



Journal of Money Laundering Control

Data mining in anti-money laundering field

Noriaki Yasaka,

Article information:

To cite this document:

Noriaki Yasaka, (2017) "Data mining in anti-money laundering field", Journal of Money Laundering Control, Vol. 20 Issue: 3, doi: 10.1108/JMLC-09-2015-0041

Permanent link to this document:

<http://dx.doi.org/10.1108/JMLC-09-2015-0041>

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1. Introduction

It is difficult to determine the definition of money laundering. Latest research report of United Nations Office on Drugs and Crime estimated the figure to be some 3.6% of global GDP (2.3%-5.5%), equivalent to about US\$2.1 trillion (2009), in which is included 2.7% of global GDP (2.3%-5.5%), or 1.6 trillion through the financial system.¹ In the financial system, one of the methods of estimating money laundering is the suspicious transaction report (STR) which is reported to financial intelligence units (FIU). Therefore, this report focuses on how STR is created with data mining methods and utilized from the point of knowledge management.

2. Definition

(1) Definition of money laundering and three stages of laundering cycles

Money laundering is the conversion of criminal income into assets that cannot be traced back to the underlying crime². Most countries subscribe to the definition adopted by the United Nations Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances (1988)(Vienna Convention) and the United Nations Convention Against Transnational Organized Crime (2000)(Palermo Convention)³

Even though money laundering often involves a complex series of transactions that are usually difficult to separate, the following three stages are commonly used to distinguish:

Placement: The initial stage of the process involves placement of illegally derived funds into the financial system, usually through a financial institutions. This can be accomplished by depositing cash into a bank account. Large amounts of cash are broken into smaller, less conspicuous amounts and deposited over time in different offices of a single financial institution or in multiple financial institutions. The exchange of one currency into another, as well as the conversion of smaller notes into large denominations, may occur at this stage.

Layering: The second money laundering stage occurs after occurs after the ill-gotten gains have entered the financial system, at which point the funds, securities or insurance contracts are converted or moved to other institutions, further separating them from

¹ United Nations Office on Drug and Crime(2011), Estimating Illicit Financial Flows Resulting From Drug Trafficking And Other Transnational Organized Crime Vienna, United Nations Office on Drug and Crime, pdf file,p.7,<www.unodc.org/documents/.../Illicit_financial_flows_2011_web.pdf>

² Reuter, P., and E.M.Truman (2004) Chasing Dirty Money, Washington: Institute for International Economics ,Washington ,p1

³ Schott, Paul Allan(2006) ,Reference Guide to Anti-Money Laundering and Combating the Financing of terrorism, Page I-3, The World Bank, Washington

their criminal source. Such funds could then be used to purchase other securities, insurance contracts or other easily transferable investment instruments and then sold through yet another institutions. The separation of illicit proceeds from their sources by layers of financial transactions is intended to obfuscate.

Integration: The third stage involves the integration of funds into the legitimate economy. This is accomplished through the purchase of assets, such as real estate, securities or other financial assets, or luxury goods.⁴

Figure 1: Process of Money Laundering



(Source: United Nations Office on Drugs and Crime)

If a financial institution suspects or has reasonable grounds to suspect that funds are the proceeds of a criminal activity, or are related to terrorist financing, it should report its suspicions to the applicable financial intelligence unit (FATF, The Forty recommendations, Rec.13). Moreover, banks should be required to report suspicious activities and significant incidents of fraud to their supervisors, and supervisors do need to ensure that appropriate authorities have been alerted (Basel Core Principle 15, Description 31). Financial institutions, when filing suspicious activity reports (STR), should not, under any circumstances, notify a customer that his/her behavior has been reported as suspect to authorities (FATF, The Forty recommendations, Rec.14). From that point on which is to say, upon notification-financial institutions should comply fully with instructions from government authorities, including the production of records (FATF, The Forty Recommendations, 10 and 28).⁵

⁴ United Nations Office(2009), United Nations Convention Against Transnational Organized Crime And The Protocols Thereto, pdf file ,United Nations Office on Drug and Crime <www.unodc.org/.../TOC%20Convention/TOCeboo>..

⁵ Schott, P.A (2006) Reference Guide to Anti-Money Laundering and Combating the Financing of

Though the procedure/threshold of Suspicious Transaction Report vary from country to country, for example, the Japan Financial Intelligence Center (JAFIC), defines this system as “Suspicious Transaction Report System aim, by supporting investigation of money laundering and predicate offences, is to prevent illegal business and ensure their(financial institutions) soundness and trust.”⁶

(2) Methods of Data-mining

Financial institutions have to cope with various daily transactions such as wire transfers and cash transactions. While no formula exists to decide whether a transaction is suspicious or not, the manager on the spot has to judge whether it is suspicious once he/she notices any unusual customer behavior.

The detection and decision making process should be done using a risk-based approach with his professional knowledge. However, there is no specific rule or standard as to what constitutes suspicious activities. The urgent important pressing concern of the financial institution is how to report Suspicious Transaction Report (STR) adequately and avoid any friction or enforcement with the authority (FIU). From the supervisor’s points of view, inadequate reporting can cause the serious damage to the financial institutions as follows:

Comparing the number of reports submitted by a particular bank to that a similar bank can also indicate whether each bank is correctly fulfilling its reporting obligations. There may be cause for supervisory concern if bank A submits only a fraction of the number of reports submitted by a bank B, located in the same area, serving the same customer base, and offering the same service. Bank A might be underreporting or bank B might be reporting too much. Either way, this is valuable information to the supervisor. This information is not only relevant for service risk profiling and determining the inspection schedule; it can also be used more straightforwardly as one element supporting an administrative sanction, such as warning or fine.⁷ As Niklas Lujmann pointed out, the financial institution is exposed to the risk of decision making⁸

In order to minimize those risks, one to cope with suspicious transaction is implementation of data

Terrorism.2nd ed. Washington: The World Bank,VI-8

⁶ Japan Financial Intelligence Center(2009), Japan Financial Intelligence Center Annual Report 2009, Tokyo: National Police Agency, pdf file, <http://www.npa.go.jp/sosikihanzai/jafic/jaficenglishpage/jafic_2009e.pdf>

⁷ Chatain,P-L., McDowell,J, et al (2009) Preventing Money Laundering and Terrorist Financing ,Washington: The World Bank, p 150

⁸ “The Observer of a decision maker may assess the risk of the decision differently form the decision maker himself; not least of all because he himself is not located in the decision taking situation, is not exposed to the same presser to decide, does not have to react as rapidly, and above all, does not share in the advantages of the decision to the same degree as the decision maker himself” Luhman, N , Risk (2008) , 4th ed.New Brunswick, New Jersey, p68

mining methods with computer database analysis. Watkins, R.C., et al, (2003) picked up the following two obstacles to overcome with data mining technology: The first one is to identify patterns of money laundering, which requires substantial training in the area of accounting and banking operations and second one is manpower which impedes law enforcement's ability to tackle money laundering activities. Advocated analysis, as an initial step in the investigation of suspected money laundering activities is the analysis of computer database.⁹

The main reason that data mining methods developed in the last decade is the availability of huge amounts of data and the impending requirement to turn particular data into information/knowledge. For combatting a artful money launderers, information/knowledge always should be updated. Having said that, employee training on suspicious activity is limited. In the financial system, cross-boarder transactions are much more complicated.

In their study of data-mining technologies as tools, Watkins, R.C. et al, (2003) categorize their technique in the following tables:

Table1: AI techniques for detecting and combating money laundering activities Technique

AI techniques for detecting and combating money laundering activities Technique	Description	Money laundering case
Linear regression	Most basic approach. Predicts values by describing the linear relationship between a dependent variable and one or more independent variables.	Useful for discovering, validating, and quantifying trends from previously solved money laundering case for use on current case
Logistic regression	Involves categorical variables such as	Rapidly evaluate all financial

⁹ Watkins, RC.,and K.M.Reynolds.,et al (2003),Tacking Dirty Proceed: Exploring Data Mining Technologies As Tools To Investigate Money Laundering Police Practice and Research Vol.4,No.2,pp.163-178

	“yes/no” or “male/female”. Very popular.	transaction records belonging to classes of interest to the investigator
Cluster analysis	Requires substantial amounts of data that can be grouped categorically.	A deeper understanding of the geographical and chronological cluster of activity
Inductive algorithms	Algorithms that generate decision trees based on historical outcomes.	Classifications of the financial transaction data by organizing it into categories.
Neural networks	An AI technique that mimics the human brain by learning from and storing inputs and outputs. Can be used with continuous/categorical variables and non-linear and collinear data.	Learn the relevant strategies that were most helpful to the investigators so that those techniques can be given priority in the analysis of future cases.
Fuzzy logic	A theory that allows incomplete information to be processed and conclusions derived.	Derive conclusions from this processing that are meaningful to investigators
Genetic algorithms	Algorithms based on evolutionary rules used to solve optimization tasks.	Delineate the most powerful leads that point toward a potential suspect or group of suspects.

(Source: Watkins, R.C. et al, 2003)

Of course, it is recommendable to set up an in house data mining system. However, the financial institutions often struggle to keep pace with legitimate change. So nowadays, a lot of financial institutions are using software provided by vendors. Many financial institutions received enforcement actions by the U.S. government recently and large fines and penalties are imposed on them which deteriorated the reputation of those financial institutions.

In the practice of financial institution, it is ideal that to train the AML professional and to invest their own AML detection system internally. However, rapid response to the legitimate requirement and change, the complicated context of financial crime make such investments fairly expensive. As a result of that, financial institutions prefer to hire the software of the AML vendors which is well advanced Data-Mining technique. It is assumed that most software house adopts the basic data-mining concepts which were described before and update the AML techniques. For example, Oracle specializes in developing sophisticated algorithms that can detect illegal behaviors quickly across several data combinations such as sequence matcher, link analysis, outlier detection, and rule

matcher.¹⁰ NICE ACTIMIZE¹¹ improves detection of unusual tactics by comparing activity with peer group segments and historical behavior profiles and leverage flexible data integration capabilities-with built-in adaptors to data warehouses in the processing architecture-for efficient integration with different payment systems¹²

In the public sector, Fin CEN (Financial Crimes Enforcement Network in the USA, Financial Intelligence unit) have developed a system called the FINCEN AI System(FAIS) , which integrates intelligent human and software agents in a cooperative discovery task on a very large data space¹³ The important thing in the system is that explicit knowledge is used in its current design. Explicit knowledge is used in there components of FAIS in its current design. The suspiciousness evaluation rules are the primary repository of knowledge in FAIS. The consolidation algorithm in the data load in the data load programs and the occupation decoding in the suspiciousness evaluation components are also knowledge based.¹⁴

3. Discussion

As described before, we checked the methodology of AML-Data Mining and process of implementation of financial institutions and others. Then, we explore how this framework could affect to internal/international cooperation.

In Japan, collected information as the Suspicious Transaction Report to Japan Financial Intelligence center (JAFIC, FIU of Japan), after sorting and analysis, disseminates these reports to investigation, detection of criminal proceeds, and tracing the source of illicit fund , related Prefectural police and foreign FIUs if necessary¹⁵ In the United States, institutions are required to submit suspicious activity reports (SARs)¹⁶ James H.Freis, Jr, Director, Financial Crimes Enforcement network describe in Director’s Forum “ FinCEN is the informational center of mass that attracts data from over a hundred thousand U.S. financial institutions and over one hundred counterpart Financial Intelligence Units (FIUs) located around world, and we broadly share that centralized knowledge”

The figure 2 shows the typical domestic (national) cooperation flow which is used the report of

¹⁰ ORACL, Best Practices for Anti Money Laundering(AML):System Selection and Implementation, Feb 19,2012<<http://www.oracle.com/us/industries/.../062008.pdf>>

¹¹ As long as their disclosure, they serve over 25,000 organizations in the enterprise and security, representing a variety of sizes and industries in more than 150 countries, and including over 80 of the Fortune 100 companies. NICE ACTIMIZE, Jan 22,2012<<http://www.actimize.com>>

¹² NICE ACTIMIZE, Jan 22,2012<<http://www.actimize.com>>

¹³ Senator,T.E., and H,G.Goldberg, et al (1995) The Financial Crimes Enforcement Network AI System(FAIS), AL Magazine Volume 16 Number 4, PP.21-39

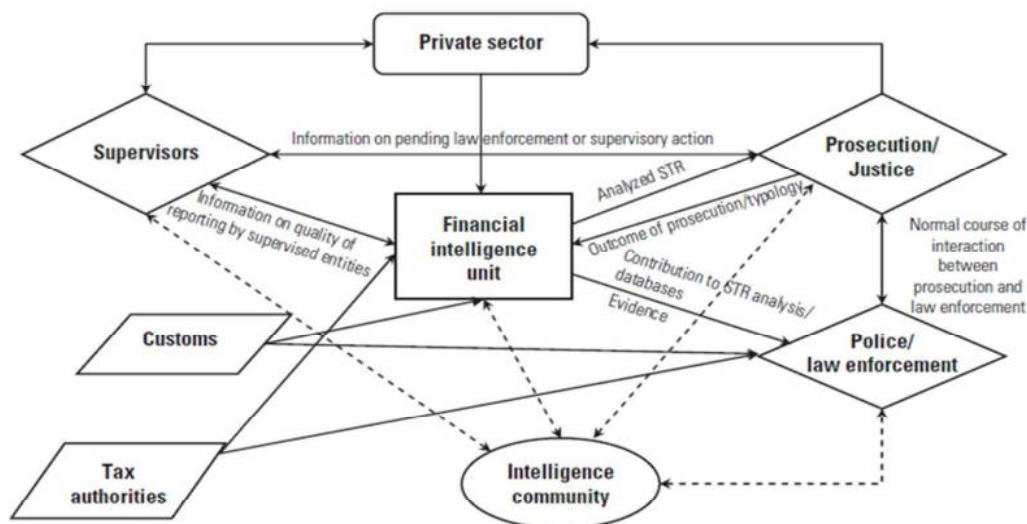
¹⁴ Ditto

¹⁵ Japan Financial Intelligence Center(2009),Japan Financial Intelligence Center Annual Report 2009, Tokyo: National Police Agency

¹⁶ A SAR can be about a transaction that may merely have been discussed or attempted but not consummated. On the other hand, STR have to be an actual transaction involved (Reuter P, 2004, Chasing Dirty Money)

suspicious transaction. It is evident that various stakeholders involve in the Anti-Money laundering framework.

Figure2: Domestic AML/CFT Cooperation



Source: The World Bank, Financial Integrity Unit, 2009.

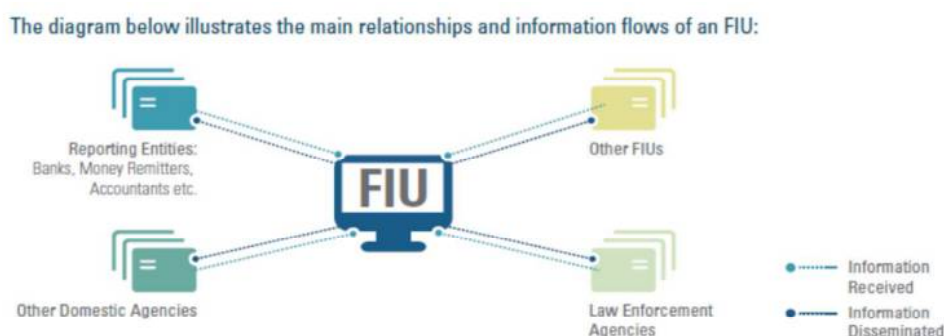
Considering international level, the Egmont Group of Financial Intelligence Units established in 1995 and now includes more than 127 entities that coordinate their work on money laundering issues. The Egmont Group set up the special occasion for international cooperation in the reciprocal exchange of information, increasing the effectiveness of FIUs by offering training and promoting personnel exchange to improve the expertise and capabilities of personnel employed by FIUs, fostering better and secure communication among FIUs through the application of technology.¹⁷ It seems that the Egmont Group is “BA” provider.¹⁸ In fact, member of the Egmont Group got

¹⁷ The Egmont Group of Financial Intelligence Units, Annual Report 2010-2011 FIUs in Action, 4 February 2012 <<http://www.egmontgroup.org>>

¹⁸ ‘Ba’ is the foundation for knowledge –creating activity. It is the place where one engages in dialectical dialogue and practice to implement the vision and driving objectives for the firm. Although it may be either to see ‘Ba’ as a physical space, such as a meeting room, it should be understood as multilevel interactive state that explains the interactions that occur at specific time-spaces. In Japanese, the word ‘Ba’ refer not just to a physical place, but a specific time and space, or the character of relationships in a groups, project teams, informal circles, temporary meeting, in virtual space such as email groups, and at the frontline in contact with the customer. ‘Ba’ is an existential place where participants share their contexts and create new meanings through interaction. Nonaka, I., R. Toyama, and T. Hirata (2008) *Managing Flow*, New York: Palgrave Macmillan

together and hold the meeting in Yervan, Armenia, July 2011 for exchanging the AML related information.¹⁹

Figure 3: The main relationships and information flows of an FIU



(Source: The Egmont Group Annual Report)

4. Challenge

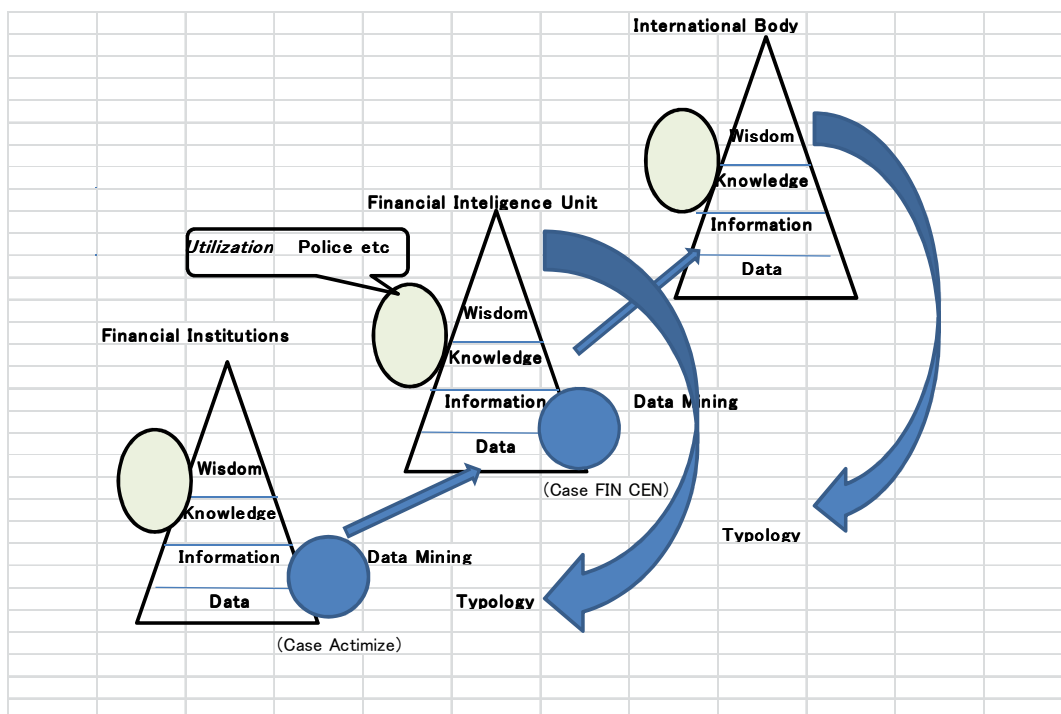
In order to utilize Data Mining in this field, Information wall is the first and most big obstacle in various ways. For example, Data which was accumulated in the vendors is not open to the other customers. Even though this information could become knowledge and sometimes wisdom, such products remain in the entity itself. Or sometimes some solutions are provided by vendors as an advice. These data-information-knowledge –wisdom circulation do not occur the knowledge creation. The only way that private financial institution can obtain such an information sharing is by direct inquiries from domestic governmental investigating bodies and by typology reports which are published by Financial Intelligence Units (each country's FIU, The Egmont group and Financial Action Task Force).

The Egmont Group is assumed to be the 'Ba' provider and struggle to be. However, with the nature of information, they have to handle with care. It means that, under the status quo, even though Data Mining Technology is getting sophisticated, no useful tool for knowledge-sharing could find out.

In addition to that, there is dilemma possibility that the information obtains from the same data result in the different knowledge in the different level of entities.

Figure 4: Work flow of Suspicious Transaction Reports

¹⁹ The Egmont Group of Financial Intelligence Units, Annual Report 2010-2011 FIUs in Action, 4 February 2012<<http://www.egmontgroup.org>>



(Source: author)

Having said that, in the Anti-Money Laundering Field, the methodology was well discussed, Data-Mining mechanism was established and in the current circumstance, it is practicing and improving in various aspects.

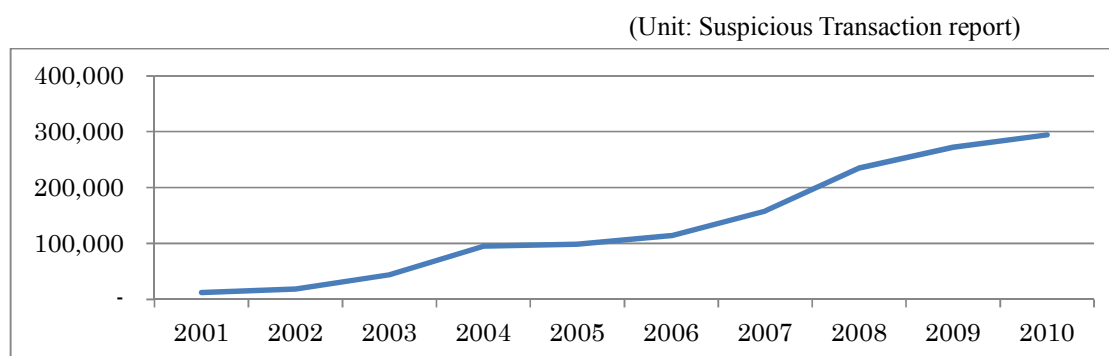
5. Data Mining vs. knowledge management in the Anti-Money Laundering Field

It seems to us that the technology of data mining was improved and the number of Suspicious Transaction Report was increased remarkably as the diagrams below. However, it is wondered if the purpose of data mining of global Anti Money laundering filed is acknowledged adequately. The major reason that data mining has attracted a great deal of attention in the information industry in recent years is due to the wide availability of huge amount of data and the imminent need for turning such data into useful information and knowledge²⁰. On the other hand, it is assumed that the increased number of report (STR) from financial institutions to FIU is the strategy of them to avoidable impending legitimate enforcement by the authority. As the case in the United States, Peter Reuter et.al (2004) point out that a rise in the number of SARs(Suspicious Activity Reports) may reflect either an increase in money laundering or increased stringency of the AML regime. The rate

²⁰ Han,J.,and M.Kamber(2001) Data Mining: Concepts and Techniques
San Francisco: Morgan Kaufmann Publishers P1

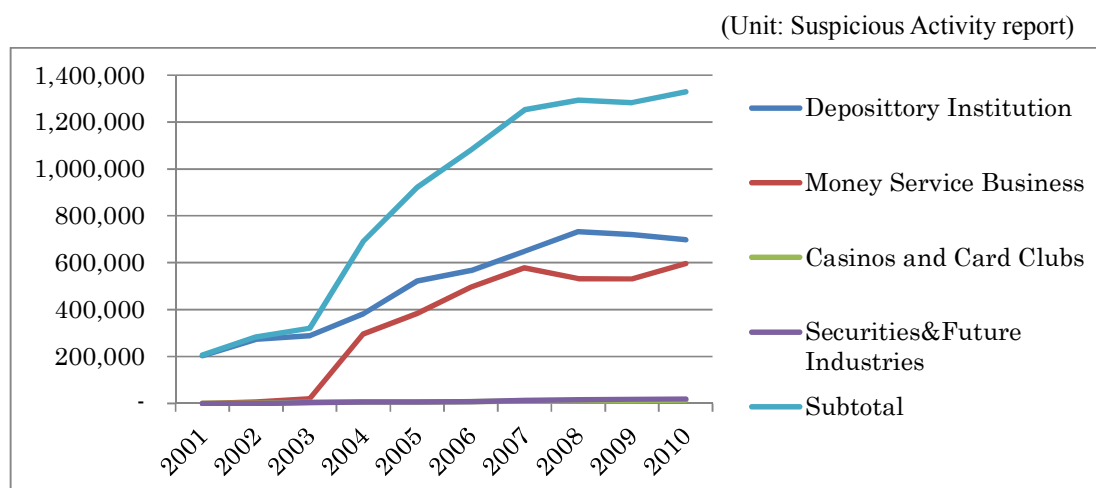
of increase in recent years is so large that, with a caveat as to quality, there is good reason to believe that it is the stringency of the regime that has intensified²¹ In fact, charges of violating reporting requirements has reached outrageous amounts and sometimes it threatens the continuity of the bank business.²²

Figure 5 Trend Diagram of Number of Reports of Suspicious Transactions (2001-2010) to JAFIC (Japan)



(Source: JAFIC Annual Report)

Figure 6: Trend Diagram of Number of Suspicious Activities Reports to Fin CEN (U.S.A)



(Source: FinCEN STR Activity Review)

In addition to that, the complexity of money laundering techniques is forcing the private sector to invest large amounts of money on the detection system. However, ironically speaking, in spite of the enhanced detection system of suspicious transaction which is provided by data mining vendors, the data is just only used for reporting to the authorities due to no feedback from them, whether or not it

²¹ Reuter, P., and E.M.Truman (2004) Chasing Dirty Money, Washington: Institute for International Economics p106

²² For example, Riggs Bank, fine \$41Million(2004),Abby National plc, fine 2million pond(2006),Bank of New York , \$38Million in total penalty(2005)

is used to the actual investigation. In other words, the information / knowledge which is collected about the suspicious transaction is not disclosed clearly how to be utilized.

The situation is the same in the public sector, for example, in the United States, a huge amount of raw data on financial transactions is collected by the U.S. government. Nevertheless, just as academics and researchers find themselves overwhelmed by the sheer mass of information available, in print and electronically, so are financial analysts, bank staff, and regulatory and law enforcement agencies.²³ It is evident that the information/knowledge once acknowledged is used only among a specific circle or community. Additionally, the information/knowledge is oriented from private sector to public sector, mostly one way. It is crucial that the information/knowledge through data mining is not shared and utilized among stakeholders. From the criminology point of view, it is confessed that this is the one of the biggest obstacles disseminating the knowledge-sharing culture in this field

Is there any solution to overcome this obstacle? Yes, there is. It is in the HS-KCSU Model²⁴. In this model, I explained the network of professionals. Naturally speaking, these professional possesses the knowledge, either tacit knowledge or explicit knowledge. When Ikujiro Nonaka and Hirotaka Takeuchi advocated SECI Model, the modes were ordered as socialization (from tacit to tacit), externalization (from tacit to explicit), combination (from explicit to explicit), and internalization (from explicit to tacit).²⁵ I changed this order with the combination of the community in the HS-KCSU model as following: internalization (from explicit to tacit) among the network of community, externalization (form tacit to explicit) among the community which the person is originally belonging to, externalization (from tacit to explicit), combination (form explicit to explicit), and internalization (from explicit to tacit)- in the network of professionals.

The main reason for this modification is that the SECI model is focused on behavior within an organization itself. On the other hand, the knowledge sharing of global Anti-Money laundering is carrying out within different organization/entities/ networks simultaneously. As the result of that, in the data mining process, tacit knowledge emerges as explicit knowledge and could establish a knowledge management framework.

6. Conclusion

In the AML field, especially detection system of suspicious transaction report (STR), we recognized that the data-mining theory such as multivariate date analysis (liner regression, logistic regression, luster analysis) and artificial intelligence technique (inductive algorithms, neural networks, fuzzy

²³ Vlcek, W, Aleviathan Rejuvenated: Surveillance, Money Laundering, and War on Terror, *International Journal of Politics ,culture and science* (2008) pp-21-40, Springer Science

²⁴ The hybrid system of knowledge creating, sharing and utilizing model

²⁵ Nonaka.I, Takeuchi.H, *The knowledge Creating Company* (1995), Oxford University Press, NewYork PP224-225

logic and Generic algorithms) is in practice and well developed. However, the information and knowledge gained are not necessarily used for or shared with the related shareholders, because data mining is considered one of the most important frontiers in database systems and one of the most promising interdisciplinary developments in the information industry²⁶, we cannot help taking advantage of this concept. A lot of AML professionals realize the importance of cooperation at the national / international and private /public sector levels. Peter Reuter (2004) insists that the global AML regime clearly needs further development and promulgation of anti-money laundering strategies at the international as well as national levels. Cooperation with the private sector also should be enhanced, more technical and financial assistance should be provided, and more technical and financial assistance should be made available to poor jurisdictions²⁷

But, is it sufficient to take preventive measures against money laundering? My answer is no. In addition to establishing such a regime, creating and co-evolving the network of 'knowledge professionals' is the impending assignment in this industry. The first and most important task is knowledge management in the global Anti-Money Laundering Field.

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²⁶ Han,J.,and M.Kamber(2001) Data Mining: Concepts and Techniques, San Francisco: Morgan Kaufmann Publishers, p9

²⁷ Reuter, P., and E.M.Truman (2004) Chasing Dirty Money, Washington: Institute for International Economics p192

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