

# Conceptual modeling and development of an intelligent agent-assisted decision support system for anti-money laundering

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## Abstract

Criminal elements in today's technology-driven society are using every means available at their disposal to launder the proceeds from their illegal activities. In response, international anti-money laundering (AML) efforts are being made. The events of September 11, 2001, highlighted the need for more sophisticated AML and anti-terrorist financing programs across the industry and nation. In the wake of this, regulators are focusing on the role that technology can play in compliance with laws and ultimately in law enforcement. Banks will have to employ or enhance AML tools and technology to satisfy rising regulatory expectations. While many AML solutions have been in place for some time within the banks, they are faced with the challenge of adapting to the ever-changing risks and methods related to money laundering. In order to provide support for AML decisions, we have formulated an AML conceptual model by following Simon [Simon, H. A. (1977). *The new science of management decision*. Englewood Cliffs, NJ: Prentice-Hall] decision-making process model. Based on this model, a novel and open multi-agent AML system prototype has been designed and developed. Intelligent agents with their properties of autonomy, reactivity, and proactivity are well suited for dynamic, ill-structured, and complex ML prevention controls. The advanced architecture is able to provide more adaptive, intelligent, and flexible solution for AML. This paper is the first attempt at intelligent agent financial application in the AML domain, with a decision-making/problem-solving process model, an innovative agent-based architecture, and a prototype system.

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## 1. Introduction

Since the mid-1980s, money laundering (ML) has been recognized as a significant global problem with serious economic and social ramifications (Camdessus, 1998). The sheer magnitude of money laundering is such that it now ranks as one of the gravest criminal threats to the global community, capable of corroding international financial systems and corrupting entire democracies (IMoLIN, 1998). Today, ML has become a key funding mechanism for international religious extremism and drug trafficking. Curtailing these illegal activities has become an important focus of governments as part of their ongoing wars on terrorism and drug abuse. The international community has

made major strides in the fight against ML, most notably through the work of the Financial Action Task Force (FATF). Its recommendations have strengthened the regulatory framework aimed at stemming the flow of “dirty money.” Globalization, exponential growth in transactions and accounts, and criminal creativity all combine to challenge current ML efforts. Following the terrorist acts of September 11, 2001, there has been an increased focus in the United States, and across the globe, on the prevention of ML and terrorist financing. Governments and law enforcement agencies have called on the financial services industry to be vigilant in helping to identify potential sources of terrorist financing. In the United States, these efforts have included passage of the USA PATRIOT ACT—legislation that contains major new ML provisions. Diversified regulations, guidelines, and laws have been issued by governments, involved organizations and institutions around the

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globe. What had traditionally been viewed as a compliance issue is now an issue of national and international concern (Van Ness, 2003).

Increasingly, anti-money laundering (AML) systems are being implemented to combat ML. However, some of these systems simply transform vast quantities of data into vast numbers of reports that do not facilitate timely detection or effective interdiction. Some of the traditional rule-based solutions suffer from a number of drawbacks, such as ineffective thresholds, major false-positive problems, lack of a pattern-recognition function, and insufficient data-processing capability. A comprehensive, effective surveillance program requires the use of advanced technology that can sort through reams of data, analyze it automatically, and generate alerts or exceptions on which ML compliance officers can act immediately. In this research, we focus on ML detection and prevention in electronic transaction environments in banks, which are aimed at automating the monitoring and diagnosis of ML schemes in order to report suspicious activities to banks.

ML is a kind of complex, dynamic, and distributed process. Therefore, the system designed for combating ML requires a high degree of cooperative problem-solving capability. Thus, it is very important to start from a decision-making/problem-solving perspective when analyzing and representing AML domain knowledge. In this research, we have adopted Simon's (1977) well-known model of the decision-making process as a framework for a decision-based AML model. Based on this conceptual model, we apply intelligent agent technology to assist decision support for ML prevention controls by taking advantage of the agent's autonomy, reactivity, proactivity, and social ability. AML is a complex process involving many entities, where activities are delegated to a number of both autonomous and collaborative problem-solving agents. Each agent manages its AML-related activities based on situational awareness and real-time decisions. From a holistic perspective, such agents have specific goals to achieve and interact with one another to manage their interdependencies. They work both autonomously and collaboratively to achieve the AML goals.

The organization of this paper is as follows. The next section briefly reviews the relevant literature on ML, AML, AML systems, Simon's decision-making/problem-solving process model, and intelligent agent theory. Section 3 presents our proposed decision-making/problem-solving process model of AML. Section 4 presents the architecture, development, and operation of a multi-agent-based AML prototype system—IAMLS. The final section addresses our contribution to the field as well as future work.

## 2. Background

### 2.1. Money laundering and anti-money laundering

Money laundering (ML) is a term used to describe the ways in which criminals process illegal or "dirty" money

derived from the proceeds of any illegal activity (e.g., the proceeds of drug dealing, human trafficking, fraud, embezzlement, insider trading, bribery, theft, or tax evasion) through a succession of transfers and deals until the source of illegally acquired funds is obscured and the money takes on the appearance of legitimate or "clean" funds or assets (HM Treasury, 2004). ML is a diverse and often complex process that need not involve cash transactions. ML basically involves three independent steps that can occur simultaneously (IFAC, 2002):

- Placement—the process of transferring the proceeds from illegal activities into the financial system in such a manner as to avoid detection by financial institutions and government authorities.
- Layering—the process of generating a series or layers of transactions to distance the proceeds from their illegal source and obscure the audit trail.
- Integration—the unnoticed reinsertion of successfully laundered, untraceable proceeds into an economy.

ML subverts legitimate financial mechanisms and banking relationships by using them as protective cover for the movement of the proceeds of criminal and corrupt activities as well as for the financing of terrorism (Van Ness, 2003). The figures are staggering. The International Monetary Fund (IMF) estimates that the aggregate size of ML in the world could be somewhere between 2% and 5% of the global gross domestic product (GDP), equivalent to approximately US\$590 billion to US\$1.5 trillion annually. According to Celent Communications (Celent, 2002), the amount of illicit funds traveling through ML channels grows at an annual rate of 2.7%. However, those are just estimates—the full magnitude of the problem is not yet known.

Recent years have witnessed a growing number of highly publicized money laundering scandals involving major international providers of diversified financial services and their correspondents in "off-shore" jurisdictions, Russia, other former Soviet Republics, Latin America, and the Caribbean (IFAC, 2002). In response, governments and legal authorities in various jurisdictions have issued an accelerated level of pronouncements and taken other enforcement steps focused on combating ML and related financial crime. In 1989, the Group of Seven Industrial Democracies (G-7) created a global ML watchdog organization called the Financial Action Task Force (FATF). In 1990, the FATF issued its first annual report, containing its now-famous *FATF 40 Recommendations* (FATF, 2003), which are the most important set of international anti-money laundering (AML) standards to date and have been a substantial force in encouraging government AML initiatives. An important element and theme of the *FATF 40 Recommendations* is the KnowYourCustomer (KYC) or enhanced due diligence principles. KYC guidelines require or recommend developing a keen understanding, through appropriate due diligence, of who the true beneficial

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