AN INVESTIGATION OF MULTINATIONAL ENTERPRISE INTERNAL CONTROL AND RISK MANAGEMENT INFORMATION INTEGRATION

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ABSTRACT

Different countries have different internal control information regulations and policies, and it is difficult to integrate a company's overall internal control information without a standard. This study develops an internal control information translation and integration mechanism. The company's headquarters regulation is used as the standard, in order to translate each subsidiary information report. Firstly, XML structure is used to define headquarters' RiskML standard taxonomies. Next, the subsidiary's internal control information report is translated into headquarters' standard regulation. Finally, the translated information report is integrated, using ontology languages. This integrated information helps the company to identify and analyze each subsidiary's internal control risks and threats and to strengthen the company's overall internal control.

INTRODUCTION

Globalization is important, in today's business world. Over the past two decades, many companies from different countries have been continuously expanding their branches, worldwide, by investing in a variety of products and services [1]. The most important issue for a multinational enterprise's internal control process is corporate subsidiary governance. Subsidiary governance can be determined as the process of headquarters management of its subsidiary, especially in a different country, and includes every single process that is managed by the subsidiaries. It is very important, in establishing subsidiary governance arrangements, to ensure overall smooth operation of the company. However, different countries have different internal control regulation and policies and it is difficult to integrate company internal control information, within the different regulations. For this reason, a standard regulation is required, to allow the integration of these internal control regulations. As an example, in the early 2010, The Toyota Motor Company, one of the world's largest automotive manufactures, faced a risk management problem. Difficulties were encountered, in the control of product quality, in a different country. The main problem was the lack of risk information reports, from different subsidiaries in many countries. Because of this issue the company lost billions of U.S. dollars [2]. Toyota is just one of many cases of problems in Multinational Enterprises (MNE's) that are caused by a lack of integrated internal control and risk management (IC/RM) information.

Although an IC/RM report is an important management tool, only those which contain structural and critical management reports will be helpful to the decision making process. When managing international companies, reliable information must be collected from each subsidiary and integrated, to be of greatest use [3]. Much has been written about various information integration technologies, but only a few reports discuss the integration of internal control and risk management IC/RM information. Some argue for a standard that must be used to integrate IC/RM reports. In October 2003, The Open Applications Group (OAGi) announced the formation of a new RiskML Work Group, to define an XML vocabulary, for the definition of risk and control libraries [4]. Risk Markup Language (RiskML) is an extensible Markup Language (XML) base technology, which is used as a standard, to communicate and exchange IC/RM information between enterprise systems. This study initially determines a suitable translation mechanism, using RiskML standard, and then uses an ontology language concept to integrate business information and analyze the results, to provide more useful information, that can assist executive managers in the decision making process.

LITERATURE REVIEW

Internal Control Regulations

Internal Control is a process that is affected by an entity's board of directors, management and other personnel and is designed to provide reasonable assurance of the achievement of stated objectives, in the following categories: (1) Effectiveness and efficiency of operations, (2) Reliability of financial reporting and (3) Compliance with applicable laws and regulations [5]. One of the most effective tools for improving business's internal control is Control Self-Assessment (CSA) [6]. CSA can be implemented in several ways, but its distinguishing feature is that risk assessments and internal control evaluations are made by operational employees, or lower level managers, who work in the area being evaluated. The output of the CSA process is a self-assessment information report, which contains COSO internal control elements. COSO has defined their internal control elements as COSO Internal Control Elements. These elements include Control Environment, Risk Assessment, Control Activity, Information and Communication and Monitoring [5]. This study covers four major countries, to demonstrate the mechanism for internal control [see Table 1]. Each country has different regulations. Even when it has similar regulations, the information contained in the report is different. A company requires integrated internal control information. If the information is not effectively integrated, there can be significant deficiencies in internal control, resulting in potential losses.

Table 1 Comparison of four major countries regulations

COSO	U.S.	Japan	Taiwan	China
Control Environment	Internal Environment	Control Environment	Control Environment	Control Environment
Risk Assessment	Objective Setting Event Identification Risk Assessment Risk Response	Risk Assessment	Risk Assessment	Risk Assessment
Control Activities	Control Activities	Control Activities Response to IT	Control Activities	Control Activities
Information and Communication	Information and Communication	Information and Communication	Information and Communication	Information and Communication
Monitoring	Monitoring	Monitoring	Monitoring	Internal Monitoring

Studies related to Information Translation and Integration

In 1971, Norman H. Anderson proposed Information Integration Theory, as a way to describe and model the integration of information from a number of sources, to form a basis for an overall judgment. Many related works on information integration use ontology representation language. Ontology is suitable for the integration of heterogeneous information from different data sources. One of the most powerful ontology representation languages is XML. Extensible Markup Language (XML) is a set of rules for encoding documents in machine-readable form [7]. This translation mechanism uses RiskML, based on

XML language, as a standard, to create taxonomies and also to translate internal control information reports. Finally, ontology language concepts are also used to integrate the translated information [8].

SYSTEM MECHANISM

Overview

This mechanism has three phases, which contain six steps. Firstly, the subsidiary information report is defined as the input. Thereupon, headquarters taxonomies are used as the standard schema for the translation process. Finally, the translated information is integrated in a report, using ontology languages. Figure.1 illustrates the entire mechanism

Configuration Phase

Once the company has finished the self-assessment internal control process, the system generates a subsidiary self-assessment information report, in the RiskML format. This information is defined as the input data for this mechanism. This data contains four major RiskML entities (Element, Component, Question and Sub Question). Thereafter, everything needed from the subsidiary schema, such as data type, languages and attributes, is prepared for the translation process. The internal control "Component" is also defined as the main transforming level in the mechanism. The translation phase follows.

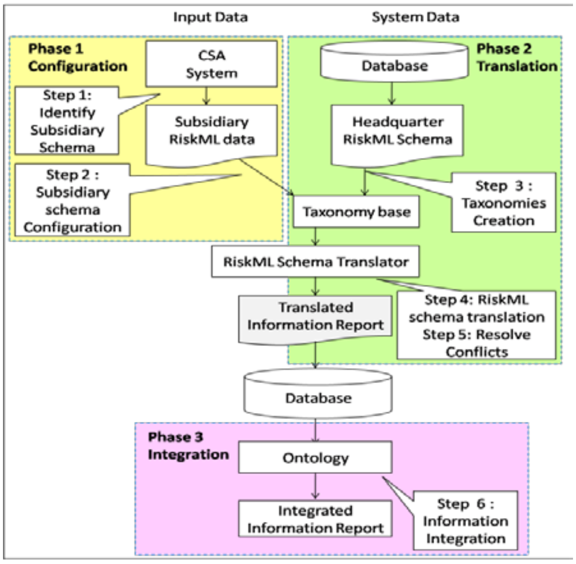

Figure.1 Overview of system mechanism

Translation Phase

The first step is the creation of taxonomies. Taxonomy is needed to translate a subsidiary's information report into headquarters standard information. The new taxonomies are created, using headquarters RiskML standard schema. The translation process can then begin. Most enterprises' internal operation is usually divided into two levels (Company and Process Level). In this section an illustrated example is given, to allow easier understanding of the translation process. As an example, company "A" is a multinational enterprise, which has a headquarters in Taiwan and subsidiaries in the United States (U.S.). It is common knowledge that both countries have different internal control regulations. Within different internal regulations there are also different formats for an internal control information report. Taiwan uses COSO regulation and the U.S. uses COSO ERM regulation. As the headquarters of this example company is in Taiwan, Taiwanese COSO regulation is the standard for this company's IC/RM regulations. Other countries' regulations must be translated into Taiwanese regulations, before they can be integrated. When the headquarters uploads its IC/RM report, the system does not need to translate this report. The U.S. COSO ERM regulation has eight elements, whereas the Taiwanese COSO element has five elements. In this case the COSO ERM regulation component is translated into component level, under the “Risk Assessment” element (Figure. 2). After the translation process, every possible conflict that occurs during translation steps is resolved. In this step, four conflicts are defined, including same information with the same name (SS), same information with a different name (SD), close information with the same name (CS), and close information with a different name (CD). As an example, when the U.S. “Risk Assessment” element is translated into a Taiwanese “Risk Assessment” element, both of these elements contain close information, but are translated into the same name (CS).

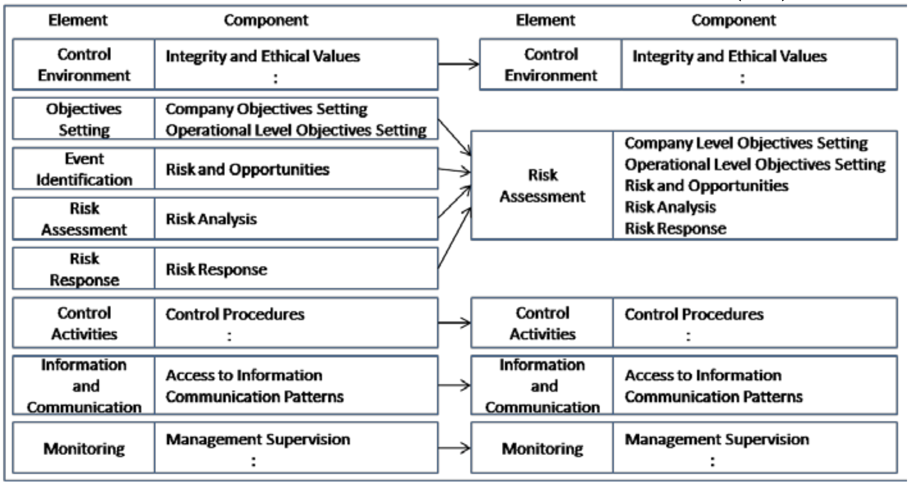

Figure.2 Example of component level translation

Integration Phase

This is the important phase of the mechanism. In this phase, ontology language concepts are used to integrate the translated information.

Ontology and Mapping Constructions

Briefly, an object with property is identified is supposed to be complex type, in XML Schema. For this condition, the mapping rules are described as: (1) Properties in the XML Schema maps as properties in the Resources Description Framework (RDF) Schema. (2) Simple type maps as properties, in the RDF Schema. (3) Complex properties with properties maps as class, in the RDF Schema.

Query Processing

To deal with user requests, Query builder is used, to receive and analyze users’ query requests and validate mistakes in the grammar. Otherwise, it returns an error hint. Secondly, the inference engine is loaded with overall mapping information, to identify similar concepts and return the result to the query conversion. Thirdly, the query conversion transmits the RDF Data Query language (RDQL) into the query transducer, according to the mapping information that is identified by the inference engine. Fourthly, Query conversion changes RDQL into structural XQuery, according to part mapping searches. For XML data, XQuery can query directly. Finally, the query is integrated by the processor and displayed on the user interface. Figure.3, below, shows the query process of this information integration mechanism.

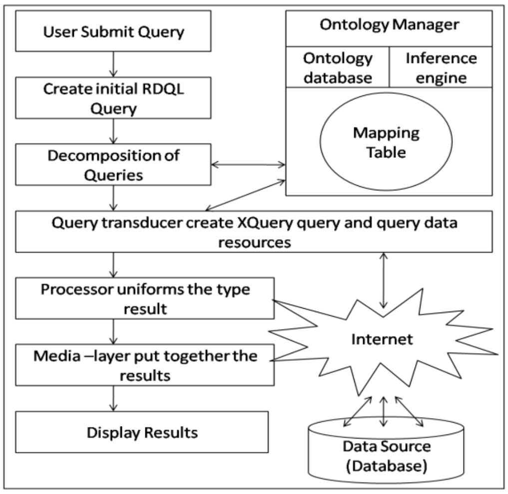

Figure.3 Query process of integration mechanism

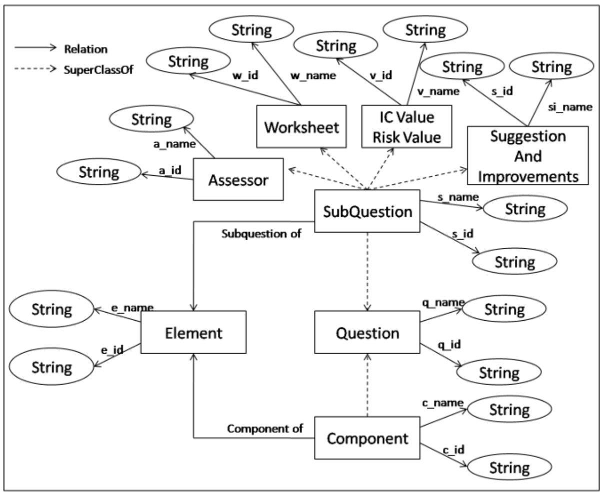

Figure.4 Integration mechanism overall ontology

In this information integration mechanism, a query is processed in the intermediary layer. A global ontology request is described by RDQL, while the data source request is described by XQuery. In this framework, a transformation, from RDQL to XQuery, is needed. The intermediary analyzes and decomposes the RDQL request into a query for local ontology, which is further transformed into a query, for each data source. Figure.4 shows the local ontology and global ontology. The process of web-based ontology information integration is then used, to translate the user query into a query that can fit a Subquery of the Local Mapping Table, using query parsing, with the Global Mapping Table. This process also translates Subquery into database Rawquery, using the Local Mapping Table.

Results

The integration mechanism produces integrated information, which contains company-wide internal control self-assessment information reports and those for each subsidiary, showing a risk value and also a suggestion for the departmental manager, in reference to future operations. (See Figure.5 and 6). This valuable integrated information can be use by executive managers to analyze the detail of both company-wide subsidiaries' operations and help with the decision-making process.

Figure.5 System Application Result 1

Figure.6 System Application Result

MECHANISM VERIFICATION

Information Capacity Equivalence and Dominance is used as a basis for the verification of translated RiskML schemas, to ensure that there is no loss of information, during RiskML schema integration and translation [9]. This study uses five classifications of information capacity. First of all let A and B sets. A is defined as RiskML information before translation and integration and B is defined as RiskML information after translation and integration. We use five classifications of information capacity includes Functional (F), if $f: A \rightarrow B, \forall a \in A, \exists b \in B \cdot f(a) = b$, Injective (I), if $f^{-1}: B \rightarrow A, \forall b \in B, \exists a \in A \cdot f^{-1}(a) = b$, Total (T), if $f: I(S_1) \rightarrow I(S_2), \forall I(S_1) \in S_1 \cdot \exists I(S_2) \in S_2$, Surjective (S), if $f^{-1}: I(S_2) \rightarrow I(S_1), \forall I(S_2) \in S_2 \cdot \exists I(S_1) \in S_1$, and Bijection (B), if the mapping function meet all the above four properties. For this mechanism, the correctness of each translation rule is certified, if and only if the rule is at least a total relation, since there may be a semantic loss, when translating between different data models.

CONCLUSION

During this study, it was found that problems associated with the integration of internal control information are an important issue in corporate subsidiary governance. However, only a few related studies mention it. The contributions of this study are related to the collection of domestic and international related studies of the integration of internal control information and to the development of a system application, within the RiskML schema translation and internal control information integration mechanisms, which can be used for xbrl and other further study. Integration of this information helps upper level managers to better manage corporate subsidiary governance. A general three-phase mechanism was developed, which fully automatically translates and integrates information resources with different regulations. Focus is not given to the system application, itself, but rather to the ways in which the integrated information can assist top management, in decision-making process.

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