

# Extensible Visual Business Intelligence for Analyzing XBRL Big Data on Blockchain

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**Abstract.** The state-of-the-art patented EVBI (Extensible Visual Business Intelligence) provides a new visual programming language for modeling Business Intelligence applications over all databases at the intra- and inter-organizational levels. This paper describes the EVBI (Extensible Visual Business Intelligence) based on a case study research method in for illustrating how the solution aid for analyzing XBRL big data securely on Blockchain. The EVBI makes it easy for senior executives to design and develop supervisory reports using an extensible visual modeler desktop, without help of technical staff such as programmers. The results would be easy to use, as well. A one-click reporting component can be served to non- technical users, which at the organizational level, senior executives of the country can access all supervised entities and organizations, even without interacting with supervised entities, at any time. Ability to model processes and processing algorithms as visual multilayer models, enable the implementation of SQL Procedures visually and without the need for technical staff, which in addition to the ability to store knowledge, the ability to develop knowledgeable teams stored in models is realized by the state-of-the-art idea. The output can be displayed in any environment, including, but not limited to web pc/smartphone applications.

**Keywords:** Business Intelligence, XBRL Analytics, Blockchain.

## 1 Introduction

The use of conventional BI in financial reporting necessitates auditors to modify their evidence-gathering procedures for implementing continuous auditing. There is a need for more flexible BI which can server effectively for various auditing procedures.

BI solutions should decrease work time searching for missing or erroneous data. The benefits of BI involved more accurate financial reporting with fewer errors due to a reduction in human involvement, resulting in more reliable and relevant information

But since BI has been expected to support dynamic auditing procedures, the BI system eventually becomes very complex.

BI systems tend to be complex for two major reasons. One reason for complexity is that BI systems have many independent components that require integration. (Deanne Larsona 2016)

From the technical point of view a traditional Business Intelligence solution BI includes etl-tools including Data warehousing (architecture, modeling, storage, managing and data processing), ETL process (extracting, transforming, loading and data integration), implementation of reports(data visualization and dashboards), Online Analytical Processing OLAP and multidimensional data analysis, data mining, statistical analysis and forecasting modules. (Mihaela Filofteia Tutunea 2012). The complexity of BI would inevitably affect the business application.

The second reason is BI systems are impacted by continuous changes.(Deanne Larsona 2016) The traditional business intelligence(BI) methodologies include identifying of requirements, designing, defining and working with data, development of creation codes and databases, testing and validating of developments, deployment to production, then supporting phases.(Deanne Larsona 2016) Aligning on one hand what a BI solution can offer and, on the other, the changing needs and expectations of users, the way they like to work – their work style, can thus be difficult.(J Jaklič 2018) Furthermore, the current BI systems do not adequately detect and characterize user interests.(Krista Drushku 2019)

This problem is felt more in fast growing and evolving auditing applications like accounting fraud detection. Because fraud makers are constantly changing their approaches and due to the rapid change of fraud scenarios, the auditing requirements cannot be fully recognized in advance.

Since it is hard to both foresee all the business intelligence users' requirements and be ensure of the covering of all new demands in advanced, the traditional business intelligence methodologies suffer from constant dependencies to support of expensive technical staff. Thus, the evolution of the traditional BI system is not possible without technical staff assistance or outsourcing team support.

In course of time, the increasing complexity of the BI systems leads to the development of diverse system islands in an organization, which does not meet organization's needs separately.

The development of various systems, in addition to wasting the available financial resources of organization, can lead to unnecessary complexity and lack of coordination among software.

For this reason, it is always observed that conventional BI users like traditional auditors cannot work paper free.

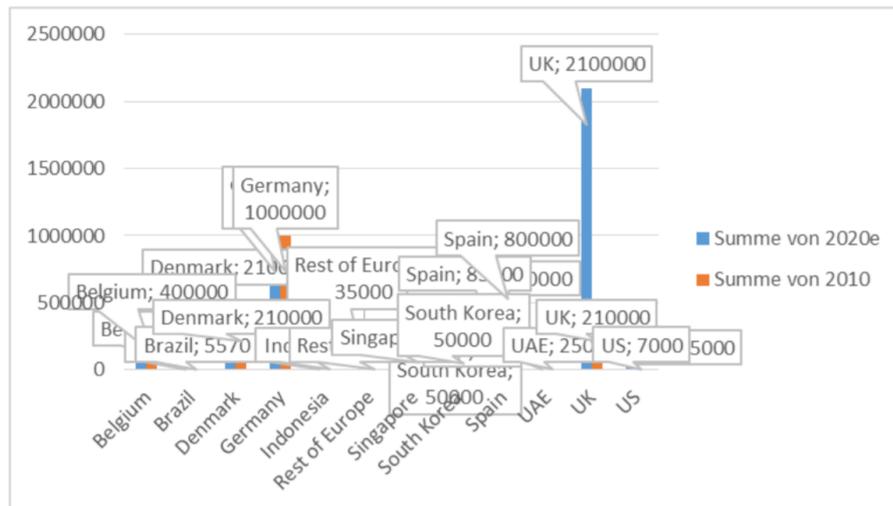
This has led to a lot of problems that some of the most important of these problems are listed below:

- Difficulty in responding BI requirements spontaneously and without tremendous support of technical team
- The impossibility of designing the information processing processes required for BI reports without making changes to existing systems
- Lack of desired agility in the implementation of new BI needs
- Lack of unlimited development possibility in existing BI systems

- Lack of sufficient scalability or flexibility of technical architecture(Vallurupalli Vamsi 2018)

To deal with above problem, there is a need for an extensible BI platform to pass traditional limitation in answering business requirements. This necessity would be felt more when there are heterogeneous business systems in the organization.

Moreover, millions of XBRL files are produced and its technology is vastly distributed. (Below figure) There is a need for boasting validation, verification and acceleration of time of auditing process for the mentioned XBRL big data.



Development of XBRL Filings by countries between 2010 and 2020(expected)(Dirk, 2018) Source: XBRL.org, World Federation of Exchanges and own estimate

BI is meant to take in all the data being generated by a business and present easy to digest performance measures and trends that will inform management decisions. (Horia Mircea BOTOS, 2017)

Without extensible BI systems, auditors not only will encounter to wasting tremendous amount of time and energy, but also dependency in responding the confidential changing business systems will increase the risk of financial frauds.

To address mentioned problems with BI platforms, the current study intended to introduce a state-of-the-art business intelligence framework named Extensible Visual Business Intelligence (EVBI) provides a blockchain based solution for modeling auditing BI procedure on XBRL filings eliminating traditional dependency to companies' systems.

The solution gets advantages of focusing on combining XBRL, business intelligence, visual modeling of big data analytics with blockchain technology.

## 2 Background

Many companies such as SAP, Microsoft, Oracle and Informatica, have developed traditional business intelligence systems. Each of these systems have their weaknesses and strengths. However, all of these systems have the same limitation as their weakness in supporting of various BI needs. For example, the system lacks the ability to provide business team full independence from the technical team.

### 2.1 Why this research is important?

High-quality financial information is the lifeblood of financial markets, and that quality can be adversely affected by the existence and persistence of corporate misconducts both financial and non-financial. Prior research has primarily focused on financial misconducts and financial reporting fraud (FRF) and their effects on quality of corporate disclosures. For example, Dichev et al. (2013, 2015) find that over 20 percent of firms intentionally misrepresent their earnings. The existing financial and auditing systems do not provide adequate incentives and accountability for management and auditors to protect investors from receiving misleading financial information (Rice et al., 2015). Business organizations lose about 5% of their revenues to fraud each year, which can exceed 3.5 trillion (USD) worldwide (The Association of Certified Fraud Examiners (ACFE), 2015). FRF incidents will continue to increase in the next several years (AICPA, 2014) and a minimal portion (less than 5%) of FRF is discovered by external auditors (Rezaee and Riley, 2009). \*\*12

In addition, there is a need for designing data processing and processing algorithms, that traditional intelligence system lacks such capabilities. The business intelligence systems have to provide both unlimited development capabilities and independence from technical staff for BI users in their platform.

There are many BI solutions, each has its pros and cons. For example, the BI solution of Informatica provides simple visual tools for designing query by non-technical user. These reports can include facilities such as data filtering, line and output columns selection, selection of output data sources, and combining them with other relevant data, grouping and using functions such as aggregation, counting and sorting, as well as data representation. The Business Object SAP Company has offered similar tools. However, both tools lack possibility of visually modeling the business processes or SQL Procedure, without the need for technical expertise. An SQL Procedure may include some queries used for data processing, as well as some code for saving the results of each processing step in temporary tables. The result would be save in physical tables and would be used in other queries and SQL Procedures for subsequent processing. The SQL Procedures may go further and includes complex business logic. However, the result would appear in reports with different visualizations.

Other feature of SQL Procedure are operators like SQL Loop such as For and While, conditions such as If, and Case Switch.

A larger financial services firm will have a substantial set of software applications to support its business processes. If you are lucky, these applications use the same

databases and run on the same operating system but typically it will be a mix of MS SQL, Oracle, and NoSQL databases plus Linux and Windows. Firms have to think carefully whether they favor buying BI solution from third parties or whether they develop in-house. If they do buy third-party products, they have to choose where on the adoption curve they want to be. This boils down to a choice between knowing with a high degree of probability you are making a suboptimal choice and taking a bet on something that can drastically change your capabilities. Build versus buy considerations can have its pros and cons.

When a firm buys BI solution, never would be an exact match to its business needs. Suppliers can act unpredictably; they can be acquired, loose focus, or unexpectedly raise prices. It may depend on supplier willingness to make enhancements to the software, or pay much more than you would have done if you controlled the code. The firm have to be careful to prevent lock-in to specific entities, such as software vendors or their consultants.

When a firm decide to build in-house BI solution with its own staff, it may be reinventing the wheel and start on a learning curve a vendor's clients have already climbed Proprietary knowledge—hard to reengineer if people leave the company.(Groot 2017)

In large organizations, there is always a stream of technical staff turnover. BI staff carry important knowledge of the organization.

Therefore, providing a BI platform to store and transfer this knowledge to the next forces is very important.

Such BI platform should provide understandable and self-interpretable framework for transferring the firms' BI knowledge treasure from the existing BI staff is to the new experts; it protects the organization's business knowledge assets and reduces risk from loss of its business operation.

On the other hand, while a firm lose its BI staff, the critical BI knowledge acquired by leaving staff, would be transferred to its biggest competitor or its own clients.

Therefore, the desired BI platform should control privileged access to business knowledge, and perhaps encapsulate its critical business secrets.

The BI solution should provide capability of separation of business content from its presentation in different access layers.

The outputs of the analysis of BI systems are reports with relevant information value for managers, which also serve as inputs into decision-making and management processes of the organizations.(Milan Kubinaa 2015)

Key attention areas for BI departments are to get tools to preserve flexibility and not lock the data to the process.(Groot 2017)

Both BI reports and its related business processes should have powered up by mentioned capabilities.

Traditional BI systems offer tools for structuring and storing data in a data warehouse, in which data are modeled with a multidimensional model representing the analysis axis.

These systems can be extended with semantic technologies to capture the meaning of data and new ways of interacting with data, intuitive and dynamic. Having the meaning of data and a reasoning mechanism may assist a user during his analysis task. (Marie-Aude Aufaure 2016)

However, there is also a need to model the process of generating information from data. The BI data, interaction, business processes and decision-making mechanism need to be harmonized by an BI modeling framework regarding above considerations.

In regulatory organization, experts spend huge amount of time over motioning many market transactions for finding suspected cases to frauds. The traditional BI solution involves regulatory roles to scrutinize every transaction detail. (Bagherian Kasgari 2016)

Proactive surveillance is essential for financial regulators who are concerned with taking appropriate actions prior to performing new scenarios of frauds in financial market. These frauds are conducted by fraud makers who creatively innovate new fraud scenarios. If the BI systems were successful in tackling fraud makers, the door will be open for regulators to proactively prevent fraud makers from fulfilling their fraud mission. (Bagherian Kasgari 2016)

Detecting new financial frauds involves new BI requirements, which means new development efforts. Whereas the stream of devising financial frauds is continuous, the process of updating financial surveillance BI systems will be continuous as well. Therefore, there is a need for extensible BI systems for financial supervision.

The current research intended to facilitate auditing of financial filings, through a BI solution for rapid reporting of all financial frauds at different levels of inter/intra organizational levels.

Thus, we contribute to the literature by extending and complementing prior research on providing new technology based solution for modernizing auditing applications.

## **2.2 Analyzing XBRL Big Data on Blockchain**

Blockchain 2.0 led to the creation of Blockchain platforms where software code, called Smart Contracts, can be stored and executed on a Blockchain publicly. These contracts allow unstoppable, unmodifiable and publicly verifiable code execution as transactions between online entities. Blockchain 3.0 is expected to further immerse the technology into our daily lives with IoT integration. (Matthew Dixon and al, 2018)

The expectation by the market are very high given the vast investments in blockchain infrastructure projects (Dirk Beerbaum, 2019). Recently Blockchain has been applied in aiding auditing applications extending literature about XBRL and blockchain as the following:

- Continuous auditing and verification with XBRL blockchain (Dai, 2017, Chan et al., 2018, Deloitte, 2018, Dai and Vasarhelyi, 2017) 11
- Real-time accounting and reporting with XBRL combined blockchain (Byström, 2016, Trigo et al., 2014)
- Acceleration of time with the XBRL blockchain (Colgren, 2018, Monterio, 2016)

- This article and demo explains how to build a distributed ledger platform prototype from the ground up, specifically designed to manage financial reports, in the line of other proposals in the financial area.(Boixo et al., 2019)
- Design and implementation of a prototype to validate and store financial statements using Ethereum blockchain (d'Atri et al., 2019)

The following advantages are seen in the application of blockchain to XBRL filings for accountants and auditors:

- Validation of postings
- Verification of financial and non-financial information
- Acceleration of time

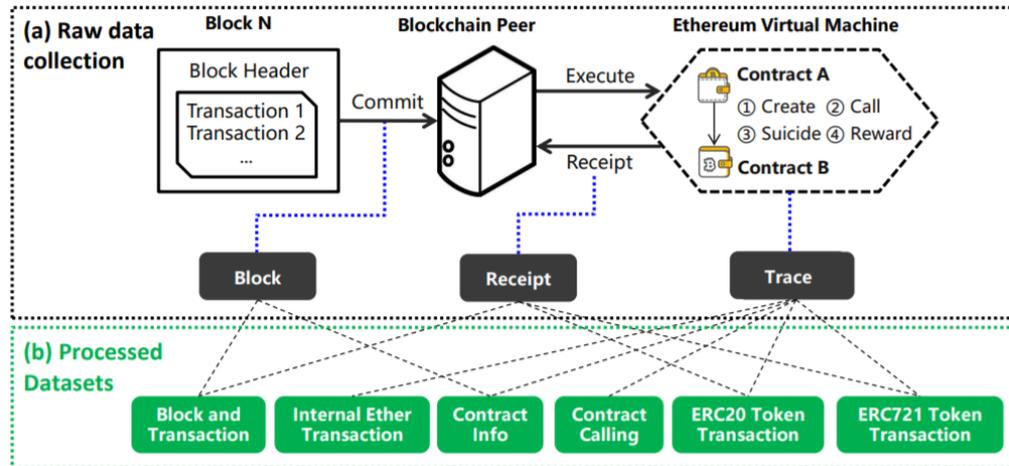
Since all entries are distributed and cryptographically sealed, falsifying or destroying them to conceal activity is practically impossible. Speed is a next domain, in which blockchain and XBRL have its real advantages. Accounting processes can vastly automated while control and audit costs will decrease due to the built-in validation. XBRL combined within a blockchain has the potential to enable real-time reporting and real-time accounting, as stakeholders can directly access to blockchain accounting information.( Dirk Beerbaum, 2018)

Blockchain records track information about financial payments, movements of products and Analytics on this data can provide provenance histories, predictive planning, fraud identification, and regulatory compliance. (D. N. Dillenberger et al,2019)



Opportunities brought by artificial intelligence to address challenges of blockchain (Zibin Zheng, et al,2020)

Big data analytics of blockchain data is beneficial to fraud recognition of transactions and vulnerability detection of smart contracts. However, it is also challenging to conduct big data analytics of blockchain data. It is extremely time consuming to download the entire blockchain data due to the bulky blockchain size and it requires substantial efforts in extracting and processing binary and encrypted blockchain data so as to obtain valuable information while this process is non-trivial as conventional data analytic methods may not work for this type of data. Also, there is no general data extract tool for blockchain data. Although several open source tools for blockchain data extraction are available, most of them can only support to extract partial blockchain data (not the entire data). (Zibin Zheng, et al,2020)



Data processing during Ethereum transaction flow(Zibin Zheng, et al,2020)

Blockchain is seen as revolutionary or incremental change technology. In the last twenty years a technological revolution also occurred fueled by the widespread diffusion of the internet. With regard to Financial Reporting, this trend also generated the development of Extensible Business Reporting Language (XBRL), which many accounting experts expect to revolutionize financial reporting since it allows corporate financial information to be aggregated, transmitted and analyzed quicker and more accurately. Blockchain and XBRL combined may represent a “centauromachy ( Dirk Beerbaum, 2019)

The ongoing digitization of the economy presents challenges and opportunities for the auditing profession and requires both auditors and their clients to adapt, motivating the current technological developments in big data analytics, artificial intelligence (AI), and blockchain technology, offering numerous opportunities to financial world. ( Victor Tiberius, 2019)

Some researchers suggested using blockchain as storage for XBRL filings, providing a standard data framework for machine learning/AI process, motivating future challenges in auditing research. (Eric E. Cohen, 2018)

Procedures to obtain audit evidence (ISA 500 .A2, AS 1105 .15-21, AU-C 500 .A14 - .A25 )	Blockchain/DLT How do you store it	XBRL How do you represent it? (Data and Asserted Rules)	AI/Machine Learning How do you perform it?
Inspection (documentation, including vouching, tracing, scanning?)			
Observation (processes or procedures)			
(External) Confirmation			
Recalculation			
Reperformance			
Analytical procedures, including scanning (AICPA)			
Inquiry			

**WORKING ON THESE AREAS:**  
 What's practical – today  
 What's practical – tomorrow  
 What's necessary or no longer necessary tomorrow (e.g., token economy)

Blockchain Auditing challenges (Eric E. Cohen, 2018)

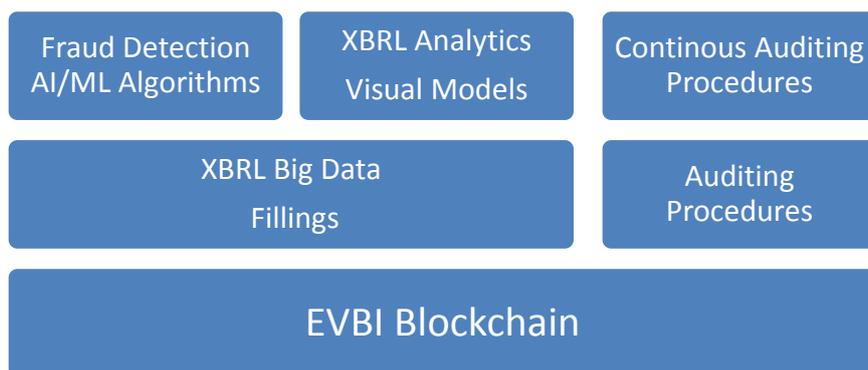
In this paper, we suggested EVBI as a visual intelligent auditing solution for modeling auditing procedure shared on blockchain as storage for processing XBRL filings. The EVBI will allow auditing firms to review transactions of public firms using a collection of auditing process of data stored on a distributed ledger, as well as streamline and automate the fraud detection process.

It is expected that the new platform will reduce audit procedure times from several weeks currently to “a fraction of second”. The blockchain maintain an audit trail that never goes away. Blockchain is not a data standard. And XBRL is not a distributed ledger system.

But both are used to communicate, which in, one is playing role as the standard, and the other uses the standard. Indeed, the blockchain uses XBRL as a data standard to record information, a digitized financial data storage that resides on the blockchain. Smart contracts between two auditing agent may specify that if the certain auditing ratio alert of one auditee company falls below a certain level, an auditing action is triggered by the digital contract. In this application, the concept of the smart contract was fully developed, and it became clear that reliable, consistent, machine-readable data is necessary for auditing smart contracts to be fulfilled.

Smart contracts that rely on XBRL data prepared using a financial data standard can automatically trigger an action without the need for auditor intervention. The EVBI provide visual modeling desktop for auditing analytics connected to blockchains to provide easy-to-use configurable dashboards, predictive models, provenance histories, and compliance checking. As it is illustrated in the below conceptual model, auditing procedure are separated from XBRL filing big data and both are stored in the blockchain. User in upper level see the visual dashboard including AI models,

We also describe how blockchain data can be combined with external data sources for secure and private analytics, enable artificial intelligence (AI) model creation over geographically dispersed data, and create a history of model creation enabling provenance and lineage tracking for trusted Fraud Detection AI/ML, XBRL Analytics Visual Models and Continuous Auditing Procedures.



Conceptual model for Extensible Visual Business Intelligence (EVBI), sharing XBRL big data analytics.

Therefore, our major contribution in this study is addressing all mentioned problem with blockchain-based with state-of-the-art idea of EVBI, which is illustrated in the next section.

### 3 Extensible Visual BI

In this section we described the features of EVBI, illustrated building a Visual BI component and finally evaluated the benchmarking EVBI with traditional BI solution.

#### 3.1 BI Visual Modeler(BO)

The following section introduce an application interface called Visual Modeler, which is the design desktop for the innovative idea EVBI launched as Visual Modeler™ (BO). In the Component Category bars, user can create libraries of BI business processes, printable reports, algorithms, and multilayer BI models. The top toolbar also includes Run, Save, Open, convert Visual Model to Business Process buttons, and a new button (to create a new BI object). There are some features for controlling the BI user privilege and sharing. By simple Drag and Drop the designed report move to the visual design desktop BO and will connect to query.

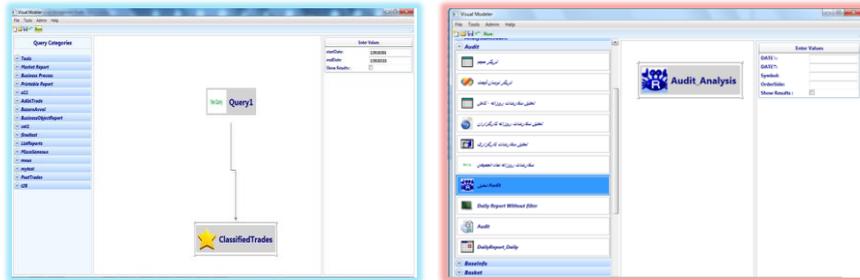


Figure 11 Visual Modeler™ (BO), displays a sample query object created by drag and drop to connect the designed BI report to query

The user can execute the report, saved as a visual BI procedure stored or a BI component and customize the output via a simple or advanced filtering parameter.

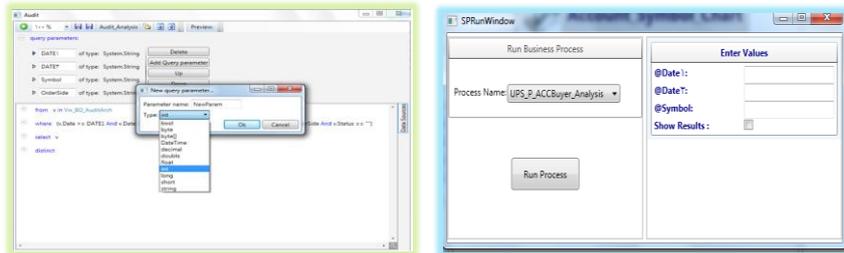


Figure 2 Setting BI Business Process Parameters

The input can have diverse formats static or dynamic formats including, but not limited to BI Reports, User-Defined, Multilayer Visual Models, Automatic feed via Algorithm, etc.

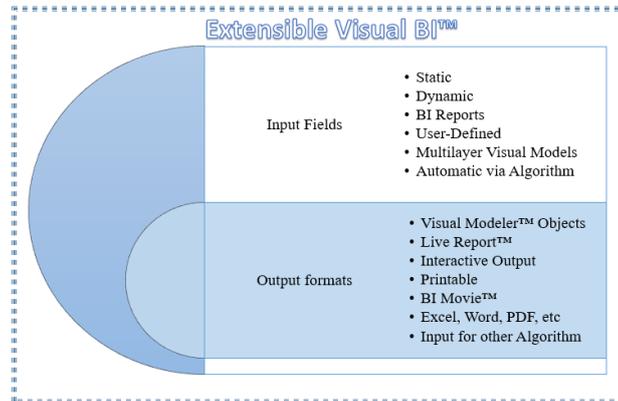


Figure 3 Diverse static or dynamic input and output in EVBI

The created BI process can be saved as BI component. Then, by dragging a saved BI component onto the screen, the component icon positioned on the drawing pad, can be used to create new BI processing models or execution for seeing the results. The output can have different format, including but not limited to Visual Modeler™ objects, Live Report™, Interactive Output, Printable reports, BI Movie™, Excel, Word, PDF, etc. and can be served as input for other BI algorithm.

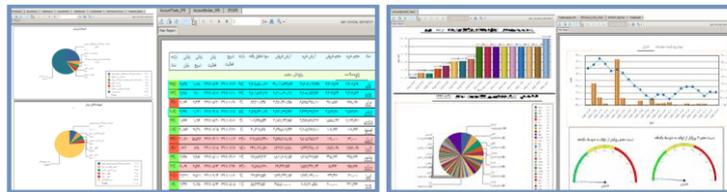


Figure 4 A sample BI report illustrating alerting trends

After designing reports in Visual Modeler (VM), BI reports can be run in-house, as an application, or published on iBO(web-based interface for BI analytics) as needed. The Web Reporting Environment is called the Intelligent Business Object (iBO). The technical model carried out a few application prototypes to show how to transform business data into BI documents, how to employ query instruments to analyze BI reports, and how to align to the globally adopted business reporting standard.

All users around the globe can access to BI analytics based on their privileges.

If the BI administrator decide, BI process, designed BI algorithms and reports, can be published over the web. For this purpose, while publishing each BI processes and reports, components within each process, is also transferred through BI web service and will be kept on the web server in the relevant database.

Complex BI process can be drawn simply by selecting and connecting related BI component which the result can be save as new BI process or algorithm.

### 3.2 Smartphone BI Applications

The development of mobile technologies and applications for mobile devices has opened new horizons for BI solution providers, in terms of developing applications for mobile BI, developing Mobile BI modules. The functionalities of mobile BI solutions will continue to improve steadily, BI solution providers giving them a better adaptability to the type of terminals and mobile software platforms, and better security and performance. We should specify that all commercial BI solutions providers already included in their offer customizable Mobile BI modules depending on the type of client and its infrastructure. (Mihaela Filofteia Tutunea 2012)

### 3.3 Building a Visual BI component

By double-clicking on each BI component, Non-technical users can change BI process using visual interface. (Fig. 8)

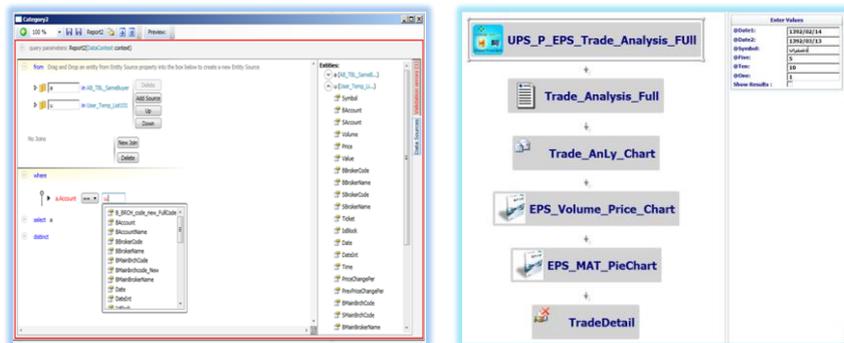


Figure 5 Designing A sample BI process using EVBI visual desktop

The BI data warehouse connect diverse databases including financial reports. Fig. 13 displays sample Eps analysis report component. Motivated by the benefits of XBRL (Extensible Business Reporting Language) and growing interest in modern financial reporting technologies among listed companies led most companies to disclose their financial report in XBRL format. (Bagherian Kasgari 2009) So, EVBI can receive and process XBRL files to build its database of financial reports.

For analysis of financial report, BI users can design different analysis component and connect the designed component to create a comprehensive financial analysis process. BI analytics can be used for different applications, including auditing.

Auditors who are dependent on company managers for receiving information cannot be sure that the company does not fabricate the financial data, this contradict auditor independency principals (SOX act). Another application which EVBI can serve effectively is continuous auditing. (Bagherian Kasgari 2014)

### 3.4 EVBI Benchmark

Numerous innovative capabilities of EVBI has initiated by it genuine Architecture. Traditional BI data warehouse in EVBI is boasted. Extensive BI cube and reusable BI process enable users to add their data structure to BI data warehouse and build their business process in multilayer EVBI architecture.

Then Visual modeler enable users to visually create and change the BI business process and then compose them to build a complex business process. This can finally trace a scenario of financial frauds. Traditional surveillance system such as NASDAQ Smart surveillance system lacks such features. User can access the result in EVBI surveillance system via Live Report™.

Live Report™ is an innovative interactive object, which bound to EVBI and carry data and upper layer process to be displayed in different environment. This object can be used for analytical or regulatory purposes. For example, financial fraud cases can be displayed via this object in court of law or financial report can be better interpreted by non-technical investor by watching BI Movie™.(Fig. 16)

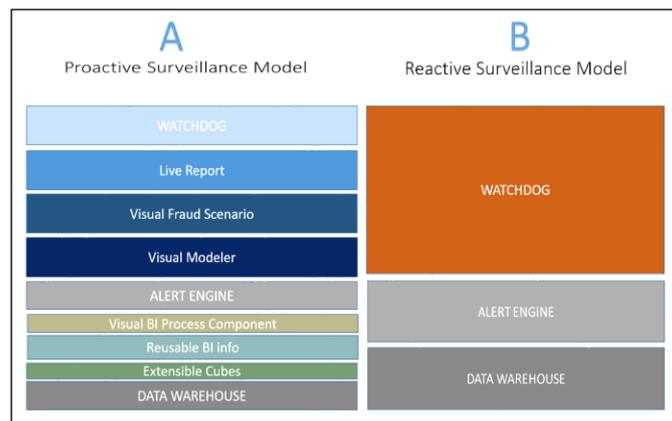


Figure 6. Benchmarking architecture of proactive surveillance base on EVBI solution vs. reactive architecture in NASDAQ SMART surveillance system

This Table 1 listed differences between financial surveillance based on EVBI technology and a sample surveillance system, NASDAQ Smart market surveillance system.

Table 1 Benchmarking EVBI and NASDAQ SMART surveillance system

Factors	EVBI	NASDAQ SMART
Extensible BI cubes	unlimited	Limited and pre-designed
Technical Staff Need	No Need	Technical staff is needed for support
BI Reports	unlimited	Limited

Data Sources Connectivity	Extensible	Limited and pre-designed
Implementing New BI Requirement	Extensible	NA
Live Report	Offered	NA
Visual Fraud Modeling	Offered	NA
Visual SQL Procedure Modeling	Offered	NA
BI Process Reusability	Offered	NA
BI Data Reusability	Offered	NA
Required Manual Alert checking	NA	Required
Development Year	2014-2019	2006-2010

The dream of proactive surveillance is realized by EVBI solution, because unlike the tradition reactive surveillance approach (used by NASDAQ SMART), the financial supervisor can track fraud makers by both tracing their activity and forecasting their next probable steps. So, since the user is pre-informed about fraud action in the market, he/she can proactively take regulatory action in advanced of fraud mission performed.

This state-of-the-art EVBI Architecture make complex BI process become transparent to high level BI users. This feature plus user friendly visual modeling options in EVBI enabled user to design visually complex business process without support of technical BI developers. The table 2 listed difference between EVBI and a traditional BI, Oracle BI.

*Table 2 Benchmarking feature of EVBI A traditional BI, Oracle BI*

<b>Factors</b>	<b>EVBI</b>	<b>Oracle BI</b>
Extensible BI cubes	unlimited	NA
Technical Staff Need	No Need	Technical staff is needed for support
BI Reports	unlimited	Limited
Data Sources Connectivity	Extensible	Limited and pre-designed
Implementing New BI Requirement	Extensible	NA
User-defined data structure	Offered	NA
User ad-hoc data en-	Offered	NA
Visual SQL Procedure Modeling	Offered	NA
BI Process Reusability	Offered	NA
BI Data Reusability	Offered	NA
Development Year	2014-2019	2006-2010

For example, the user can import a table and use it instantly in joining with other data and can create business process visually, finally saved as BI components. Users can creatively mode real life scenarios via Visual Modeling.

## 4 Conclusion and Future Work

The current study introduced state-of-the-art EVBI, known as a Blockchain-based solution for auditing on XBRL Big Data, which can be served as a continuous auditing applications. This solution can enable auditors to detect financial frauds without asking auditee staff to support. The knowledge in auditing firm can be visually modeled in multilayer levels.

This study examines the impact of BI reporting on audit and assurance services and how the use of BI in financial reporting can affect audit evidence-gathering procedures and tests.

The models can be used as media for exchanging knowledge between organizations, experts and systems. EVBI provides reusable framework for evolution of business processes as well as a reusable framework for BI data and information. Extensible BI capabilities provide an unlimited BI data warehouse. Visual modeling made it easy for non-technical users to act independently and implement their BI requirements without need for support of technical staff.

The EVBI includes a new visual method for extending BI and modeling business reports and BI processes, storing them, and reusing them for future applications.

Modeling reports and processing algorithms, in addition to overcoming technical complexities, enables better control of the reporting process and team collaboration.

Multi-layer visual modeling, not only simply the for the complexity of the BI processes, but also, it supports programmers by partial evolution of BI processes without affecting other components of the BI algorithms that are important in programming. Because it enables separate testing of each item and enables the ability to enhance processing algorithms through teamwork.

The mentioned capabilities make this idea suitable for agile BI development and executing financial supervision over all supervised entities, by managers and financial supervisory organizations, without dependency to technical staff.

For example, if this BI solution be installed in an auditing firm, auditors can report instantly, with just some clicks over surveillance components and can monitor easily supervised entities, without the need for routine correspondence.

This capability is due to the ease of design and execution of BI reports, making the EVBI suitable for senior executives who are non-technical users.

As result of this ease of use, auditors can monitor their auditee permanently and intangibly through this system.

The EVBI, by aggregating all the information into a single report, can constantly make visible all available information to auditors. This trend will result in effective surveillance with full coverage because there is no limit to adding any new databases.

It also makes possible for BI users to store the results of the BI reports in the form of user defined data structure for future use, allowing the user to design their own BI system and, if desired, share with other users.

By adding all available databases, any BI report can be prepared at any time by combining all available information.

The state-of-the-art idea will not only result in saving huge amount of time and energy in financial surveillance, but also the quality, precision and speediness of surveillance be improved greatly by realizing the dream of proactive surveillance with changing role of auditing expert from a data worker to auditing knowledge expert.

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