekly periodicals such as Economist, Businessweek, The Banker and monthly periodicals Financial Executive, Institutional Investor and Stock Market Magazine. In Russia, for instance, a number of periodicals have lately been released in the financial field including the most well known daily periodicals [3] «Vedomosti», «Commersant-daily», «Delovoi express», Weekly Periodicals «Finansovie Izvestiya», «Finansovoe Delo», «Finansovaya Gazeta», «Den'gi», monthly «Bankovskoe Delo», «Rynok Tsennikh Bumag», «Finansovii Management» and «Financist». As for Mongolia, the institutions such as National Statistical Office (NSO), Bank of Mongolia, Ministry of Finance, Mongolian National Chamber of Commerce and Industry process and provide macro level information illustrating overall economic trends for the public and industry specific needs. Particularly, Bank of Mongolia[7] provides financial statements of commercial banks, credit reports, information on money, deposits and loans, security interest rate and policy interest rate of the Bank of Mongolia and foreign sector information; NSO[8] provides money, credit, security market exchange rate as well as other sorts of information. There have also been released a number of media periodicals in the financial field including «Financial News», «Financial References», «Business News», «Business Times», «Financial and Bank Information» (newspaper), «Finance», «Bookkeeping and Audit», «Money and Finance», «Investment and Development», and «Mongolian Economy» (in English and Mongolian). Besides, TVs such as MYOHT, BTV, Education, TV9, TV5, Eagle and Bloomberg Mongolia broadcast news programs covering economy and business news. Moreover, internationally recognized media periodicals including Bloomberg, Business Week, Euro Money, Global Finance and The Economistcan be subscribed by the public.

Ensuring information service security. Information security is the practice of defending information from unauthorized access, use, disclosure, disruption, modification, perusal, inspection, recording and destruction. Information loss means the practice of disrupting, modifying and disclosing any information while it is being stored, processed, transmitted and delivered when critical issues arise. Therefore, one of the main issues to consider in the deve-

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[7] Statistical compilation of Bank of Mongolia, 2008–2015.

[8] Statistical compilation of National Statistical Organization, 2008–2015.

lopment of information services is information assurance, for information supply requires a great deal of network ranging from companies and bank branches to government information providers. Normally, state and military organizations, banks, financial institutes, airlines and food safety organizations tend to be risk-prone in the information technology area. As a whole, information security issues depend on the three factors which are human deliberate or non-deliberate actions, technical breakdowns and act of God. While human deliberate actions include listening to, spying for, modifying, vandalizing information, transmitting malicious code and viruses and identity theft, non-deliberate human actions include accidently inserting wrong information, deleting files mistakenly and giving wrong commands. Accidents, earthquakes, thunders, flooding and fires can be included in natural disasters. People who try to obtain information illegally often use information system vulnerability in order to cause harm to the system. The vulnerability of the information system is usually caused by the disorder and disorganization of the physical protection of information service organization, its poorly written policies or procedures, unprotected software and hardware which keep organizational and customer profiles. Thus, in order to ensure information security, it is important to keep the system safe and not to make it vulnerable. Even there are not any threats, the system can still function under vulnerability. System vulnerability cannot cause harm to the system in normal situations. However, it can serve as a basis for threats; therefore the organization should be aware of the vulnerability of the system and handle with it timely and properly. As the National Data Center of Mongolia registered, during September to November, 2011, 119 500 attacks[9] were made, most of which tried to enter government information databases to collect information and check whether the server is vulnerable. It is comparatively high statistics, for it occurred only during two-month time. Thus, it is important to consider the problem of system vulnerability in a comprehensive way with all parts of the functioning, rather than considering it separately.

In conclusion, information security issues should not only cover technological sides of the problem, it should also take into account legal environment, procedures, policies, and management of the organization. The components of information security are considered crucial elements in ensuring information security in an organization. These are inaccessibility (it is

closed to unauthorized[10] user), availability (it is open to authorized user), integrity, (data integrity means it is valid and protected from deletion and corruption) and accountability[11] (it means every individual who works with an information system should have specific responsibilities for information assurance). When information security fails, due to the threats implemented, all the components of the information security including confidentiality, integrity, availability and continuity of the operation will be disrupted causing harmful consequences in the organizational functioning. Besides these information system failures, the organization will suffer a great deal of financial damages andmay lose its reputation in the market and society.

In order to minimize information system vulnerability, the organization should employ many methods such as to use an appropriate server, to support reliable protocols of latest model, to install and configure SSL protocol properly, to use web server firewalls as well as to regularly delete metadata of the files. In addition, it is important to regularly take IT Auditing service from domestic and international experts in order to ensure information security. In Mongolia, there have been Japanese Auditing companies such as Klynveld Peat, Marwick Goerdele (KPMG) and PricewaterhouseCoopers (PWC) providing their services to Mongolian IT companies. IT Audit is a process of collecting and evaluating evidence to determine whether a computer system has been designed to maintain data integrity, safeguard assets, allows organizational goals to be achieved effectively, and uses resources efficiently.

CONCLUSION / RECOMMENDATIONS

In our country, individuals, students, customers, organizations and researchers need accurate, reliable and legally valid information in order to use it for their professional development and research work; thus, meeting this need has become a crucial and urgent issue. The main obstacle that hinders getting accurate and reliable information is, undeniably, bureaucracy. The most common type of bureaucracy in terms of information is hard-to-get access to databases of organizations, for they use a term «confidentiality» and keep all data under the term. Besides, the general public is still in doubt of what information is categorized «accessible». Therefore, it is crucial to set up information confidentiality ratings and adopt international approaches to determine

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[9] Statistical compilation of National Data Center, 2013.

[10] Customer or organization understands the process.
[11] Laws of Mongolia: Digital signature. Mongolian Parliament. 2011. URL: http://www.legalinfo.mn/law/details/574?lawid=574.

which information is accessible to general public and which to a particular group. Basically, every person has an equal right and freedom to acquire information. Some research works are being conducted concerning the issue. These include «Freedom of information»[12] conducted by Open Society of Mongolia and «State secrets and freedom of information»[13] conducted by Globe International, non-governmental organization (NGO). If an official or a worker refuses to give information, he or she has to prove the reason. The country lacks the legal environment which must regulate relations between an individual/organization and information providers. As 17th clause of 16th article of Mongolian Constitution states[14], a citizen has a right to seek and receive information except that which the state and its bodies are legally bound to protect as secret. Although there was adopted a law on information transparency and right to information in June, 2011[15], the law

only regulates relations in organizations financed by the state and local budget; in other words the law regulates relations in only state organizations. In countries where law on freedom of information regulates relations, an official who refused to give information without a serious reason shall be imposed an administrative punishment. But in our country we lack a law on freedom of information. Macroeconomic and statistical information in our country is processed and released in great extent for the public use. However, micro level financial information, bank information, stock exchange information and commercial information is insufficient to acquire. In addition, it is hard to obtain information for scientific research work.

Moreover, Mongolia should adopt a comprehensive law on information security. Although a draft law on Electronic information security was adopted in 2008, it has not been approved so far. The electronic information space still requires these laws. In conclusion, the need of an individual and organization for access to information is increasing in Mongolia and it is hard to study and work without necessary information. Thus, it is urgent to establish an authorized information source which will provide the public with prompt, accurate, valid, timely and well processed information and we hope the paper revealed the real demands for it.

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[12] Open Society Forum, Freedom of information. Research work. Ulaanbaatar. 2005.

[13] GlobInternational NGO, State secret and freedom of information. Research work. Ulaanbaatar. 2006.

[14] Laws of Mongolia: Constitutional law. 1992. URL: http://www.legalinfo.mn/law/details/367.

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