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# Exploring XBRL-based reporting system: A conceptual framework for system adoption and implementation

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## Abstract.

XBRL has been established as a financial reporting standard in the last 15 years. Many countries already adopting XBRL-based reporting system. In some countries it mandated by the government and for the other voluntary. IT adoption and implementation already existed as a separate process. To get more comprehensive analysis, this article aims to propose a unified conceptual model for IT adoption and implementation processes. A literature review on inter-organizational system (IOS) was conducted to reach that objective. This resulted in a conceptual framework represented by factors influencing adoption and implementation, levels of adoption and arrangement of the system. This framework will be used in further empirical study of XBRL reporting system or in broader, analysing the implementation of inter-organizational system.

**Keywords:** XBRL, IT/IS adoption, IT/IS implementation, conceptual framework, inter-organizational system, information sharing

## Introduction

Companies need to report various types of information, for example tax, statistical, inspection or annual statements regularly to several government agencies. This causes an increase on the amount of work on both sides. Processing a huge number of reports from businesses can be challenging, time consuming and error-prone for governments [1]. On another side, there is a high cost for enterprises for preparing several different reports and sometimes reproducing the same or partially already created data in various formats. Recently, organizations are able to share information with each other [2] due to the advancement of information and communication technology (ICT). The approach in exchanging data is shifting from bilateral information exchange to more advanced system, and this beneficial for private and public sector.

One of the examples of such system is XBRL-based reporting system. XBRL, an acronym of eXtensible Business Reporting Language, is an open standard to report financial and business information electronically [3] that enable the preparation, publication, exchange, and analysis of the financial and business statement [4]. Since introduced in the early 2000, XBRL has been already implemented in several countries such as the Netherlands [5], Australia [6], the United States [7], the United

Kingdom [8], China [9], India [10], South Korea [11], Israel [12], Saudi Arabia [3] and Italy [13].

Perdana et al. [14] summarized potential effects of XBRL and divided the effects into three aspects: 1) accounting, 2) auditing, and 3) decision-making process. These affect three different parties: providers, intermediaries, and requesters. In accounting, potential impacts of XBRL include an integrated accounting and financial information supply chain [15], improved accounting data and financial information quality by facilitating information exchange [16], and achieving good corporate governance by providing more transparent financial processes [17]. In auditing, XBRL provides opportunity and capability to handle continuous auditing [18], which realized by traceability of the data on the system. With this capability, auditors can focus on the evaluation of financial information rather than on extracting and calculating financial data [19]. Last, with the improvement in information quality and capability of data tracing and aggregating, XBRL also can potentially improves the decision-making process of organizations.

Apart of the importance and benefits of XBRL, Perdana et al. [14] highlighted that only few XBRL literature discussing its implementation in public organizations, where public organization can be considered as the requesting party or information users. Since most implementations of XBRL reporting system mandated by the government, there should be some information available that can be extracted concerning how implementation of this system affects their business processes.

Moreover, literature in XBRL implementation focuses on technical development; mostly discussing the taxonomy [14], and only few focus on system arrangement: IT architecture, data management or system governance. In order to get more comprehensive view for the adoption and implementation of the system, this research will also include system arrangement in the proposed model. System governance, for instance, should be clearly established since the early implementation to avoid conflict between users, and become even more important to realise the next implementation phases.

The main objective of this research is to propose a model which can be used to analyse the adoption and implementation of XBRL. This research reviewed existing IT adoption models that used in investigating inter-organizational system (IOS) and resulted in the selection of TOE model to structure the determinants in system adoption and implementation. TOE model then assembled with XBRL adoption strategy model and system arrangement.

This paper is structured as follows. In the next section, a brief overview of literature in inter-organizational system (IOS) is given, specifically about the business and government relationship, and also the implementation concept. Then, methodology used in this research is described, whereas the proposed model is presented and discussed later. Finally, conclusions are drawn in the last section.

## Literature Review

### XBRL

Government has the responsibility to control the market, as a safeguard that maintain equality in a competitive market [1]. This can be achieved by ensuring that businesses comply with established laws and regulations [20]. For this purpose, businesses have to deal with a huge number of reports sent to several government agencies. In the traditional information exchange, human-to-human or human-to-system communications, human can be considered as weak link because many activities are vulnerable of errors, take a lot of time to process and costly (ibid). On the other side, government also burdened with aggregating, comparing, and evaluating the information (ibid).

Inter-organizational system (IOS) can be defined as “an automated system distributed in two or more organizations which provide the collection of information resources, such as common databases, infrastructure and applications that extend beyond organizational borders and facilitate information sharing to support the business process of the organization” [21, p.2]. System-to-system information sharing among organizations not only minimize the paper-based process, but also simplify the processes, and improves formulation and implementation of policy that lead to many other benefits [22].

XBRL-based reporting system is an example of IOS. XBRL, often referred as ‘bar-codes for reporting’, is an open international standard for the electronic communication of financial and business information [23]. The first generation of XBRL was developed by Charles Hoffman in 1998, with the main objectives facilitate data sharing in financial report and to invent the new method that simplifies the way financial data prepared, validated, consumed and analysed [24]. Today, XBRL international, a global and not-for-profit organization, which consists of approximately 600 public and private organizations has been developed to consistently support the enhancement of reporting and analysis to meet global business practice [23].

An XBRL consists of four main elements: 1) XML standard, 2) XBRL taxonomy, 3) instance document, and 4) XBRL specification [25]. The XML standard and syntax allow the semantic meaning, expression and information modelling in XBRL [26]. A taxonomy contains the metadata that corresponding with a particular XBRL entity in the instance documents [27], and by using this metadata, taxonomy manages *the elements* and *elements’ relationships* which support data validation [28]. XBRL instance document is basically the financial statements which are formatted with tag [29]. XBRL specification includes the rules and technology that defines how XBRL works by allowing multiple instance documents of different taxonomies to be processed by the same software tools (ibid).

### IT/IS Adoption and Implementation

In this research, XBRL is viewed as IS innovation in the financial sector. Magalhaes [30] defined IS implementation as “a process of change aimed at the integration of technological artefacts into the social structure and processes of the organization” [30,

p.10]. Furthermore, Thompson [31] explained the process of innovation divided into three-stage process, initiation which consists of the need of change, gathering information and evaluation, led to adoption stage. Adoption stage explains the decision to use innovation and to allocate resources to the innovation. Implementation stage refers to the development and installation of innovation to ensure the benefits of innovation are realized. IS implementation used in this research mainly focus on adoption and implementation stages.

Myers [32] stated that IS implementation research developed into two dominant categories: factor and process. Factor research tried to identify variables related with implementation success and failure. In the area of XBRL implementation, there is plenty research focus on this aspect [3, 29, 33, 34, 35]. Process research tried to explain how and why the implementation running over time. Several research in XBRL implementation falling into this aspect [36, 37, 38].

XBRL reporting system is used by organizations as a tool for preparing and reporting their financial statement. Even though the real users of the system and the decision maker in the organization might be individuals or groups, from the system perspective the user is an organization. In this regards, from many IT adoption models available in literature, this research only focus with models that used in organizational level. There are three dominating models found in the literature: 1) Technology Acceptance Model (TAM), 2) Technology-Organization-Environment Model (TOE), and 3) Integrated Acceptance and Sustainability Assessment Model (IASAM). Table 1 summarizes the focus and limitations of each model.

**Table 1.** Comparison of established IT adoption models

Models	Main focus	Limitations
TAM [39]	<ol style="list-style-type: none"> <li>1. Behavioural theories with focus on beliefs, attitudes, and behaviour [40].</li> <li>2. Provides a room for intervention of individual behaviour via external variables [41].</li> <li>3. Reflects mutual relationship between adoption intention and attitudes, perceptions, and beliefs [42]</li> </ol>	<ol style="list-style-type: none"> <li>1. Pays more focus on initial adoption rather than continuous adoption [40].</li> <li>2. Focus on prediction of behaviour on the exploitation stage, and lack of focus on possibility of failure on development and testing stage [43]</li> <li>3. Deals mostly with the voluntary adoption [42].</li> </ol>

TOE [44]	<ol style="list-style-type: none"> <li>1. Provides theoretical perspective of contextual factors [44].</li> <li>2. Presents variables that assess project complexity from theoretical aspects and practical aspects [45].</li> <li>3. Supports the assessment to investigate the dynamic of project complexity [45].</li> <li>4. Includes environmental context in the analysis [46].</li> <li>5. Provides a solid theoretical foundation, consistent empirical basis, and the potential of application for IS adoption [46].</li> <li>6. Free from industry and firm-size restrictions [47].</li> </ol>	<ol style="list-style-type: none"> <li>1. Some predictors are more suitable for large organizations instead of for small and medium enterprises [48].</li> <li>2. Does not explaining the decision process and causality within the factors [49].</li> <li>3. Offer not more than a taxonomy for categorizing variables and does not provide an integral conceptual model or a comprehensive theory [50].</li> </ol>
IASAM [51]	<ol style="list-style-type: none"> <li>1. Combines socio-economic aspects and socio-technical aspect of technology [43].</li> <li>2. Addresses technology acceptance issue and sustainability issue [51].</li> <li>3. Takes into account technical, social, financial, and sustainability assessment [51].</li> <li>4. Assessing potential failure of a new technology since the development phase [43].</li> </ol>	<ol style="list-style-type: none"> <li>1. Relatively too complex [43].</li> <li>2. Need relatively more time to analyse [51].</li> </ol>

## Methodology

In order to achieve the objective, this research using multi-stages literature review. First, articles discussing IOS, for instance electronic data interchange (EDI), Public Safety Network (PSN), and especially XBRL reporting system from academic journals in information system area such as Management Information System Quarterly (MISQ), Government Information Quarterly (GIQ), or Information System Research (ISR), were collected. These articles were combined with papers from international conference proceedings in information system and electronic government area. This list includes the newest version of e-government references library.

Second, those articles were reviewed. Only relevant articles were selected as we wanted to identify which IT adoption model to be used in proposed model. As a result, prior research mainly using TAM [3, 52, 53] and TOE frameworks [33, 35, 54] in analysing the adoption and implementation of IOS.

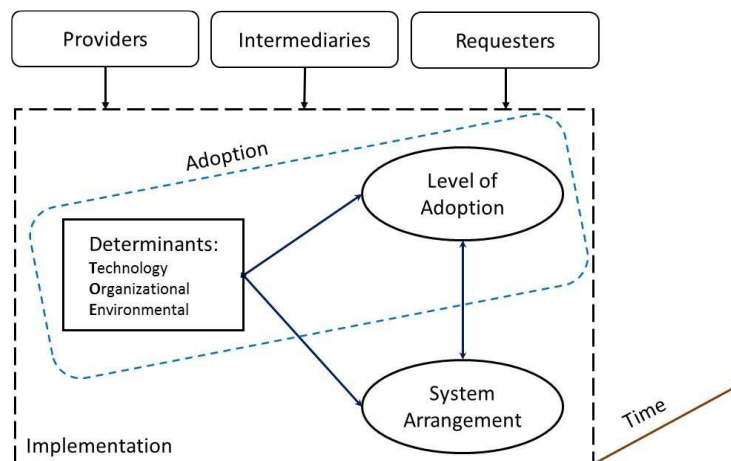
Third, original papers which proposed those IT adoption models were studied. Most cited papers that using the models were also studied to gain information about the limitations and advantages of each model to be considered as a proper model in ex-

plaining XBRL reporting system (as shown in table 1). Based on this, TOE were selected for the proposed model.

Fourth, other important elements for the proposed model were identified. In this stage, one article proposed a model to explain in specific IOS adoption [55], one article propose adoption strategy of XBRL [56], and another article propose level of adoption of the XBRL reporting system [57] were studied. These three models then were combined to analyse how organizations adopt XBRL in their organization. Further, the importance of system arrangement was also recognized [58, 59] in implementing IOS.

Last, from aforementioned affluent sources, factors, adoption level, implementation stage and other information related to inter-organizational system were collected and used to propose a conceptual framework in investigating XBRL reporting system.

### Model construction



**Fig. 1.** Proposed conceptual model

As a system that involving many organizations, implementing XBRL reporting system is a complex endeavour. Learning from existing implementations may be critical for the future implementation. In this regards, the objective of this research is to propose a conceptual model for analysing this system. As shown in the figure 1, the IT/IS implementation concept from [30] which describe adoption as a part of implementation process is used. Therefore, the successful of implementation reflected by the successful of system adoption in users. The blue line represents the adoption process in an organization that influenced by several factors structured using TOE. Some factors are also influencing system arrangement. Then, according to [58], architecture and governance of IT system are influenced by the willingness of organization to adopt the system. Some elements were identified during the research and explained in detail as follow:

a) Determinants

There are many factors influencing implementation of XBRL provided from literature, even more if other IOS implementations are included. Perceived benefits and perceived risk, both mainly refer to return on investment, were usually used in explaining why an organization has to use an innovation [29, 60, 61, 62]. Other determinants were also used to explain the adoption of innovation such as complexity [29, 54, 60], compatibility [54, 60, 63, 64], organizational readiness [29, 33, 61, 64], system security [65, 66], management support [1, 54], power and trust [65, 67], firm structure, size and culture [68, 69, 70], external pressure [33], regulation [1, 71, 72], and incentive [1, 37].

In order to make factors found from literature more structured, TOE model is adopted in this research. The TOE framework at first described by [44] in explaining how the organization context plays as important role in adopting and implementing innovations. As an organization-level theory, this framework explains three elements of an organization that influence their adoption decision of technological innovations: *technological*, *organizational*, and *environmental context*. The technological context refers to existing technologies that are currently used by the firm and other technologies available in the market but has not been used by the organization [73]. The organizational context includes characteristics and resources of the organization [71]. The environmental context refers to external condition that might stimulate the firm in technology adoption [73]. The used of TOE as synthesizing model is also because it offers flexibility of factors in each context (ibid).

b) Levels of adoption

As XBRL can be implemented for inter-organizational purpose and internal purpose [33], levels of adoption variable need to be included in the model. Research from [57] provides four adoption levels of XBRL: 1) non-adopters, which is irrelevant for the proposed model; 2) low adopters, by outsourcing the XBRL conversion; 3) medium adopters, reflected by retaining their current financial system and converting their financial data to XBRL in-house; 4) high adopters, which have potential to gain the optimal benefits from the system. Findings from this research show that organization who decide to use XBRL mainly choose to be low adopters or high adopters.

On another literature, Sledgianowski et al. [56] offers three XBRL adoption strategy for organization: 1) bolt-on, using XBRL conversion at the end of traditional reporting chain; 2) built-in, integrating XBRL as part of reporting process without interfering other domains reporting system that still need manual conversion; 3) embedded, standardizing the reporting process using XBRL. However, XBRL might not suitable for different domains reporting process, thus adoption using embedded strategy might not feasible in present day.

In the inter-organizational perspective, levels of adoption can also be demonstrated by actively or passively contributing in the system governance, participating in decision-making process, involving in problem solving and information sharing [62].

c) IT/IS Arrangement



The terminology arrangement that used in this study is referring to prior study from [74] that provide explanation about how the interplay between IT architecture and IT governance ensures IT activities in supporting organizational objective by providing IT agility. The system arrangement refers to governance and architecture of IOS system that support information process. Level of adoption and system arrangement are used to address TOE limitations by providing better correlation and causality of each element in the proposed model.

d) Time

As indicated in SBR (Standard Business Reporting) implementation in Netherlands, system arrangement could be changed during the implementation process, factors influencing or key actors and their roles in each implementation phase could also be different [36]. For this reason, time variable need to be added in the proposed model to show that all variables in the model may change throughout the implementation phase.

e) Actors

Another variable that should also be added in the model is actors, including their roles in each implementation phase [8]. For example, at the early phase, system owner and developer plays an important role to developing the system. Then the system will be tested by the user, to find out if there is any bugs or error in the system. This process than being followed-up by the developer to create an adjustment in order to solve issues found by users. By adding this variable, the governance of the system can also be explained, including the decision making process, monitoring and formal communication.

## **Conclusion**

This article aims to propose a conceptual model to be used for investigating XBRL reporting system. The proposed model presented was acquired by assembling IT adoption models with XBRL adoption strategy model. Further, to get more comprehensive result, system arrangement in term of system architecture and system governance included in the model, this will fill a gap in XBRL research which lack of system perspective research.

The proposed model indicates that an interrelation between adoption and implementation is exist, which means if there is any change in the determinants, in may affect adoption, implementation or both. For example, changes on the regulation and legal framework of XBRL reporting system, from voluntary to mandatory, will have an impact on adoption process and system arrangement. With the changing, there is an additional incentive for organizations to adopt the system and this resulted in a significant raise of data transactions need to be handled by system.

XBRL is still considered in the initial stage of maturity. This proposed will be tested using survey and case study in the future research. The objective is to collect empirical data in identifying factors influencing of the implementation, identifying actors

and their responsibility in the implementation process, explaining how and why implementation running over time, and evaluating gap between theoretical and practical of XBRL reporting system. This data can be used to develop a comparative study of the cross-nation boundary and develop future system that can solve XBRL reporting system issues and challenges identified.

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