The Integration of Financial and Non-Financial Information in Financial Reports

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XBRL XXV
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TO THE NEXT LEVEL OF BUSINESS REPORTING. AND BEYOND.

Backgrounds (1)

- Non-financial information has been proved to have information contents.
  - Nelson and Tayler (2007)
  - Lev and Thiagarajan (1993)
  - Amir and Lev (1996)
  - Blacconiere and Northcut (1997)
  - Ittner and Larcker (1998)
- Some other studies focus on the association between financial and non-financial information
  - Bryan (1997)
  - Cole and Jones (2004)
  - Sun (2010)

Backgrounds (2)

- However, non-financial, narrative information is defined as “hard info.” which is considered not easy to be processed, re-used and integrated with financial data (“soft info.”).
  - Engelberg (2009)
  - Campbell and Slack (2008)
- XBRL info. contains a lot of non-financial, narrative info., such as footnotes, MD&A, etc.

Research problem

- Can we use native XBRL technology to create associations between related information (face of the financial statements, footnotes, MD&A)?
- Especially for those info. could be used for (UF) a specific “topic”.

Basic thinking (1)

- Although XBRL taxonomy covers both financial and non-financial information, the link between them does not exist.
- The well-known XBRL linkbases, such as presentation, calculation, label, reference and definition linkbases, are proved to be very useful in many projects. But non of them provide have semantic links between financial and non-financial information.
- XLink, like RDF and RDFS, was originally developed by W3C to build semantic webs by linking network resources using XML syntax.

Basic thinking (2)

- Let's go back to the original purpose of XLink!
- The authors try to use the existing XBRL XLink technology (in our case, genericLink) to build the "additional" links between financial and non-financial information.
- Additionally, we adopt two important conceptual framework to guide the usage of XLink:
  - Link analysis
  - Topic maps

Topical Link Model (TLM)

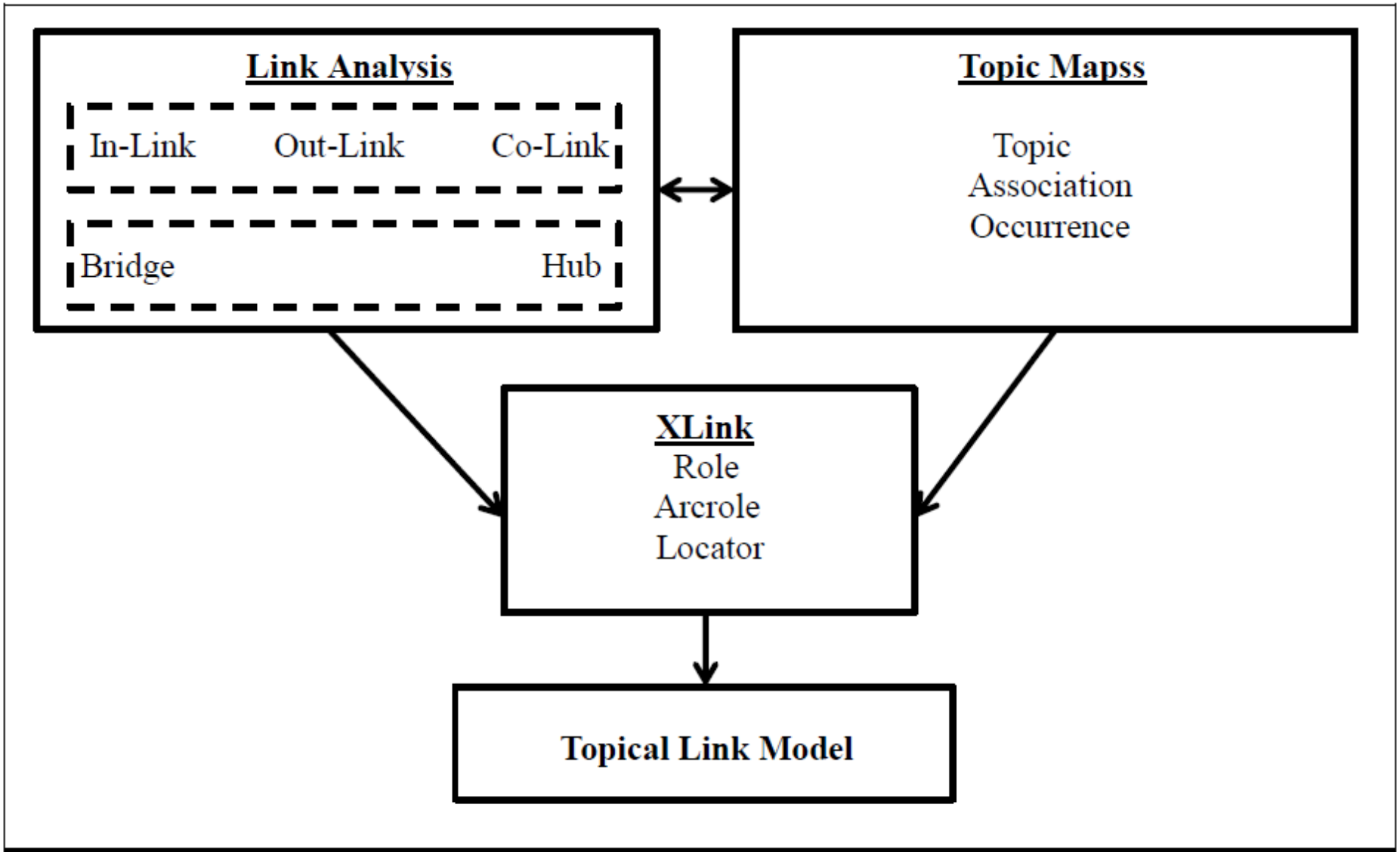


Figure 3. TLM Framework

Link Analysis / Mining (1)

- Link analysis is an analytical technique used to evaluate the various types of relations (links) between nodes in a network. (Liu, 2007; Srinivas, Kiran Kumar Reddy, and Govardhan, 2010)
- Three link types (Katz 2004):
  - out-link
  - in-link
  - co-links
- Linking centrality (Björneborn 2004; Freeman 1977; Park et al. 2002) :
  - Hub node: has the largest number of links to other nodes
  - Bridge node: can connect several nodes that are not directly linked
- Link query

Link Analysis / Mining (2)

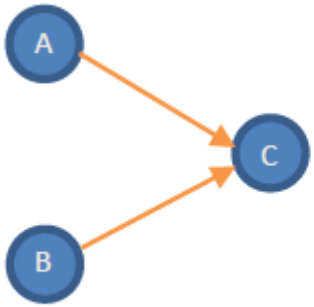


Figure 1a Node A and B has a co-outlink: node C

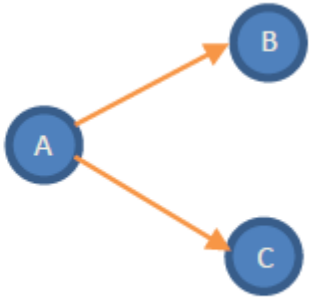


Figure 1b Node B and C has co-inlink: node A

- Corresponding to XLink:
- Figure 1a: A and B has the same xlink:arcrole and the same xlink:to
- Figure 1b: B and C has the same xlink:arcrole and the same xlink:from

Topic maps (1)

- Topic maps are used to represent knowledge and featured with linking as well as finding information (Garshol 2002).
- It becomes an ISO/IEC 13250 standard in 1999 and has an XML-based format: XML Topic Maps (XTM) (Pepper 2010).
- Using the topic maps, all the information in a network can be presented as topics, associations or occurrences (Garshol 2002).
  - *Topics* represent any subject the map is about.
  - *Associations* represent the relation between topics.
  - *Occurrences* are the locations of the resources corresponding to topics.

Topic maps (2)

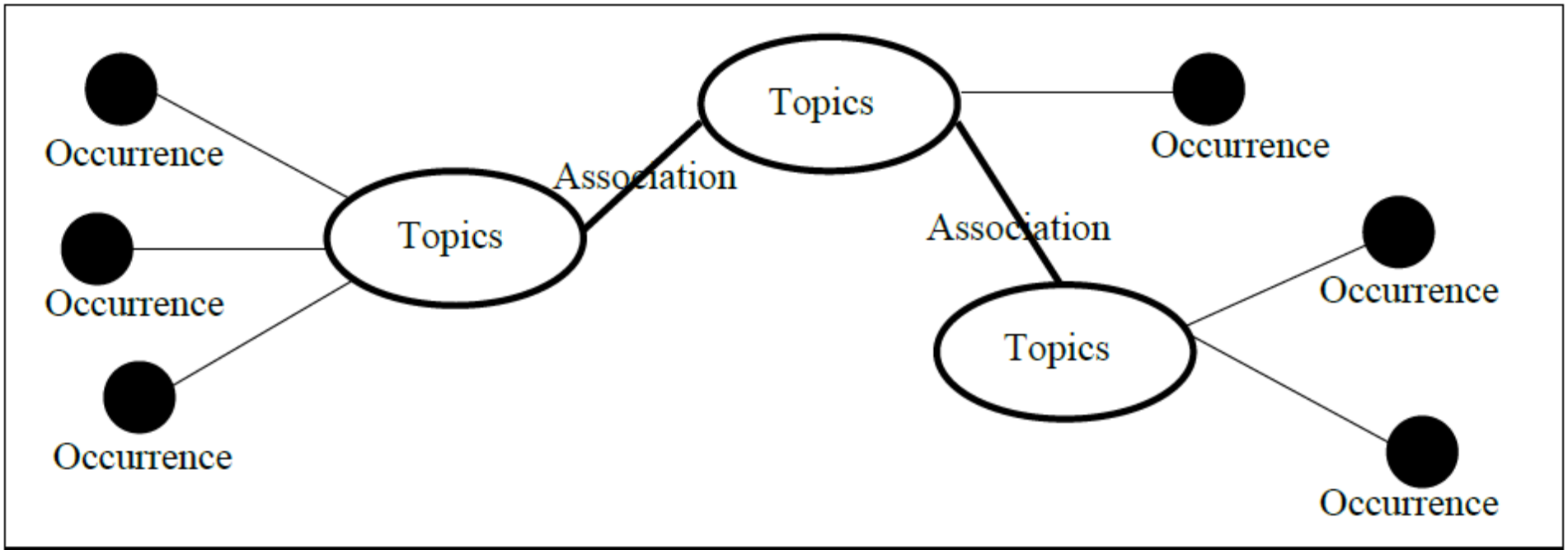


Figure 2. Topics, Associations, and Occurrences

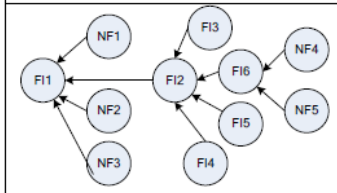
How to combine link analysis, topic maps and XLink?

- Combining the concept in *topic maps* and *link analysis*, the TLM framework can convert the elements in financial reports into decision oriented topics while the in-link, out-link or co-link features complement the association concept by specifying the direction of how the information is connected.

Table 1. Comparison of Link Analysis, Topic Maps, and XLink

	Link Analysis	Topic Maps	XLink
Objectives	Link type analysis	Represent Information	Create links within XML documents
Semantic Tool	No	XTM	XLink itself is a semantic tool, we use genericLink in the paper
Semantic Link	In-link Out-link Co-link	Association	arcrole from-to attributes
Network Resources	Node	Occurrence	Resource Location
Central point	Bridge and Hub	Topic	Role
Compatibility to XBRL	No	XML	Yes

A partial sample case (1)

Table 2. Link Hierarchy			
Level-0	Level-1	Level-2	Level-3
RelatedDisclosure_DealingWithShareholders (Topic, FI1)			
	Anti-Oxidation Market (NF1) Desulphurization Market (NF2) Note To Subsequent Events (NF3) Due From Shareholders (FI2)		
		Due To Shareholders (FI3) Payment To Shareholders (FI4) Proceeds From Shareholders (FI5) Loan To Related Parties (FI6)	
			Related Party Transactions Discussion (NF4) Note To Related Party Transaction (NF5)
FI: Financial NF: Non-financial			

A partial sample case (2)

- Define three Xlink:roleTypes: (TAO:topics, LinkAnalysis:hub/bridge)
  - RelatedDisclosure_DealingWithShareholders_HubExample
  - DueFromShareholder_BridgeExample
  - LoanToRelatedParties_Bridge
- Define three Xlink:arcroleTypes: (TAO:associations, LinkAnalysis:linkTypes)
  - additional-topic: provide additional info. to the topic info.
  - explanatory-topic: provide explanatory info. to the topic info.
  - supporting-topic : provide supporting info. to the topic info.

A partial sample case (3)

```
<link:linkbase xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:tlm="http://www.R-Firm.com/tlm"
xmlns:gen="http://xbrl.org/2008/generic" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:link="http://www.xbrl.org/2003/linkbase" xmlns="http://www.w3.org/1999/xhtml"
xsi:schemaLocation="http://www.R-Firm.com/tlm.xsd">
<link:roleRef roleURI="http://www.R-Firm.com/role/RelatedDisclosure_DealingWithShareholders"
xlink:href="tlm.xsd#RelatedDisclosure_DealingWithShareholders_HubExample" xlink:type="simple"/>

<link:roleRef roleURI="http://www.R-Firm.com/role/DueFromShareholder"
xlink:href="tlm.xsd#DueFromShareholder_BridgeExample" xlink:type="simple"/>
<link:roleRef roleURI="http://www.R-Firm.com/role/LoanToRelatedParties" xlink:href="tlm.xsd#
LoanToRelatedParties_Bridge" xlink:type="simple"/>
<link:arcroleRef xlink:type="simple" xlink:href="tlm.xsd#additional-topic" arcroleURI="http://www.R-
Firm.com/arcrole/additional-topic"/>

<link:arcroleRef xlink:type="simple" xlink:href="tlm.xsd#explanatory-topic" arcroleURI="http://www.R-
Firm.com/arcrole/explanatory-topic"/>

<link:arcroleRef xlink:type="simple" xlink:href="tlm.xsd#supporting-topic" arcroleURI="http://www.R-
Firm.com/arcrole/supporting-topic"/>
<tlm:topicLink xlink:type="extended" xlink:role="http://www.R-
Firm.com/role/RelatedDisclosure_DealingWithShareholders_HubExample"> <!-- Level-0 -->
```

Figure 4. Illustration of thIllustration of the Integration of Financial and Non-financial information using genericLink, TLM Linkbasee Integration of Financial and Non-financial information using genericLink, TLM Linkbase

A partial sample case (4)

```
<link:loc xlink:href="http://taxonomies.xbrl.us/us-gaap/2009/elts/us-gaap-2009-01-31.xsd#us-
gaap_ReceivableFromShareholdersOrAffiliatesForIssuanceOfCapitalStock" xlink:label="us-
gaap_ReceivableFromShareholdersOrAffiliatesForIssuanceOfCapitalStock"
xlink:title="ReceivableFromShareholdersOrAffiliatesForIssuanceOfCapitalStock" xlink:type="locator"/>
<link:loc xlink:href="R-Firm-20091231.xsd#R-Firm_Anti-OxidationMarket" xlink:label="Anti-OxidationMarket"
xlink:title="Anti-OxidationMarket" xlink:type="locator"/>
<gen:arc xlink:type="arc" xlink:arcrole="http://www.R-Firm.com/arcrole/explanatory-topic" xlink:from="Anti-OxidationMarket"
xlink:to="us-gaap_ReceivableFromShareholdersOrAffiliatesForIssuanceOfCapitalStock" order="1.0"/>
<link:loc xlink:href="R-Firm-20091231.xsd#R-Firm_DesulphurizationMarket" xlink:label="DesulphurizationMarket"
xlink:title="DesulphurizationMarket" xlink:type="locator"/>
<gen:arc xlink:type="arc" xlink:arcrole="http://www.R-Firm.com/arcrole/additional-topic" xlink:from="DesulphurizationMarket"
xlink:to="us-gaap_ReceivableFromShareholdersOrAffiliatesForIssuanceOfCapitalStock" order="2.0"/>
<link:loc xlink:href="R-Firm-20091231.xsd#us-gaap_ScheduleOfSubsequentEventsTextBlock" xlink:label="us-
gaap_ScheduleOfSubsequentEventsTextBlock" xlink:title="us-gaap_ScheduleOfSubsequentEventsTextBlock"
xlink:type="locator"/>
 <gen:arc xlink:type="arc" xlink:arcrole="http://www.R-Firm.com/arcrole/additional-topic" xlink:from="us-
gaap_ScheduleOfSubsequentEventsTextBlock" xlink:to=" us-
gaap_ReceivableFromShareholdersOrAffiliatesForIssuanceOfCapitalStock " order="3.0"/>
<link:loc xlink:href="R-Firm-20091231.xsd#R-Firm_DueFromShareholder" xlink:label="DueFromShareholder"
xlink:title="DueFromShareholder" xlink:type="locator"/>
 <gen:arc xlink:type="arc" xlink:arcrole="http://www.R-Firm.com/arcrole/supporting-topic" xlink:from="DueFromShareholder"
xlink:to="us-gaap_ReceivableFromShareholdersOrAffiliatesForIssuanceOfCapitalStock" order="4.0"/>
</tlm:topicLink> <!-- Level-1 -->
```

A partial sample case (5)

```
<xs:schema xmlns:xlink="http://www.w3.org/1999/xlink"http://www.w3.org/1999/xlink""
xmlns:xs="http://www.w3.org/2001/XMLSchema"http://www.w3.org/2001/XMLSchema""
xmlns:gen="http://xbrl.org/2008/generic"http://xbrl.org/2008/generic" xmlns:tlm="http://www.R-Firm.com/tlm"
xmlns:xl="http://www.xbrl.org/2003/XLink" xmlns:link="http://www.xbrl.org/2003/linkbase"
targetNamespace="http://www.R-Firm.com/tlm" attributeFormDefault="unqualified" elementFormDefault="qualified">
<xs:annotation>
<xs:appinfo>
<link:roleType roleURI="http://www.R-Firm.com/role/RelatedDisclosure_DealingWithShareholders"
id="RelatedDisclosure_DealingWithShareholders_HubExample">

<link:definition> Define a financial element as a topic (a hub node). </link:definition>

<link:usedOn>gen:link</link:usedOn>

</link:roleType>

<link:roleType roleURI="http://www.R-Firm.com/role/DueFromShareholder" id="DueFromShareholder_BridgeExample">
<link:definition> Define a financial element as a bridge node. </link:definition>
<link:usedOn>gen:link</link:usedOn>
</link:roleType>
<link:roleType roleURI="http://www.R-Firm.com/role/LoanToRelatedParties" id=" LoanToRelatedParties_Bridge">
<link:definition> Define a financial element as a second bridge node. </link:definition>
<link:usedOn>gen:link</link:usedOn>
</link:roleType>
```

A partial sample case (6)

```
<link:arcroleType arcroleURI="http://www.R-Firm.com/arcrole/additional-topic" cyclesAllowed="any" id="additional-topic">

<link:definition> An additional item to a topic. </link:definition>

<link:usedOn> gen:arc </link:usedOn>

</link:arcroleType>

<link:arcroleType arcroleURI="http://www.R-Firm.com/arcrole/explanatory-topic" cyclesAllowed="any" id="explanatory-topic">

<link:definition> An explanatory item to a topic. </link:definition>

<link:usedOn> gen:arc </link:usedOn>

</link:arcroleType>

<link:arcroleType arcroleURI="http://www.R-Firm.com/arcrole/supporting-topic" cyclesAllowed="any" id="supporting-topic">

<link:definition> An supporting item to a topic. </link:definition>

<link:usedOn> gen:arc </link:usedOn>

</link:arcroleType>
</xs:appinfo>
</xs:annotation>
```

A partial sample case (7)

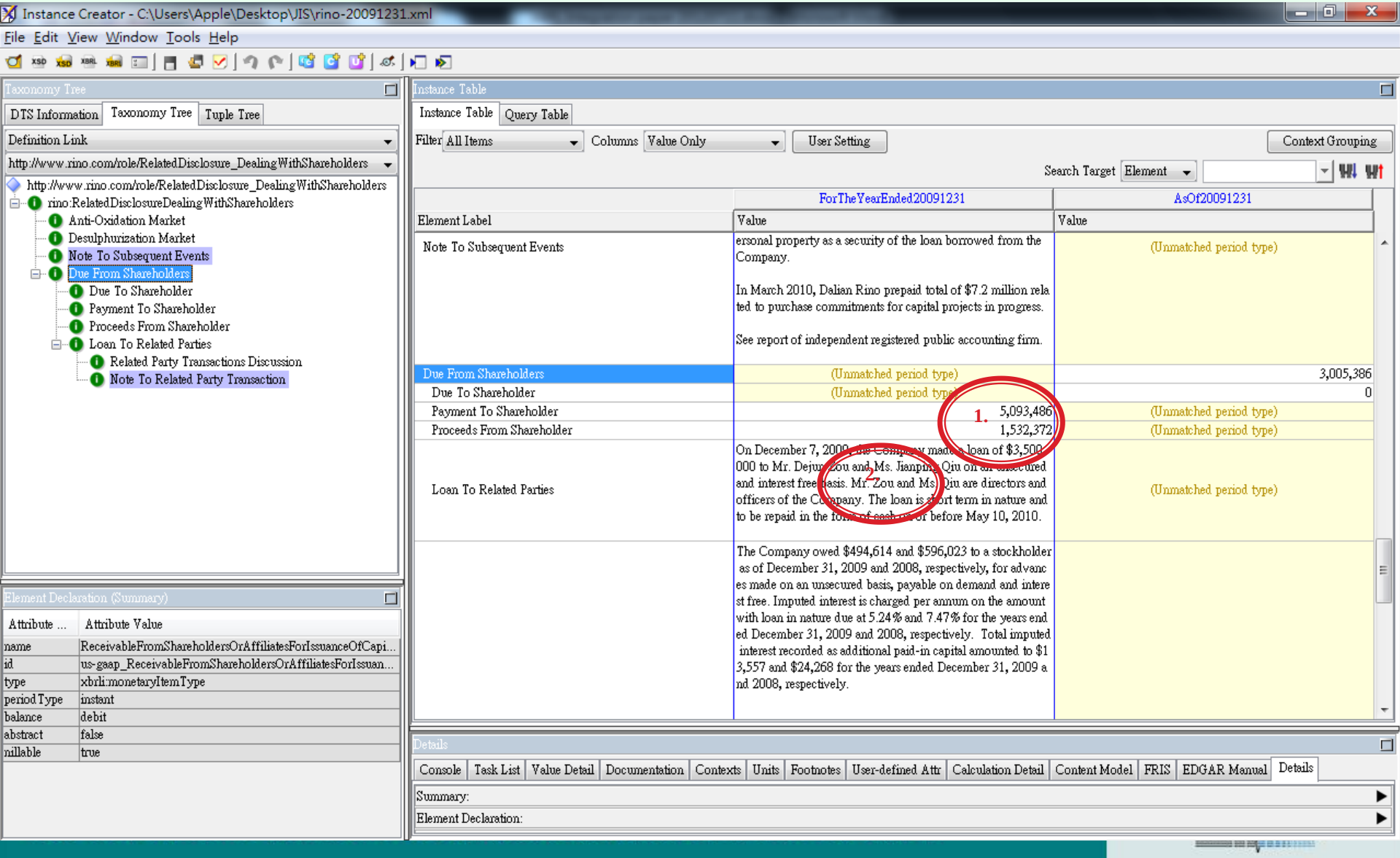
```
<xs:import namespace=http://www.w3.org/1999/xlink" schemaLocation="http://www.xbrl.org/2003/xlink-2003-12-31.xsd"/>
<xs:import namespace="http://www.xbrl.org/2003/XLink" schemaLocation="http://www.xbrl.org/2003/xl-2003-12-31.xsd"/>
<xs:import namespace="http://www.xbrl.org/2003/linkbase" schemaLocation="http://www.xbrl.org/2003/xbrl-linkbase-2003-12-
31.xsd"/>
<xs:import namespace="http://xbrl.org/2008/generic" schemaLocation="http://www.xbrl.org/2008/generic-link.xsd"/>
<xs:element name=="topicLink" substitutionGroup="xl:extended">
<xs:complexType>
<xs:complexContent>
<xs:restriction base base=="xl:extendedType">
<xs:choice maxOccurs="unbounded" minOccurs="0">
<xs:element ref="xl:documentation"/>

<xs:element ref="link:loc"/>

<xs:element ref="gen:arc"/>
</xs:choice>
<xs:attribute fixed="extended" use=="required" ref="xlink:type"/>
<xs:attribute use="required" ref="xlink:role"/>
<xs:attribute use="optional" ref="xlink:title"/>
<xs:attribute name="id" use="optional" type="xs:ID"/>
<xs:anyAttribute namespace="http://www.w3.org/XML/1998/namespace" processContents="lax"/>
</xs:restriction>
</xs:complexContent> </xs:complexType> </xs:element> </xs:schema>
```

Figure 5. Illustration of the Integration of Financial and Non-financial information using genericLink, TLM Schema

XWand sample demo - Firm R



An evaluation – experiment design (1)

- Scenario
  - Firm R : 2009 / 2008 10-K report and MD&A
  - critical problems about the firm's data: (1) revenue sources: some of the revenues are fictitious, (2) tax related information: does not have income taxes and the value income taxes do not match sales revenues, and (3) due to shareholders: the amount is inconsistent by calculating from different information sources in the financial reports.

An evaluation – experiment design (2)

- Experiment Design
  - Single-factor / between-subject
  - Subjects: 44 senior accounting major students from the same university and all have the education background of financial statement analysis, XBRL and XWand tool
  - One experiment group (TLM-based XBRL info.) / one control group (XBRL info. w/o TLM)
  - A pilot test was administered to ensure the contents and the XWand tools were understandable and free of errors.
  - Problems assigned: 7 different problems (46 questions) related to the three aspects (revenues, tax, and due to shareholders)

An evaluation – experiment design (3)

- Results
  - 5 subjects do not complete the problems: eliminated, left 20 for experiment group / 19 for control group
  - Total time spent:
    - experiment group: 44.2 mins / control group: 57.7 min
  - Decision making ability (locating and identifying the relevant and correct information for decision making):
    - experiment group: 83.5% / control group: 53.2%

Conclusions

- We prove once again a good mechanism of information combination could dramatically enhance the usage of hard-to-understand, over-sized financial report.
- Our proposed methodology indicates, given the current technologies, firms should be responsible to link topic-related XBRL elements. However, current use of XBRL is not on the direction.
- We also prove XBRL linkbases can be used to create useful semantic links among associated elements.

Extensions – what we do not do for now

- The potentials of link analysis for XBRL info. is worth noting: (e.g. linkbase query)
  - e.g. “SELECT elements FROM Role=’some Hubs/Bridges’ WHERE Arcrole=’[additional-topic / explanatory-topic / supporting-topic]’ [AND/OR] [From=’some node’] [AND/OR] [To=’some node’]
- The possibility of connecting XBRL to semantic technology
  - RDF, RDFS, SPARQL
  - SKOS (UF, BT, NT, RT, lexical labels): e.g. US-GAAP-SKOS
  - OWL: e.g. the work of Roberto García and Rosa Gil
    - http://rhizomik.net/html/ontologies/bizontos/