Departamento de Economía Financiera y Contabilidad I

Improving the comparability of Financial Statements in a changeable context: a Semantic Web-based approach.

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Acknowledgements

In memory of my mother

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0. Resumen

A continuación se incluye un resumen suficiente en castellano del presente trabajo y que consta de las siguientes partes:

I. Antecedentes.
II. Objetivo.
III. Metodología.
IV. Conclusiones

I. Antecedentes

En el mundo actual en el que la información está convirtiéndose en una carga para los seres humanos, la gestión eficiente de la misma es un objetivo primordial. Internet tal y como lo conocemos actualmente es un éxito indiscutible a nivel global. Los flujos de información que se intercambian crecen muy rápidamente. Asimismo, el número de usuarios y la cantidad de contenidos crece sin límite de una manera cada vez más rápida. Todo esto viene acompañado de un incremento igualmente significativo de dispositivos electrónicos conectados a Internet. Son las nuevas tecnologías las que están modificando la forma en la que nos relacionamos con la Red.

Así, Internet puede llegar a ser, sino lo es ya, el instrumento económico fundamental en un futuro próximo. Las empresas dependen ampliamente y cada vez más de Internet, al igual que los consumidores. Internet está cambiando la forma en la que las empresas se relacionan con los clientes, proveedores, socios, inversores e instituciones. La Red (o la Web) es universalmente aceptada por cualquiera, en cualquier sitio, dentro y fuera de las empresas emisoras de la información financiera (Quetglás 2006).

Por ello, el éxito de las empresas vendrá principalmente determinado por las metodologías y soluciones digitales que estas adopten.

Por otro lado, a nivel mundial, el mundo de los negocios exige cada vez más información de los sistemas contables. Así, tanto inversores, como acreedores y demás

partes interesadas, demandan cada vez más información y no sólo de carácter financiero (Bonsón 2001b).

Los mercados de capitales más avanzados son los que han provocado inicialmente esta revolución de la información. Los usuarios de dichos mercados, cada vez más exigentes y competitivos, demandan una información hecha a su medida: información personalizada y descriptiva, acorde con las necesidades de cada momento y que, gracias a su versatilidad, pueda ser integrada por diferentes soluciones informáticas, software y bases de datos.

Es importante conocer cuál es la actual situación normativa a nivel internacional en el área de la contabilidad para poder comprender mejor a qué se enfrentan actualmente las empresas emisoras de la información contable. Por eso, esta tesis recoge, entre otros aspectos, un estudio amplio acerca de cuál es esta situación, haciendo especial hincapié en Estados Unidos y Europa y, dentro de esta última, más concretamente en España. Atendiendo a la evolución normativa a ambos lados del Océano Atlántico, se hace imprescindible hablar del *proceso de convergencia* iniciado por los cuerpos regulatorios contables estadounidense y europeo: el *Federal Accounting Standars Board* (FASB) y el *International Accounting Standards Board* (IASB). Dicho proceso de convergencia, que es analizado con cierto grado de profundidad en esta tesis, tiene como origen y justificación el acercamiento o armonización de los principios contables a nivel internacional, con una finalidad clara de mejorar la comparabilidad de los estados financieros a nivel mundial. Sin embargo, y tal y como se discute con posterioridad, este proceso escapa a aspectos puramente contables, provocando que el mismo tenga por delante un horizonte de indefinición en cuanto a su desarrollo temporal y en cuanto al grado de convergencia a conseguir.

De este proceso de convergencia solamente puede afirmarse con total rotundidad, que se trata de un proceso complejo, que va a alargarse en el medio y largo plazo y que esto va a provocar un futuro con los mayores cambios que hayan tenido que afrontar las empresas nunca antes: tanto por la profundidad de los cambios, como por la cantidad de los mismos. Además, podemos afirmar, tal y como se demuestra en el desarrollo informático contenido en esta tesis, que las regulaciones tendentes a uniformar criterios

para la elaboración de los estados financieros, por diversidad de motivos, en algún caso, producen el efecto contrario, esto es, reducen la comparabilidad. Este es uno de los motivos que justifica el presente trabajo, ya que tal y como se explica más adelante, se ofrece una solución que permite mejorar la comparabilidad de los estados financieros y, por lo tanto, mejora el proceso de toma de decisiones, incluso en un entorno regulatorio tan cambiante como el descrito.

Pero si bien este aspecto regulatorio determinante, explica en gran parte la problemática que merma la comparabilidad de los estados financieros, no es menos importante analizar, tal y como también se recoge en el presente trabajo, la evolución de las tecnologías de la información en el campo de la contabilidad. Es decir, no sólo es importante hablar del fondo o contenido de los estados financieros, sino también de la forma en que los mismos son presentados, dados los importantes cambios que se han producido en este área en los últimos años. Es de hecho este campo, el del nuevo formato electrónico de presentación de los estados financieros, el argumento principal de discusión en esta tesis.

En este sentido, es importante insistir en el desarrollo de las tecnologías de la información producido en los últimos años, que han permitido alcanzar una utilización de Internet nunca antes conocida. Dentro del mundo de los negocios, Internet desde sus primeros inicios se convirtió rápidamente en la herramienta preferida por las empresas para la divulgación de sus estados financieros por razones de coste, eficiencia y audiencia. La disparidad inicial existente tanto en la forma como en los contenidos incluidos en los primeros estados contables divulgados a través de este medio, dejaron ver rápidamente la imperiosa necesidad de uniformar criterios que permitieran un uso más eficiente de estos estados contables, a través de la creación de un lenguaje único, un estándar, que permitiera expresar la información financiera de cualquier empresa, independientemente del lugar, normas contables y lenguaje utilizados en su elaboración.

Es en este contexto de uso masivo de Internet, junto con la globalización de la economía impulsada inicialmente por la demanda de los mercados de capitales más desarrollados, y en el que las fronteras nacionales más propias de la era industrial del siglo pasado, dejan paso a un punto de vista global más acorde con las nuevas necesidades

empresariales, donde surge el estándar XBRL (eXtensible Busines Reporting Language) como respuesta.

Este estándar, basado en XML (eXtensible Markup Language), es analizado en la sección 4.1. del presente trabajo, con la intención de acercar esta tecnología a los contables, aunque sin entrar en un estudio exhaustivo que poco aportaría al propósito perseguido, pero con la suficiente profundidad como para permitir comprender al lector cuál es su funcionamiento, y tal y como se expone más adelante, cuáles son algunas de sus limitaciones.

El XBRL ha sido adoptado ya en gran parte de las economías occidentales y en algunas de las orientales más avanzadas. Tras esta implantación mundial irregular que sigue actualmente en proceso, podemos afirmar sin discusión que nos encontramos ante el estándar financiero más utilizado de principios del siglo XXI, que se ha convertido en una nueva manera de transmitir información financiera a nivel mundial y que permite un mejor aprovechamiento y automatización de la misma.

Este lenguaje ha sido desarrollado para transmitir de forma electrónica la información financiera contenida en los estados financieros de las empresas y tiene una clara vocación de flexibilidad, que le permite ser utilizado por cualquier empresa, en cualquier lengua y con cualesquiera principios contables. Sin embargo, ha dejado ver ya algunas de sus debilidades "de facto", que si bien no se derivan de fallos en su construcción, ya que su propia estructura está orientada hacia la máxima flexibilidad posible, como ya se ha dicho anteriormente, si pueden ser parcialmente achacadas a las rigideces propias de las tecnologías en las que se basa, especialmente el XML.

Una vez explicada la importancia del XBRL y sus limitaciones, es necesario hablar de la actual evolución de la Web, la cual está mejorando las posibilidades de manejo automatizado de la información que contiene. Debido al enorme volumen de información que contiene la Web, hecho que se erige como su principal ventaja sin duda, pero cuyo imparable crecimiento se convierte, a su vez, en el principal problema, actualmente se están desarrollando nuevas tecnologías que permitan minimizarlo o incluso eliminarlo. Desde un punto de vista humano, el manejo de la cantidad cada vez

más inabarcable de información por su propio volumen, así como por su presentación y acceso, deviene en el principal problema para su gestión eficiente.

Por ello, en los últimos años se han desarrollado herramientas que permiten un tratamiento más automatizado de dicha información a través de las tecnologías contenidas en lo que se ha venido a llamar Web Semántica o Web 3.0 (ver sección 5.1. What is the Semantic Web and brief history.). Dicha Web Semántica, que es una extensión de la Web que conocemos hoy en día (Web 2.0), incorpora *metadatos* a la información publicada "online", es decir, datos sólo legibles por las máquinas acerca de los datos legibles por los humanos, los cuáles aportan "pistas" a las máquinas para que éstas sean capaces de interpretarlos de forma correcta y, por lo tanto, puedan manejarlos convenientemente, incluso llegando a ser capaces de inferir nuevo conocimiento.

II. Objetivo

A la vista de la falta de comparabilidad entre los estados financieros emitidos por las empresas, en los diferentes países, el objetivo principal que nos hemos planteado en la presente tesis es lograr una mejora de dicha comparabilidad, actualmente mermada por la utilización de diferentes normas y criterios contables. Para ello, proponemos un acercamiento de conocimientos de las áreas de contabilidad e informática, ya que hemos evidenciado la enorme importancia e influencia recientemente adquirida por la informática dentro del campo de la contabilidad, derivada por el nuevo modo de transmisión electrónica de la información financiera. En este sentido, ambas áreas vienen desarrollando una estrecha colaboración en las últimas décadas, que ha mejorado, de manera significativa, la administración de la información contenida en los sistemas de información contable. Pero es ahora, con la implantación internacional del estándar XBRL, cuando ambos conocimientos quedan inexorable y profundamente ligados.

En este sentido, para lograr el objetivo propuesto, hemos diseñado una herramienta informática que permite detectar y explicar las igualdades y las diferencias, tanto terminológicas como numéricas, entre balances de situación elaborados con distintos criterios contables, mejorando así la comparabilidad de los mismos.

III. Metodología

Para llevar a cabo el desarrollo informático, hemos trabajado con los balances consolidados de los ejercicios 2009[1] y 2008 de la empresa Telefónica S.A. que es de las pocas empresas españolas que presenta sus estados financieros ante la Comisión del Mercado de Valores de los Estados Unidos (US SEC) y ante la Comisión Nacional del Mercado de Valores española (CNMV). Al ser un grupo de empresas que cotiza en Bolsa está obligado desde el año 2005[2] a elaborar sus cuentas siguiendo los International Financial Reporting Standards (IFRS). Por otro lado, la U.S. SEC permite, desde el año 2007, y hasta la fecha, presentar a las empresas extranjeras sus estados contables, siempre y cuando estos hayan sido elaborados de acuerdo con los mencionados IFRS. Por lo tanto, estos balances consolidados, tanto el presentado ante la CNMV, como el presentado ante la U.S. SEC, han sido elaborados siguiendo en ambos casos los estándares dictados por el IASB. Por lo tanto, ambos balances deberían ser muy similares, sino idénticos. Sin embargo esto no es así. Tal y como se analiza en la sección 6.2. Data analysis del presente trabajo, diferencias en los niveles de desagregación y en las denominaciones de las diferentes partidas, hace que la comparabilidad se vea mermada de manera significativa.

Por otro lado, el balance enviado por Teléfonica S.A. a la CNMV está en formato XBRL, sin embargo, el balance enviado a la U.S. SEC no, ya que esta Comisión aún no permite el formato XBRL para empresas extranjeras. Es importante destacar que probablemente esta situación se modifique en un futuro cercano, tal y como se puede desprender de las informaciones divulgadas a través de la propia página web de esta Comisión[3].

Por ello, hemos procedido a generar manualmente el balance consolidado enviado por Telefónica a la US SEC en formato XBRL, utilizando para ello la nueva terminología incluida en la taxonomía publicada en el año 2011 por el IASB, de manera que se

[1] A la fecha de elaboración de este trabajo estas eran las cuentas disponibles en la web de la Comisión Nacional del Mercado de Valores. Más información en http://www.cnmv.es

[2] Esta Norma (NIC 27) revisada sustituye a la NIC 27 (revisada en 2000) Estados financieros consolidados y contabilización de las inversiones en dependientes, y se aplicará en los ejercicios anuales que comiencen a partir del 1de enero de 2005.

[3] Más información en http://www.sec.gov/

obtiene el balance consolidado que Telefónica hubiera enviado a la US SEC en formato XBRL, en el supuesto de que dicho formato fuera admitido.

Además de la falta de comparabilidad debida al diferente nivel de desagregación entre ambos balances mencionada previamente, hay que resaltar que la nueva taxonomía de XBRL publicada por el IASB, incluye una nueva terminología de las partidas del balance, que difiere de la utilizada por la taxonomía de la CNMV, lo cual perjudica aún más dicha comparabilidad. Ambos balances y sus diferencias se explican en profundidad en la sección 6.2. Data analysis.

Una vez que ambos balances están escritos en el formato XBRL (XML), se procede a su transformación o traducción al Resource Data Format (RDF, ver sección 5.2.1. Components of the Semantic Web), base de la tecnología utilizada en la Web Semántica. Este formato describe cada elemento o partida del balance como un *triple*: así por ejemplo, el elemento "Caja" quedaría definido con un *sujeto* (Caja), un *predicado* (2.000 €) y una *relación* (es igual a) que une ambos elementos. Cada elemento se define por sí mismo y por su relación con los elementos restantes. De esta manera, una vez hemos traducido ambos documentos XBRL a formato RDF (proceso que se explica en la sección 6.3. Methodology), es posible definir mediante el Ontology Web Language (OWL, ver sección 5.2.1. Components of the Semantic Web) la correspondiente ontología que establece el tipo de relación existente entre los diferentes elementos de ambos balances.

A modo de ejemplo, en la ontología se define que la partida de *Activo no corriente* (`ipp-gen: ActivoNoCorrienteNiif,`) correspondiente al balance presentado a la CNMV, sea igual a la partida *Non-current assets* (`ifrs:NoncurrentAssets`) correspondiente al balance presentado por Telefónica ante la U.S. SEC, de acuerdo a la nueva nomenclatura que se introduce en la taxonomía publicada por el IASB en el año 2011. Esta equivalencia escrita en código máquina quedaría expresada de la siguiente manera:

```
ipp-gen:ActivoNoCorrienteNiif
owl:equivalentClass
ifrs:NoncurrentAssets
```

Del mismo modo se establecen las relaciones de equivalencia para todos los elementos del balance, obteniendo así una herramienta que de manera inmediata, nos advierte de las diferencias entre uno y otro balance y, cuando es posible, nos indica a qué se deben esas diferencias. O dicho de otra manera, sería posible construir el balance presentado ante la US SEC a partir de los datos del balance presentado ante la CNMV. Disminuimos así la falta de comparabilidad entre ambos balances debida al diferente nivel de desagregación y a las diferencias terminológicas. Por último, cabe señalar que no todas las diferencias existentes entre los dos balances pueden ser detectadas y explicadas por el desarrollo informático que se propone en este trabajo, como es el caso de los impuestos, cuya desagregación difiere entre ambos balances. La información que se encuentra disponible en la memoria referente a los mismos, no arroja suficiente luz como para poder establecer las posibles relaciones existentes entre los dos balances de situación.

IV. Conclusiones

Las conclusiones a las que llegamos con el presente trabajo se describen a continuación:

I. La comparabilidad de los estados contables se ve reducida no sólo por la utilización de diferentes criterios contables, sino también como consecuencia del actual proceso de convergencia desarrollado por el IASB y el FASB, del que hemos podido comprobar que todavía está lejos de alcanzar la deseada convergencia y del que podemos afirmar se extenderá en el medio y largo plazo.
II. Se ha producido un cambio de máxima importancia en la manera en la que se transmite la información contable: del tradicional formato en papel vigente durante siglos, se ha pasado a la utilización de medios electrónicos, siendo XBRL el estándar de referencia e Internet el medio utilizado para dicha transmisión. Las consecuencias derivadas de este cambio son difíciles de predecir, puesto que se trata de un cambio reciente.
III. La informática permite mejorar la comparabilidad deteriorada de la información financiera mediante el uso de tecnologías propias de la Web Semántica, desarrolladas para mejorar la gestión de la información, una vez que la información financiera se encuentra expresada en XBRL.

IV. Es por ello deseable un acercamiento mayor de las áreas de contabilidad e informática que permita resolver, no sólo el problema de la comparabilidad de la información financiera, sino también mejorar otros aspectos como su reutilización y análisis, de manera tal que se pueda mejorar el proceso de toma de decisiones.

V. Gracias a la solución alcanzada con la utilización de la informática, no sería necesario que el proceso de convergencia se desarrollara hasta el máximo nivel de detalle. De esta manera este proceso se relajaría, permitiendo la coexistencia de criterios contables diferentes, en la que las divergencias quedarían identificadas en las correspondientes ontologías de forma que los datos seguirían siendo comparables. Además se podría optar por la mejor solución entre las posibles alternativas existentes para un mismo hecho económico, si se considerara necesario. En este mismo sentido, pensamos que a nivel normativo, se podría plantear una estructura en la que en un primer peldaño se situaría una organización contable internacional, como pueda ser el IASB, la cual establecería unos principios mínimos contables comunes a todos los países. En un peldaño posterior, los países (y/o agrupaciones de los mismos) tendrían un cierto margen de maniobra para poder establecer unos principios contables más detallados que, tomando como base y respetando los principios contables internacionales, desarrollarán de manera más precisa y particular la aplicación de los mismos, definiendo en ese mismo momento las correspondientes relaciones de los elementos patrimoniales y partidas contables de manera exhaustiva para su posterior utilización en la definición de ontologías que relacionarían, vía identificación de las diferencias, los diversos sistemas contables de una manera precisa y automatizada.

A modo de recapitulación podemos afirmar que dentro del campo de la contabilidad tanto el presente como el futuro son y se adivinan muy cambiantes. No sólo por la profundidad de los cambios, sino también por la frecuencia de los mismos, incrementada esta de manera importante.

Abstract

Accounting at the international level has become more changeable than never before due to several reasons, but one stands above the others: the convergence process carried out by the International Accounting Standards Board (IASB) and the Federal Accounting Standards Board (FASB). This process started in order to enhance the comparability of the financial statements worldwide, among other purposes, but also brought complexity and uncertainty about the temporal horizon and the degree of convergence that will be finally achieved. The only certainty that can be said about this process is that it will elongate throughout the following years and, due to its own complexity, the impairment of the comparability of the financial statements becomes a reality, as a non-desired effect.

In the mean time, the advances achieved in the implementation of the electronic standard eXtensible Business Report Language (XBRL) bring to this context new possibilities, not yet foreseen to manage the financial information more efficiently, improving the decision-making process. Taking advantage from the fact that the financial statements are now written in this standard (XBRL), and applying technologies recently developed in the context of the Semantic Web, the present work proposes a new semantic-web-based approach that tries to overcome the limitations imposed by the changeable accounting regulation framework and its derived comparability impairments.

Starting from XBRL statements (XML documents), the information is translated into RDF, so ontologies can be defined upon that information, taking advantage from the characteristics of Semantic Web technologies and over passing the limitations due to XBRL's underlying ones, more specifically those due to the fact it is based on XML.

KEY WORDS

Financial statements comparability, XBRL, Ontologies, Semantic Web, RDF, interactive data, IFRS, US GAAP, US SEC, accounting.

Introduction

The main contribution of this thesis is the improvement of the comparability of the financial information in XBRL format based on similar but not identical accounting principles, partially impaired due to the current complex process of convergence carried out by the International Accounting Standards Board and the Federal Accounting Standards Boards, using technologies of the Semantic Web, thus enhancing its ulterior analysis.

I. Businesses and the Internet

In a world where the information is becoming a hurdle for human beings, its efficient management is becoming primary. Internet as we know it today is an outstanding success. The growth of the information exchanged between users increases rapidly. The number of users and the amount of content is growing faster and faster. Nowadays, the number of electronic devices with Internet connectivity increases rapidly. New technologies are changing the way we use the Net.

Internet has become a fundamental economic instrument. Businesses will widely depend on the Internet, as consumers will do. The Internet is changing the way businesses interact with their customers, providers, stockholders, investors and institutions. Besides, the Web[4] is accepted worldwide by everyone, everywhere, inside and outside the information issuing organizations (Quetglás 2006).

Businesses success is going to be highly determined by the digital methods and solutions in the following years. Globally, the business environment is pulling the information demand from the accounting information systems. External interest groups (investors, creditors, social agents, etc.) demand more and not only financial information (Bonsón 2001b).

Financial markets have triggered this information revolution. Increasingly demanding and competitive, financial market users require that the information provided is tailored

[4] Web meaning World Wide Web (WWW) as a collection of interconnected documents and other resources linked by hyperlinks and Uniform Resource Locators (URLs). It is a part of the Internet which is a global data communication infrastructure (hardware and software).

to their needs, i.e. customized and descriptive, so that it can be used by different software and integrated into different databases.

In order to face this new requirements and profiting from the wide adoption of the Internet, together with the increasing demand mentioned before, businesses use the Web to distribute their financial information (Debreceny, Gray et al. 2002).

Despite of the advances, it is obvious that in the Web, the process of report exchange is still emulating to a great extent the traditional paper lay-out. Therefore, working with text processors, spreadsheets, PDFs, etc, has been the common procedure. The possibilities and potential of the information systems are not fully exploited, as the different report formats do not facilitate the integration of the information (Alexiev, Fensel et al. 2005). Available financial information is getting bigger and dispersed, thus the need to systematize and gather it is becoming essential.

Besides, some authors demonstrated the crisis of the traditional financial reporting systems (Elliott, Jacobson 1991), (Wallman 1995). Since late eighties, a variety of reports from different environments confirm the weaknesses of the current financial reporting model due to two primary reasons:

- the contents of the reports (based on an industrial era more than in a services and information technologies one) as pointed out by Giner. The shortage of information in the current model, concerning important aspects that are crucial to understand companies' risks and potentials, such as environmental issues and intangible assets as intellectual capital, structural capital, relational capital, etc. (Giner, Larran 2002).
- The way the enterprises communicate the information to their external users using the paper format. Advantages obtained through the electronic means are deeply explained in this paper compared to the traditional paper format.

In addition, it has been reported the idea that the relevance or informative value of the accounting information systems has been clearly affected, diminishing in the last 50 years. This relevance decreases more significantly in highly technical companies, as

indicated by Gallego (Gallego 2009). These two mentioned primary reasons mainly affect the relevance of the financial information.

Additionally, and due to the following facts:

- the format of the digital documents has diverged with the lack of a standard and,
- the necessity to improve the contents and communication of the financial reports;

two initiatives held by the *American Institute of Certified Public Accountants* (AICPA) must be highlighted:

- The first one is the *Special Committee on Enhanced Business Reporting* (SCEBR) as investors, creditors, managers, regulators and other stakeholders' consortium, created in 2002.
- The second one is the project for the development of the standard *eXtensible Business Report Language* (XBRL), initially named as *eXtensible Financial Reporting Markup Language* (XFRML) created in 1998 by Charles Hoffman and adopted later by the AICPA.

The purpose of the SCEBR "is a collaborative, market-driven initiative that provides an opportunity for users and providers of capital to work together for the public interest to improve the quality of information provided to capital markets. The Consortium works to promote greater transparency by developing an internationally recognized, voluntary framework for presentation and disclosure of value drivers, non-financial performance measures and qualitative information"[5].

The aim of XBRL is to provide users with the breadth of information they require, at the speed they need, to be successful in today's economy. XBRL will be deeply explained in chapter three, but in order to help readers to briefly understand what XBRL is, these are some of its key characteristics:

[5] http://www.aicpa.org/InterestAreas/AccountingAndAuditing/Resources/EBR/Pages/EnhancedBusinessReportingConsortium.aspx

- XBRL allows generating files automatically with relevant information, understood by the machines as intermediaries in the information supply chain.
- XBRL is an automated way for the financial information exchange, which saves time and avoids errors, facilitating the data analysis.

XBRL is the language for the electronic communication of financial and commercial data. The idea behind XBRL is simple. Instead of processing the financial information as a text block – as in a standard web page in the Internet or in a printed document – XBRL provides to each individual element of information with a label, which identifies it. This label is readable by the machine, e.g., the Net Income of one enterprise has a unique and own label.

Thereby, using the Internet as the distribution channel of information, and XBRL as the means for this distribution, the improvements in the quality of the delivered information to the stakeholders, are warranted through the increase of the frequency and the speed it is produced, delivered and analysed (Martins 2007), thus adding value to that information.

Nevertheless, XBRL has already shown some limitations:

- "First, the (…) taxonomy (see section 3.2.2. taxonomy) should include validations that involve the evaluation of information items in different contexts. However, the current XBRL specification does not allow for this kind of validation, and calculation links are defined between information items independently of their context (see section 3.2.2.2.2.2. Calculation linkbase): a calculation link for a given context (one specific company and one determined period) may be not valid for another context, which makes the calculation link not reusable.

- Second, XBRL calculation links only allow for the summation of items. However, there are analytical values, whose calculations from descriptive values are more complex, involving the use of other mathematical operators" (Lara, Cantador et al. 2006). This situation has partially been solved through the FORMULAE[6] extension.

[6] More info in www.eurofiling.info/data/presentations/9Workshop/VMorillaFormulaeBdE.ppt

This extension permits programmers to include any mathematical calculation. Although this extension has shown its stability and validity, it is still narrowly applied. Besides, it only permits calculations in one taxonomy at a time, not permitting sophisticated calculations among different taxonomies.

- Third, differences in assessments and accounting practices among different countries set an obstacle for comparing the financial statements internationally. Diverse social, economic and environmental factors and their influence in the accounting practices must be taken into account (Lainez 2006). So the definition of the concepts in the reports may differ from one country to another, and even within the same country, the definition of the same concept in the report may differ from one enterprise to another: this fact reduces dramatically the comparability of the information. Moreover, XBRL does not provide the mechanism that might facilitate stating equivalences or divergences among terms from different accounting practices (or taxonomies). Consequently, it does not provide with features that facilitate sharing these relations among accounting terms.

- Fourth, and as demonstrated in this thesis, the same concept is differently defined within the same company and in the same period for filing purposes.

- Fifth, different XBRL jurisdictions have developed different taxonomies as their standards of financial data. These taxonomies are heterogeneous, so do the corresponding instance documents (see section 3.2.3. Instance document) and the internal systems where data are stored. Therefore, there are still important handicaps to create and use different instance documents related to various taxonomies. Furthermore, as discussed in the following sections, new regulations introduced in order to enhance the information comparability, among other aims, result in temporary comparability impairment as an unexpected effect.

These XBRL limitations can be overcome using Semantic Web technologies as explained later, but next, an explanation of the current international regulation framework to later focus on Europe and Spain. It will help the reader to better

understand the influence of both, the new technologies and the countries accounting regulations, in the comparability of the financial information.

II. Current international accounting regulation framework overview

The *Financial Accounting Standards Board*[7] (FASB) and the *International Accounting Standards Board*[8] (IASB), in consultation with other national and regional bodies, issued in London, United Kingdom, October 29, 2002 a Memorandum of Understanding (MoU) setting an important significant step toward formalizing their commitment to the *convergence* of U.S. and international accounting standards. Therefore, the main aim is to eliminate the differences between *International Financial Reporting Standards* (IFRS) set by the IASB and U.S. GAAP set by the FASB, as the current focus of the financial information standardisation efforts is on comparability, despite the economic industrial sector and nationality of the business.

In the short term, the *convergence process* will require from both boards to channel their best efforts to propose changes to both sets of standards to solve identified differences. The commitment by both Boards to eliminate or reduce remaining differences through continued progress on joint projects and coordination of future work programs, will improve comparability of financial statements across national jurisdictions.

This decision was embodied in the MoU between the boards known as the Norwalk Agreement. The boards' goal was further strengthened in 2006 when the IASB and FASB set specific milestones to be reached by 2008 (a roadmap for convergence 2006 - 2008).

In 2007, and considering the progress achieved by the boards and other factors, the US Securities and Exchange Commission[9] (U.S. SEC) removed the requirement for non-U.S. companies registered in the United States to reconcile their financial reports with

[7] http://www.ifrs.org/Home.htm
[8] http://www.fasb.org/home
[9] http://www.sec.gov/

U.S. GAAP if their accounts complied with IFRSs as issued by the IASB. At the same time, the U.S. SEC also published a proposed roadmap for the adoption of IFRSs for domestic U.S. companies addressing six key areas:

1. Sufficient development and application of IFRS for the U.S. domestic reporting system;
2. Standard setting independence for the benefit of investors;
3. IFRS investor's knowledge;
4. Analysis of the U.S. regulatory environment that would be affected by a change in accounting standards;
5. The impact on issuers, both large and small, of the adoption of the IFRS: changes to accounting systems, changes to contractual arrangements, corporate governance considerations, and litigation contingencies; and
6. Human capital readiness.

In 2008, the two boards issued an update to the MoU, identifying priorities and milestones to complete the remaining major joint projects by 2011, stressing the goal of joint projects to produce common, principle-based standards.

The U.S. SEC Commission, considering the Work Plan and other factors, will probably decide in 2012 whether, when, and how the current financial reporting system for U.S. issuers should be transitioned to an accounting information system incorporating IFRS.

This complex process of convergence will surely extend throughout the following years. PriceWaterhouseCoopers believes, that despite the uncertainty of the adoption of the IFRS by the U.S. companies, they will adopt them. Supporting their idea is the interconnectedness of capital markets illustrated by the current financial crisis and the acknowledgement done by the Group of Twenty Nations (G20) and the U.S. government of the need for a single set of high-quality global standards (PricewateerhouseCoopers 2010). Some other observers like Bruce Pounder[10], President of Leveraged Logic[11], defend in different opinion forums[12] the complexity and

[10] http://www.leveragedlogic.com/bpounder.asp

[11] A leader in the development and delivery of educational products and services for financial professionals http://www.leveragedlogic.com/default.asp

elongation of the process of convergence and final adoption of the IFRS by the U.S. companies (and only public companies under the jurisdiction of the U.S. SEC) due to different causes:

- The U.S. SEC has made it clear that they will not even consider obliging the adoption of the IFRS until there are fewer differences between U.S. GAAP and IFRS, i.e., until the FASB and IASB make further substantial progress on converging the two sets of standards at the primary level. Besides, the degree of future standard-level convergence between U.S. GAAP and IFRS is itself uncertain.
- The United States generally have been content to adhere to standards as long as they set them. The thought of ceding global standard-setting authority to an organization that the U.S. does not "control" is, to most U.S. (especially U.S. politicians), unthinkable.
- The U.S. SEC will not put more pressure on U.S. companies with avoidable costs, while companies remain in the shadow of the actual global financial crisis.

Other authors (Hail, Leuz et al. 2010) defend the idea that the adoption of IFRS is not just an economic but also a political issue. Hail lays out the political, legal and institutional potential ramifications of adopting (or not) IFRS in the U.S. This includes discussions of the future role of U.S. authorities (namely, Congress, the U.S. SEC and the FASB) in setting generally accepted accounting principles, and how the governance structure of the IASB may affect the future evolution of IFRS.

In this sense, in a 2011 November 15, letter to the U.S. SEC, Financial Accounting Foundation[13] (FAF) chairman John J. Brennan wrote, that reducing FASB's role in

[12] http://www.cfo.com/article.cfm/14521760/c_2984313/?f=archives

[13] Organized in 1972, the U.S. Financial Accounting Foundation (FAF) is the independent, private-sector organization with responsibility for:
- establishing and improving financial accounting and reporting standards;
- educating constituents about those standards;
- the oversight, administration, and finances of its standard-setting Boards, the Financial Accounting Standards Board (FASB) and the Governmental Accounting Standards Board (GASB), and their Advisory Councils;
- selecting the members of the standard-setting Boards and Advisory Councils; and
- protecting the independence and integrity of the standard-setting process.
Further details in http://www.accountingfoundation.org/home

setting U.S. financial reporting standards, as once the convergence has been achieved, FASB would merely endorse the standards the International Accounting Standards Board has developed, "may weaken the positive leverage that U.S. GAAP and U.S. standard setting have provided to improving accounting standards for investors in the world's most robust and transparent capital market." The FAF also disputed the U.S. SEC staff's proposed goal of achieving one set of global accounting standards. Instead, the organization believes that "a more practical goal for the foreseeable future is to achieve highly comparable (but not necessarily identical) financial reporting standards among the most developed capital markets that are based on a common set of international standards."

Ampofo states several arguments 'pros' and 'cons' for global GAAP:

- Global GAAP will avoid duplicating costs of the development of two different sets of standards (national and international), will narrow the differences in accounting practices across the world, and will increase the comparability of the financial statements as the main in-favour reasons.
- As main 'cons', Ampofo stresses the difficulties due to national sovereignty, politics, culture, language, economic and business environments in order to develop the global GAAP. Besides, the author highlights the lack of political and legal power of an international regulator (Ampofo, Sellani 2005).

Resuming and given the following two main facts:

- The convergence process has many years to come, whatever the U.S. SEC finally decides and,
- throughout this convergence process, there will be a big amount of changes on the definition of the accounting concepts and principles.

It is expectable that the definition of the accounting practices and concepts will remain different within the international business environment worldwide, especially at both sides of the Atlantic Ocean, in the next years.

II.I. Europe and Spain

Focusing on the European Union (EU) area, the process to homogenize the financial statements started with the fourth council directive of 25 July 1978 based on Article 54 (3) (g) of the Treaty on the annual accounts of certain types of companies (78/660/EEC). The mentioned directive was lately amended by several provisions[14].

The European Council of 23-24 March 2000, celebrated in Lisbon determined three milestones:

- emphasized the need to accelerate the completion of the internal market for financial services,
- set the deadline of 2005 for implementation of the Commission's Financial Services Action Plan, and
- urged to accomplish the steps to be taken in order to enhance the comparability of financial statements prepared by EU companies, whose securities are admitted for trading on a regulated market (listed companies).

On 13 June 2000, the Commission published its Communication entitled "EU Financial Reporting Strategy: The Way Forward" in which it was proposed that all listed companies prepare their consolidated accounts in accordance with one single set of accounting standards, namely International Accounting Standards (IAS), at the latest by 2005.

Regulation (EC) No 1606/2002 of the European Parliament and of the Council of 19 July 2002 on the application of IAS introduced the requirement that, from 2005 onwards, all listed companies prepare their consolidated accounts in accordance with IAS adopted for application within the Community. It also provided an option for Member States to permit or require the application of adopted IAS in the preparation of annual accounts and to permit or require the application of adopted IAS by unlisted companies. From that date, every EU Member State started to adapt their legislation in that sense.

[14] Futher details in http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1978L0660:20070101:EN:PDF

Ulterior EC regulations have kept adapting the European legislation to the changes of the IFRS as the Commission Regulation (EU) No 149/2011[15] of 18 February 2011. It amends Regulation (EC) No 1126/2008 adopting certain international accounting standards in accordance with Regulation (EC) No 1606/2002 of the European Parliament and of the Council as regards Improvements to International Financial Reporting Standards (IFRSs).

With the publication of the *Law 16/2007, July 4, for the reform and adaption of the mercantile Law on accounting issues for its international harmonization based on the European Union regulations,* Spain starts the process of reforms and adaptation of the commercial and corporate law in accounting issues for the international harmonization. The adaption process by the internal Spanish legislation of the *International Financial Reporting Standards* (IFRS) culminated with the publication of the Royal Decree 1514/2007, November 16 approving the Spanish GAAP where recognition, valuation, elaboration and presentation standards for the financial information are developed and must be used from 2008. Additionally the Royal Decree 1515/2007, November 16, is published containing the Spanish GAAP for the Small and Medium Enterprises (SMEs).

The new Spanish GAAP entered into force January 1, 2008 and it is compulsory for the periods starting from that date.

At this point, it is remarkable the introduction of a modification in the Spanish legislation supposed to improve the process of adaption of the new regulations. An unexpected result appeared.

The Spanish regulator introduced the concept of *date of transition* in order to ease the adaptation of the financial statements to the new legislation. Therefore, enterprises which accounting period was equivalent to the natural year had two alternatives:

- Enterprises having the transitional date January 1, 2008 (*excluding comparative information*)

[15] Further details in http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:046:0001:01:EN:HTML

- Enterprises having the transitional date January 1, 2007 (including comparative information adapted to the new legislation)

The possibility given to the enterprises to avoid issuing comparative information differs from the international regulation, where the presentation of the comparative financial statements was compulsory. (Gonzalo 2004)

The changes in the Spanish GAAP introduced not only changes in the recognition, valuation and accounting classification standards, but an alternative not included in the IFRS 1[16], mentioned in the previous paragraph, causing that the impact of the change of regulation, concerning the comparability of the information, has been disparate. (Fitó, Gómez et al. 2010)

This change illustrates how the introduction of a modification in the regulations meant to increase, among other purposes, the comparability of the financial statements, introduced a temporary perverse effect: comparability impairment.

III. Hypothesis

The public relevance of the accounting information became a fact after the 1929 big financial crisis (Norverto 2002). The quality of the financial information depends on the utility obtained by its different users, so the economic value of this information depends on each user, the alternatives the user identifies, the user value judgements and the timeliness of the information. The concern for the information utility arose in 1966 when the *American Accounting Association,* founded in 1916 as the American Association of University Instructors in Accounting[17], established four requirements in order to identify the utility of the information: relevance, verifiability, neutrality and measurement (Carreira 2003). The *Financial Accounting Standards Board* (FASB) and *International Accounting Standard Board* (IASB) are devote to promote understandable financial information, useful, relevant and available for the decision makers (Cohen, Lamberton et al. 2003) and point as its economic value, the utility it has to reduce the uncertainty.

[16] http://www.iasplus.com/standard/ifrs01.htm
[17] http://aaahq.org/about.cfm

In accordance with the Spanish GAAP, "the annual financial statements consist of the balance sheet, income statement, statement of owner's equity, cash flow statement and the explanatory notes (…). Additionally, the financial information must accomplish with the qualities of *comparability* and clarity. *Comparability* must allow contrasting the situation and profitability of the enterprises. It implies a similar treatment for the transactions, and any other economic event, carried out under similar circumstances. The *comparability* must extend to both, financial statements of the same enterprise throughout time, and across different enterprises in the very same period of time." (Boletín Oficial del Estado 2007c).

The information included in the annual statements must be *relevant* and reliable.

"The information is relevant when it is useful for economic decision making …" (Boletín Oficial del Estado 2007c). One requirement of the relevance is the *timeliness of the accounting information*: the information must be available as soon as possible. Outdated information becomes useless for its purpose: decision-making.

Given the current situation, the financial information is immersed in a changing context, where the international accounting standards are in a big process of change due to the convergence process. The parties involved are developing the mentioned process with determination and resolution, even though it discovers itself as a complex process that escapes strictly accounting regulatory decisions. The US SEC has recently postponed[18] the fundamental decision whether U.S. will or will not adopt the IFRS. Nevertheless, even in the most probable situation where the U.S. SEC confirms the adoption, the way ahead will be difficult and with no little obstacles.

Decision-making in the convergence process is intended to be developed with the intervention and cooperation of all the financial information stakeholders: issuers, regulators, investors, supervisors and other users. The decisions to be adopted, although intended for producing high-quality international standards, are far from being democratic decisions, where the majority would set the final choice. Decisions are mainly agreed, but, sometimes, determined by the pressure capacity performed by the

[18] The decision was initially set for September 2011. It has been utterly delayed to 2012.

proponent lobbies. As suggested by some experts, the process may extend from five to seven years. The reasons are diverse. Nevertheless, it is possible to address the two main reasons: the big magnitude of the project and the possible impediments set by the project holders.

In this sense, it is remarkable one American view that is increasingly gaining supporters, which establishes the *condorsement*[19] or endorsement with the "handbrake" on. Nevertheless, an elongated convergence process has also no-desired effects as the additional confusion and pressure put over the stakeholders, due to a changeable regulation framework.

All of the above result in the impairment of the comparability of the financial statements.

Besides, the existence of a tool like XBRL, a standard for financial information, allows the information transmission in a way that comparable information could be obtained, if there were no terminological differences, or if any, they were not as changeable as they are. In fact, it only happens at a theoretical level. In the real world, and due to diverse reasons, XBRL is a powerful tool that enhanced the transmissibility and comparability of the financial information, among other virtues, but limited by this changeable current regulator context.

Moreover, due to XBRL's architecture and implementation, it could be added that XBRL "does not feel good" about changes. It can adapt to them, as it is designed for that purpose, but actually, it is not happening as it should. For instance, the current XBRL specification does not permit validations that involve the evaluation of information items in different contexts, a study developed in North Carolina State University evaluating XBRL filings revealed multiple errors in signage, amounts, labelling, and classification (Bartley, Chen et al. 2010). The way links establishes the relations between elements in XBRL are defined through Linkbases defining offline links, so no advanced relationships among elements are possible (García, Aguilera et al.

[19] A blend of convergence and endorsment

2006). Finally, XBRL tools have limitations for cross analysis, inherited from the technologies lying beneath.(García, Gil 2010), (García, Gil 2009).

Given this complex context, it is highly desirable a greater rapprochement between the Information Technologies (IT) and accounting areas. It will allow reaching a successful development of the international process of convergence, providing it with solutions that facilitate and overcome tensions and political ballasts: using techniques that easily assimilate and/or identify the differences among figures/assertions, initially disparate, contained in the financial statements.

This rapprochement, which could be also supported by other areas, is highly important in the financial information area. Given the international character of the accounting information (it may be not crazy to start talking about the *internationality* accounting principle) and the timeliness principle, the rapprochement becomes an essential tool to keep control over the financial information by issuers and users.

Strictly regarding the role played by accountants within this context, they become overwhelmed by the current facts. In one hand, the accountant has received the XBRL from the IT area. XBRL theoretically resolves the comparability problem, but actually, it does not solve it, adding some new uncontrolled problems. In the other hand, regulators, conscious of the problem caused by the terminological differences, are involved in a complex process, presumably extendable throughout the following years. The issuer and the user of the information are surrounded by a unstable regulation framework, which increases the pressure upon the information elaboration and utility. According to this last handicap, the changeable regulation framework, the accountant can do little, not to say anything. Nevertheless, accountants can do something about the "uncontrolled" electronic tool.

If accountants were aware about the possibilities offered by the IT area, they would be able to contribute solutions, increasing the comparability within this changeable regulatory context. Thus, the professional accountant would become an individual, IT and accountancy literate, who knows how to overcome the handicaps due to sovereignty, political and economic issues, etc. offering a global vision, more adequate

to the businesses purposes and getting around, when necessary, potential and real political obstacles.

At this point, it is important to briefly talk about the possible contribution of the Semantic Web, as an evolution of the World Wide Web, in order to help solving the problems referred above.

IV. Semantic web contribution

The electronic transmission of financial information is the simpler and more efficient way, endowing transparency and timeliness to the financial information. Users of the financial information can access the information in a quicker and easier way (Martins 2007).

Therefore, the Internet is the most common way to broadcast the financial information, but requires considerable efforts from businesses to manage it (Alexiev, Fensel et al. 2005).The economic and financial information has a critical value for all kind of institutions and stakeholders. Generating, gathering, integrating and effectively analyzing that information, are the key factors and techniques that reduce the actual limitation when managing huge amounts of information. Whereas the problem of the integration of the information is common to all business areas, it is obvious in the financial one, because the information comes from different resources that must be homogenized in order to both, facilitate its analysis and set a standardized picture of the business. Besides, the financial knowledge domain is conceptually rich. It includes complex concepts, huge volumes of data and, by itself, represents a high value product for businesses (Lara, Foncillas), (Castells, Foncillas et al. 2004).

There are no formal definitions for the Semantic Web, but there are different approaches. Truly, the complexity and variety of applications referred to the Semantic Web are increasing on a daily basis, implying that developers, implementers, etc. would emphasize the different aspects of technologies of the Semantic Web. This broad range of applications include the integration of data, knowledge representation and analysis, indexing services, algorithms and enhanced search methods, social networks, etc.

Berners-Lee defines the "*Semantic Web* as an evolution of the World Wide Web (www) where the semantics of the information and services are defined, making possible for the Web to understand and satisfy the needs of the users and machines for utilizing the web" (Berners-Lee, Hendler et al. 2001).

The view of the Semantic Web is to extend the principles of the Web from the documents to the data. The data should be accessed using the Web general architecture, i.e. *Uniform Resource Identifiers* (URI-s). Moreover, data pieces should be related among them as the documents are (or fragments of the documents). It implies the creation of a common framework, allowing data sharing and reuse by third parties' applications, be automatically or manually processed by tools, possibly revealing relations among them not foreseen previously (new knowledge).

The formalisms used in the Semantic Web (RDF's, OWL[20]) are richer and more complete than the ones used by XBRL (XML[21] based) and allow defining more specific contents with more nuances and more complex relations and properties, in an easier way. An *ontology* differs from an XML schema (XML archive containing the structure of an XML document) in that it is a knowledge representation, not a message format. These semantic languages aim to provide a formal description of concepts and their relations within a knowledge domain.

Ontologies are used to capture knowledge from a specific domain. The *ontology* describes the concepts within the domain and the existing relations among them[22]. Ontology is a concept borrowed from the Philosophy and refers to the science that describes the types of entities in the world and how they are related (Curras 2005).

The design of an ontology upon an XBRL taxonomy increases the *utility* of the financial information through the enhancement of two different aspects of the financial information:

[20] See section 5.2.1. Components of the Semantic Web
[21] eXtensible Markup Language
[22] http://www.w3.org/TR/owl-guide/

- The ontology increases the *relevance* of the information improving its *timeliness*, provided that the ontology will reduce the time to obtain the desired financial information,
- the ontology increases the *comparability* across financial statements through the definition of equivalences among the different concepts, within the different jurisdictional taxonomies and their relations.

This thesis shows, using the semantic web technologies, how to overcome the differences in the definition of the same concepts in different XBRL taxonomies, providing as a result, financial information with enhanced comparability and relevance through the utilisation of Semantic Web technologies.

V. Work structure

The present work is developed in the following sections:

The first chapter focuses on Internet Financial Reporting (IFR), analyzing first the international reporting precedents. Then it focuses on the evolution of Web-based financial information exchange through a literature review where the conclusions of the most important studies realized in this regard are exposed. It explains how businesses and stakeholders of the financial information have moved towards electronic means as the main way to broadcast, manage and analyze this information. Consequently, this chapter analyzes these two aspects, precedents and evolution of IFR, to understand better the need of a standard as the eXtensible Business Report Language (XBRL).

The second chapter explains the current process of convergence carried out by the International Accounting Standards Board (IASB) and the Federal Accounting Standards Board (FASB). First, it explains the current degree of adoption of the International Financial Report Standards (IFRS) worldwide, focusing later on the most important economic areas. Spain receives special attention because the evaluation conduced in this thesis is based on financial data from this country. Second, it focuses later on finding the main clues that would explain better whether the United States will finally adopt the IFRS and, if so, when. Besides, it includes an idea of the key obstacles

of the process. Finally, the second chapter focuses on an update of the main joint projects carried out within the process of convergence by both accounting bodies (IASB & FASB), highlighting the most remarkable aspects of the different projects. It will give an idea to the reader about some of the difficulties that must be overcome regarding international accounting regulation.

The third chapter describes the irregular implementation of the XBRL standard worldwide, including Europe and Spain. The evolution of the accounting regulation in the latter is deeply depicted in order to get a whole picture of the implementation of this standard nowadays in Spain. Other EU countries may have fulfilled similar steps in order to adopt and use XBRL. The reason why Spain is deeper analyzed is that a Spanish corporation (Telefonica) issues the financial statements used in the evaluation. Besides, the chapter explains what is XBRL and how it works, explaining the main characteristics and key elements. Finally, some XBRL limitations are depicted.

Chapter 4 will focus on the eXtensible Markup Language (XML). This chapter is included in order to explain XBRL underlying technologies. Knowing the XML performance and characteristics will shed light on how the XBRL works and what its limitations are in regards of financial reporting. What is XML, how it works and other aspects are included showing the basics of the language that will help to better understand the architecture upon which XBRL is designed.

The fifth chapter introduces the Semantic Web coming and explores how it might overcome the XBRL limitations discussed in the previous chapter. It includes an explanation of the Semantic Web, a brief history, to later focus on its components, especially RDFs and OWL, technologies that will be used in the evaluation. The characteristics, the way they operate and other important aspects are included to explain the contributions that the Semantic Web can provide to the process of convergence towards a single set of high-quality international accounting standards, overcoming the identified XBRL limitations.

The sixth chapter will include the explanation of the evaluation carried out: an analysis of the considered data, the methodology and an explanation of the results obtained.

Chapter 7 contains the conclusions derived from the evaluation and the analysis carried out through the rest of this thesis.

Chapter eight includes proposals for future research lines derived from the present work and the evaluation carried out, trying to contribute the best opportunities opened in financial reporting by IT initiatives like the semantic Web.

1. Internet Financial Reporting

"*Electronic Distribution of Information*

30. Enterprises are beginning to use channels such as the Internet and CD-ROMs to distribute financial and other performance information more quickly and in greater volume. The availability of greater computing power is also making it feasible to generate information of a kind or quality that was not available only a few years ago. In time, enterprises may be reporting on a real-time basis. This trend may call for changes in the nature of financial reporting standards. Also, standard setters may need to find new mechanisms for responding quickly to new reporting practices stemming from the rapid innovation in information technology".

December 1998 IASC strategic planning document, "Shaping IASC for The Future"

This chapter analyzes the precedents and evolution of the *Internet Financial Reporting* (IFR), setting the scene for understanding the need for the XBRL standard.

During the last decades, the way companies broadcast their financial information has changed significantly. The factors that have influenced on this evolution are diverse, but one stands above all: the evolution of Information Technologies (IT).

IFR refers to the use of the firms' web sites to disseminate information about the financial performance of the corporations.

Initially firm's websites included just information about the company, their products and/or services. Nevertheless, managers quickly understood that the Internet had the ability to broadcast the business information widely and in a different way, leveraging its own nature and the incessant growth of the Internet's audience worldwide. The development of online reporting has been fundamentally stimulated by the growth of the Internet since 1994 (Allam, Lymer 2003). In 1995, there were 44-million users (Bonsón 2001a), that figure jumped into 182 millions in just three years (see figures 1 & 2 for period 2000-2010). By means of the Internet, corporations increased the possibilities to manage the corporation's information, not only for internal but for

external purposes too: marketing, commerce and submitting financial information to the stakeholders.

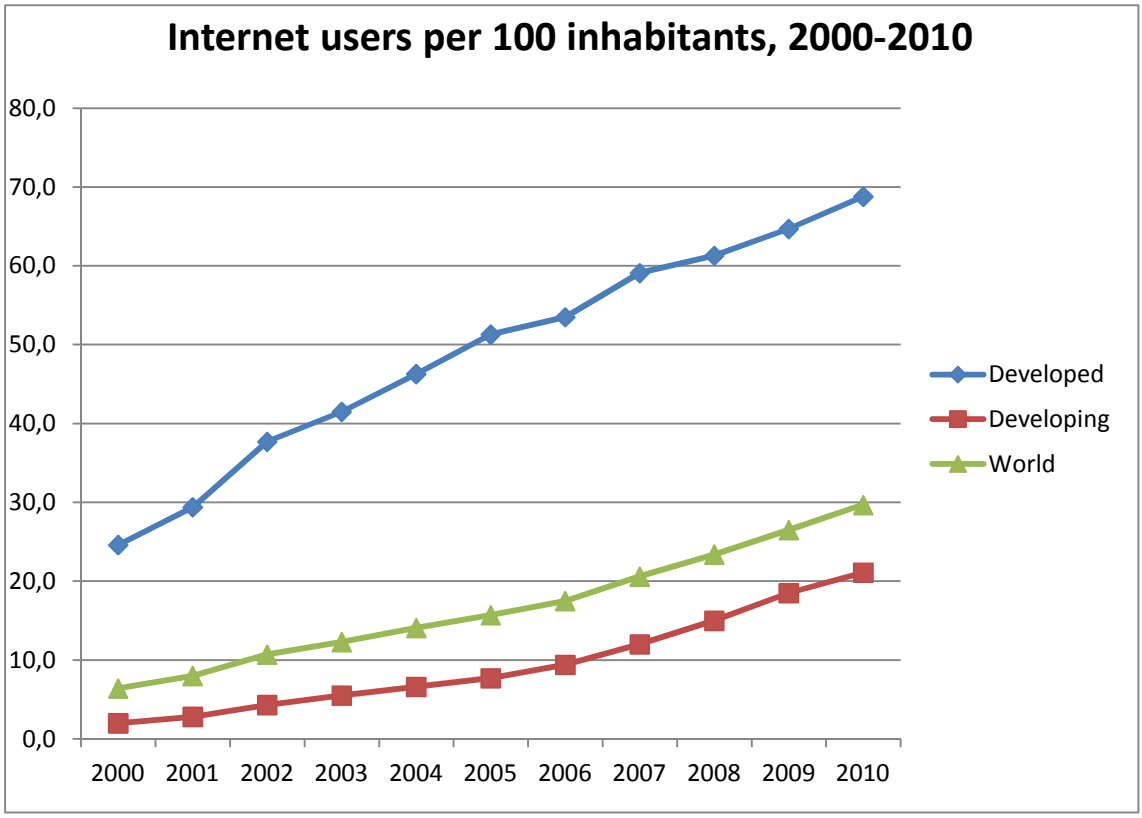

Figure 1. Source: ITU Statistics updated August 2011(http://www.itu.int/ict/statistics). The developed/developing country classifications are based on the UN M49, more details: http://www.itu.int/ITU-D/ict/definitions/regions/index.html

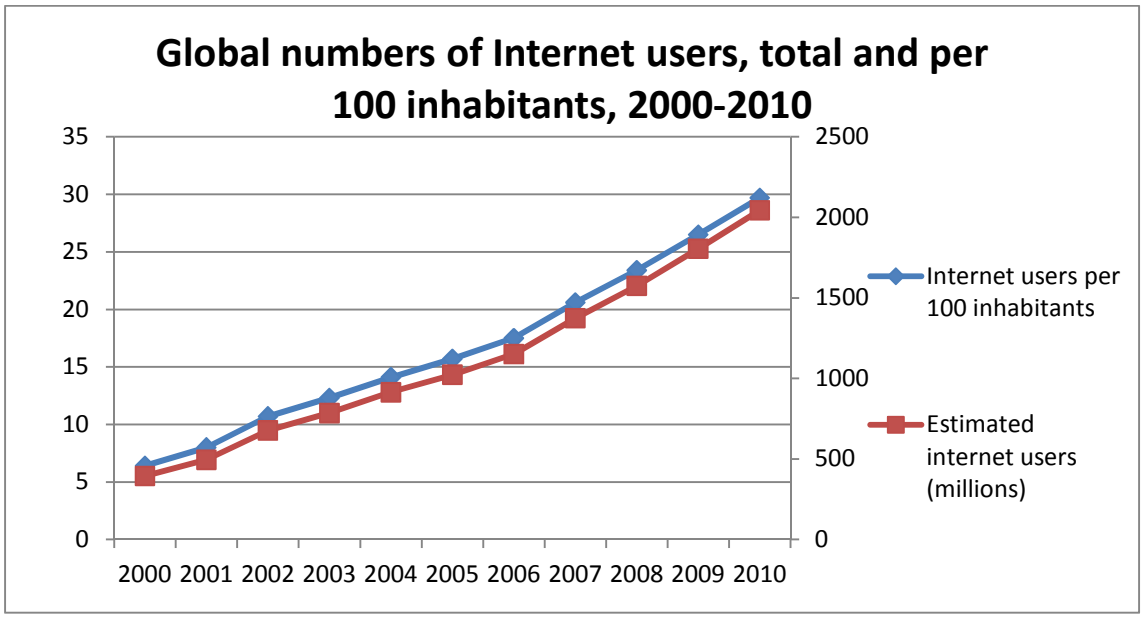

Figure 2: Global numbers of Internet users, total and per 100 inhabitants, 2000-2010. Data updated August 2011. Source: ITU Statistics (http://www.itu.int/ict/statistics)

1.1. IFR precedents

The History of Accounting is an international history. Double-entry bookkeeping, generally accepted as the genesis of today's accounting, emerged in the 14th and 15th[23] centuries in the Italian territory. Its development came parallel to the growth of the international commerce in northern Italy during the late Middle Ages and the willingness of the authorities to find ways to tax commercial transactions. From the Italian territory, the bookkeeping in the Italian fashion travelled to Germany assisting merchants of the Fugger era and the Hanseatic League. In the mean time, Netherlanders defined ways to calculate periodic income and French took advantage applying it to governmental planning and accountability.

Modern accounting research and organizational apparatus of the Spanish Royal Treasury has discovered and called attention to the important role played in this context by the formidable administrative organization of the Spanish Empire, created entirely from scratch, with no precedents of any class, and then served as a model for all systems of colonial rule that followed the Spanish. Thus, Spanish accounting historical research was set at the forefront of historical research on the organization of the Spanish administration of that time, emerging as one of the most significant factors to know in depth and explain the evolution and vicissitudes of the Spanish Empire. Similarly, historical research has shown accounting knowledge and interest of the Spanish authorities, at that time, on the accounting practices used by the merchants. So much was the interest that the first legislation in the world imposing on traders a duty to keep accounts, and to do so, precisely, in accordance with the double-entry method, took place in the Spanish territories, over two hundred years before its closest followers through the Cigales and Madrid pragmatic instructions in 1549 and 1552 respectively (Hernández Esteve 1981).

This legislation, which sets a milestone and is one of the greatest moments of the Spanish accounting history in the global context, was intended to prevent, or at least to

[23] Some authors establish its first use by the Genovese merchants in the 13th century, but the first published work on double-entry bookkeeping text is dated in 1495 by Luca Bartolomeo de Pacioli Italian friar.

reduce, the fraudulent outflow of precious metals beyond the Spanish borders, taking indelible trace from the double-entry bookkeeping practice.

In due course, double-entry accounting methods jumped to the British Isles where the British Empire had unprecedented to manage and control their colonial enterprises. From there, British accounting practices spread not only across North America, but also throughout the British Commonwealth as it was in the 19th century. A similar development occurred elsewhere. The Dutch exported their accounting practices to Indonesia, among other territories, and influenced other areas as Japan, Sweden and the czarist Russia. French did likewise to Polynesia and some African territories.

Due to the economic growth of the U.S. during the first half of the 20th century, the sophistication in accounting matters grew there in parallel. After World War II, U.S. accounting influence spread across the Western world, particularly to Germany, and Japan. To a lesser extent, the same influence is observable in countries as Mexico, Brazil, Israel, Taiwan, Sweden and the Philippines.

Accounting in China has a long story behind. Its functioning in a management role can first be detected as far back as 2200 B.C. during the Hsiu Dynasty, where documents show that it was used to measure wealth and compare achievements among dukes and princes in the Xia Dynasty. After the founding of the People's Republic in 1949, China installed a highly centralized planned economy after the Soviet Union pattern (Choi, Frost et al. 1992).

Despite this international heritage, in most countries, accounting remained a nationalistic affair, with domestic standards and practices influenced by diverse factors:

- *Sources of finance*: in countries with strong and developed equity markets, accountancy is designed to help investors assess future cash flows and risks. Meanwhile, in credit-based economies, where banks are the dominant source of funding, accounting focuses on creditor protection.
- *Legal system*: code (civil) law versus common (or case) law. Code law derives from the Roman law and the Code Napoleon. In code law countries, laws are an all-embracing set of requirements and procedures and tend to be highly

prescriptive and procedural. However, in common law countries, regulation develops with no attempt to cover all cases. It tends to be less detailed and more flexible, as it develops through a case-by-case basis.

- *Taxation*: countries where tax legislation determines accounting standards, vs. countries where financial and tax accounting are separated (despite the ulterior adjustments required).
- *Political and economic ties*: accounting ideas and technologies are transferred through conquest, commerce and similar forces as previously discussed.
- *Inflation*: countries with high inflation often required price changes to be factored into accounts as the inflation understates historical costs and overstates income.
- *Level of economic development*: more developed economies will face new accounting challenges. Intangible asset valuation makes sense in a developed economy based on the services and information sector more than in the industrial sector.
- *Culture*: cultural variables underpin nations' legal systems.

The knowledge of a determined reality, the economic in this case, is the final result of a cognition process. Although these factors have contributed definitely to the genesis of the differences across accounting national standards, international markets have pulled-up the need of the reduction of the accounting diversity as the best effort to facilitate and stimulate global economic growth.

In this sense, capital flows, foreign exchange, foreign direct investment and related transactions, - i.e. global competition, cross-border mergers and acquisitions, - have been dramatically liberalized in recent years, reducing the barriers to international business, traditionally associated with foreign trade, thus boosting their volumes. Therefore, the necessity to understand accounting records by anyone, anywhere, becomes essential. The next table depicts the recent relative evolution of international merchandise trade and trade in commercial services by region:

World merchandise trade and trade in commercial services by region and selected economy, 2005-2010

(Annual percentage change)

Exports				Imports		
2005-10	2009	2010		2005-10	2009	2010
			Merchandise			
8	**-23**	**22**	**World**	**7**	**-23**	**21**
6	-21	23	North America	3	-25	23
7	-18	21	United States	3	-26	23
1	-31	23	Canada	5	-21	22
10	-24	26	South and Central America	14	-26	30
11	-23	32	Brazil	20	-27	43
11	-18	32	Chile	12	-31	38
5	-22	12	Europe	5	-25	13
5	-22	12	European Union (27)	5	-25	13
8	-14	13	Switzerland	7	-15	13
11	-36	31	Commonwealth of Independent States (CIS)	14	-33	24
10	-36	32	Russian Federation	15	-34	30
9	-41	29	Ukraine	11	-47	34
10	-30	30	Africa	13	-15	15
10	-24	33	South Africa	9	-27	29
10	-35	49	Nigeria a	16	-32	30
11	-31	27	Middle East	11	-15	10
7	-39	30	Saudi Arabia, Kingdom of	10	-17	2
13	-23	19	United Arab Emirates a	14	-15	7
11	-18	31	Asia	11	-20	32
16	-16	31	China	16	-11	39
5	-26	33	Japan	6	-28	26
			Commercial services			
8	**-12**	**9**	**World**	**8**	**-11**	**9**
7	-8	9	North America	6	-9	8
8	-7	9	United States	6	-8	7
4	-12	15	Canada	7	-11	15
10	-8	12	South and Central America	14	-8	23
15	-9	15	Brazil	22	-1	36
15	-9	18	Argentina	13	-10	15
6	-14	3	Europe	6	-13	2
6	-15	3	European Union (27)	6	-13	2
10	-5	8	Switzerland	8	7	-3
14	-17	12	Commonwealth of Independent States (CIS)	13	-19	16
12	-19	7	Russian Federation	13	-20	19
13	-23	24	Ukraine	11	-30	6
9	-9	10	Africa	14	-11	10
10	-14	11	Egypt	6	-22	2
4	-6	17	South Africa	9	-13	25
8	-3	3	Middle East	14	-8	9
-2	3	10	Saudi Arabia, Kingdom of	21	-5	8
21	6	16	United Arab Emirates	17	-14	11
13	-11	22	Asia	11	-10	20
18	-12	32	China	18	0	22
6	-14	10	Japan	5	-12	6

Table 1. Source: World Trade Organization. http://www.wto.org/english/res_e/statis_e/its2011_e/its11_world_trade_dev_e.htm

Table 1 shows how imports/exports percentages decreased in the year 2009, due to the financial crisis, and recovered irregularly in 2010, comparing them with the average percentage for the entire period shown (2005-2010).

Besides, national governments have realized that financial markets liberalization permits them to access international funds, inaccessible before. This is one of the biggest problems the economy of the euro zone and their Member States are facing nowadays, as the financial markets mistrust the capacity of the EU Governments, either national or regional, to attend their national debts payments.

However, as previously discussed in this work, the main factor that has triggered the current accounting information revolution is IT evolution.

1.2. Literature review

Turrent and Rodríguez (Turrent, Rodríguez 2012) point out the use of Internet as a means to disseminate corporate information, has caused a new form of communication between companies and their stakeholders. Different researches analyzing the impact of Internet in the accounting profession, some of them sponsored by the main international accounting bodies, first appeared in the late nineties. Find below the most relevant:

(Molero, Prado et al. 1999), (Giner, Larran 2002), (Bonsón 2001a), (Brennan, Hourigan 2000), (Craven, Marston 1999), (Gowthorpe, Amat 1999), (Hedlin 1999), (Lymer 1999b), (Lymer 1999a), (Lymer, Tallberg 1997), (Pirchegger, Wagenhofer 1999), (Deller, Stubenrath et al. 1999)[24].

[24] Other references: McCafferty, J. (1995, December). How much to reveal online. CFO: The Magazine for Senior Financial Executives, 11, 12.;
Louwers, T. J., Pasewark, W. R., and Typpo, E. W. (1996) 'The Internet: Changing the way corporations tell their story', CPA Journal, 66(11): 24-28.;
Koreto, R. J. (1997) 'When the bottom line is online', Journal of Accountancy, 183(3): 63-5.;
Gray, G. L., and Debreceny, R. S. (1997, November). Corporate Reporting on the Internet: Opportunities and Challenges. Paper presented at the Seventh Asian-Pacific Conference on International Accounting Issues, Bangkok.;
Miller, R., and Young, M. R. (1997) 'Financial Reporting and Risk Management in the 21st Century', Fordham Law Review, 65(5): 1987-2064.;

The studies have been developed across different geographic regions and periods. Next is a summary of the more significant studies, together with the conclusions obtained by region.

Giner found in the year 2000 that the level of IFR achieved by 144 Spanish companies was low, but increasing gradually over time. The level of disclosure through this communication channel was related to company size. Although Spain was in the early stages of developing the possibilities offered by the Internet, it was not significantly behind the degree of utilization in other countries such as the USA and the UK (Giner, Larran 2002).

Debreceny et al. (2002) found that voluntary adoption of IFR in 22 countries was associated with company size and listing on an U.S. stock exchange, but not with leverage, risk, and Internet penetration in the countries. In contrast to Ettredge et al. (2002), this study discriminates between presentation format and disclosure content. It indicated that the level of technology and disclosure environment determined presentation format, but not so much content. However, the study does not distinguish between disclosure of mandatory and non-mandatory items.

Lymer et al. concluded on their study carried on 250 companies in the U.S., United Kingdom, Australia, Canada and Hong Kong that the level of implementation of IFR was similar between U.K. and Canadian companies and between U.S. and U.K. companies. These three countries lead the development of IFR. Australia followed closely, while Hong Kong companies lagged behind with considerable differences on both technological and content issues. Nevertheless, the study pointed out its

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Gowthorpe, C., and Flynn, G.(1997) 'Reporting on the Web: The state of the art', Accountancy, 120(1248): 58-59.;

Debreceny, R., Gray, G., and Barry, T. (1998). Accounting Information in a Networked World - Resource Discovery, Processing and Analysis. Paper presented at the American Accounting Association Annual Meeting, New Orleans. ;

Petravick, S., and Gillett, J. W. (1998) 'Distributing earnings reports on the Internet', Management Accounting (USA), 80(4): 54-56. ;

Debreceny, R., Gray, G., and Rahman, A. (1999). Voluntary financial reporting on the Internet: An international perspective. Paper presented at the American Accounting Association Annual Meeting, San Diego.

Sánchez, M. (1999): La Memoria como cuenta anual. Un estudio empírico. Doctoral Thesis, University of Sevilla.

limitations: the way data was collected (via researchers experience in the companies' web sites) and the lack of a significant index used to track the relation between the size of the companies and the level of IFR (Allam, Lymer 2003).

Xiao et al. (2004) studied IFR in China. They found that there was a marked positive relation between mandated and voluntary disclosure. They further showed that the presentation format of IFR was associated with the format used by one of the Big-5 auditor firms when contracted, and whether the corporation was in the information technology industry, while a negative association existed between profitability and the voluntary disclosures. Voluntary IFR was positively and significantly associated with the proportion of legal person ownership, but not so with ownership by domestic private investors, foreign investors and the state. In addition, the proportion of independent directors had a positive relation with presentation format, voluntary disclosures, and the availability of English Web pages.

A survey performed on twenty UK accounting and Internet experts examined the role of the Internet, recognizing it as a double-edged weapon: not only as a potential means for alleviating some existing problems in financial reporting, but also as a source of additional problems (Xiao, Jones et al. 2005).

The conclusions of the majority of the studies are similar:

- Significant proportions of companies in many countries used the Web for communication of business performance to stakeholders.
- IFR continued to grow, especially in those countries with a developed capital market.
- Corporations leading this change were big listed companies.

These comprehensive and summarised conclusions require a wider and deeper analysis.

All the studies mentioned above place a new situation originated by the new technologies. Now it is easier than ever before to compare financial information across diverse issuers. Besides, it becomes clear that the rapid evolution of the IFR has brought new conditions that are having a deep and broad impact on the way accounting

standards are set. In this sense, along centuries and under the traditional paper format, the presentation of the information played a secondary role, where recognition and measurement criteria were the main issues for the accounting standard setters. In other words, form was secondary to substance. Given that Web-based technologies disclosure can provide information in many ways that can affect user perception, the form becomes important and claims more attention from the standard bodies and regulators.

The Web has decreased the cost of producing information and greatly increased the potential population of users. The Web provides instantaneous and simultaneous access to accounting information, which can be either static pages or pages dynamically drawn from corporate databases or other layouts. The delivery of the reports is no longer a serious handicap to the dissemination of information, as its cost is now insignificant. Nor is the cost of tailoring the information for different stakeholders and audiences relevant.

As pointed by Lymer (Lymer 1999a), there are four clear causes that have triggered this change:

- First, the dissemination of the information via the Web is cheaper than in print, thereby the information of the publisher carries greater added value.
- Second, business reporting in general, and financial information in particular, have high time value in the short-term. The instantaneous broadcast by means of the Web also adds value to the information recipient.
- Third, while it is true that the value of business reporting information quickly decreases over time, the same information can be reused in cross and/or longitudinal analysis.
- Fourth, the Web allows interactive information dissemination in a fashion that is no possible in print form.

Besides, it is important to bear in mind that there are also quick changes in the demand of IFR. As a sector, the fast advance of the Web has affected financial markets in general and the equity securities market in particular. This environment attracts to the market a new class of individual investors that are using the Web to trade and make

investment decisions. Lower security transaction fees have also turned into higher transactional volumes by small investors.

Although not explicitly stated in the studies, there is another very important aspect that can be deduced from them. Globalization and IT developments have implications for many areas of business, management and regulators. Dyson points out how the Web is positively affecting IFR (Dyson 1998). In the current global market, financial information and stakeholders shed their national identities for a more appropriate global point of view. In this new changeable and complex scenario arises an explicit need for services such as accountancy, which adds value to information consumers via the provision of reliable and trustworthy information.

The information revolution created by the Web has deeper implications for regulation of markets. IFR cannot be restricted to the disclosure of financial information exclusively. Both financial information users' requirements and professional accounting bodies, indicate that this medium of communication contributes to enhancing and broadening traditional financial reporting. This improvement is not only shown by the increase in the quantity of information, but also in terms of timeliness (information more oriented to the future than to the past and present of the corporation), extending its availability to a vast audience (not only for a professional audience, but also for the web-accessed public in general). Besides, the information provided via Internet allows interactivity, and increases the frequency in order to transform the current periodical reporting into a desirable continuous one eventually.

IT and the Web in particular, becomes the perfect tool to achieve this goal. The current challenge for the professional accounting bodies is to set rules, regulations and recommendations that guarantee both, their reliability and the comparability of information.

The IASB and the national accounting standard setters have had their respective conceptual frameworks for financial accounting until very recently. These parallel frameworks were generally quite harmonised and the qualitative characteristics of financial information outlined in these conceptual frameworks were very similar. The

conceptual frameworks have been reasonably efficient for setting accounting standards in recent times. However, one important point to note is that the previous generation of conceptual frameworks was established for an industrial world with national boundaries, and not for the current globalized information age, i.e. without national boundaries.

Considering the disappearance of borders in the transfer of information, it makes sense that this regulation process, develops internationally. In an interconnected world, individual countries cannot be effective regulatory jurisdictions any longer, and regulations from a respected international regulator could be the solution for governing activities that transcend national boundaries. The IASB is the best-positioned candidate to play this role in the future, although with no little ballasts.

At both, the macro and micro levels, IFR positively affects businesses. At the micro-level, positive effects have been already mentioned before as IFR reduces significantly the cost of business reporting, makes instantaneous reporting a reality, adds breadth and depth to business reporting, allows for the usage of analytical tools on the underlying business data, and enhances the delivery of reports to anywhere in the world instantaneously.

At the macro level, IFR is a gift for the globalization of businesses because it returns benefits for stakeholders. However, the multidimensionality of this new reporting model raises new issues and dimensions, not previously foreseen, for the financial information issuers, regulators and consumers. Given this context, and as it is understood by the international accounting bodies, international standards and electronic presentation must walk hand in hand.

Accounting Standards and business information must avoid any conflict with those that operate for other media reporting, at the national level. Besides, international standards should seek to reinforce a common global and networked representation of accounting principles, practices and terminologies. International accounting standards and business reporting will significantly enhance the visibility of such information, among the many hundreds of millions of pages on the Web, by increasing the quality of the information

produced under their specifications. Moreover, the reutilization and integration of information in wider business analysis will also be firmly enhanced.

The key constraint to the development of wider electronic dissemination and use of financial data is the limited nature of current global agreement over accounting terms and methods of producing accounting figures. While those major differences between the way countries produce financial data exist, problems for the greater use of electronically available financial data will endure (Ampofo, Sellani 2005), (Lymer 1999a). Governments worldwide will have to carry out coordinated efforts, to improve and fully develop the advantages that could be obtained from a single set of international standards: the current convergence process IASB-FASB leads to this end.

2. The IASB - FASB process of convergence.

"*The journey towards convergence continues. Standard setters are re-exposing key projects, and the U.S. SEC is evaluating how IFRS might be incorporated into the US financial reporting system. The standard setting process is slowing in response to concerns raised by constituents, but progress on key standards continues. While the pace of change is slowing, it's still clear that significant changes to US GAAP and IFRS are expected.*"

James G. Kaiser, Partner, US Convergence & IFRS Leader
PricewaterhouseCoopers LLP
August 10, 2011

Undoubtedly, the IASB and FASB have set an aggressive schedule for their joint standards. Despite all the efforts made up to date, it is clear that more time is needed to complete the convergence process and now completion date has been postponed to December 2011, in order to allow for more feedback in the drafts. Figure 3 shows the estimate schedule for the different projects.

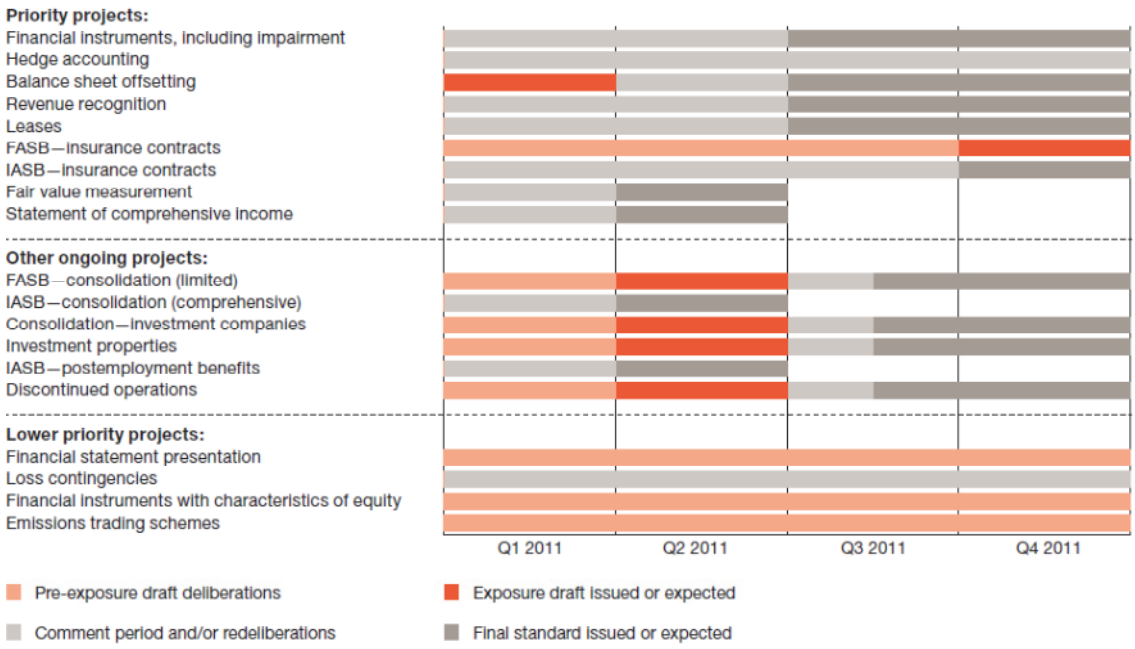

Figure 3. Source: US GAAP Convergence & IFRS -PricewaterhouseCoopers LLP

The boards continue to evaluate and act on feedback from their ongoing outreach activities, and have yet to finalize significant areas of redeliberations. Also looming on the horizon is the question of re-exposure their drafts. If the boards ultimately re-expose their standards for another round of comments, the need for more time will be inevitable. Whether through re-exposure or extended outreach, the boards have declared again that stakeholders' input is crucial to their end-goal of delivering high-quality standards.

In February 2010, the U.S. SEC published a statement of continued support for a single set of high quality global accounting standards and acknowledged that IFRS are better positioned to serve that role.

2.1. The convergence process: a general overview

In December 2010, the U.S. SEC announced that by the end of 2011 it planned to decide on next steps regarding whether, when, and how IFRS should be incorporated into the US financial reporting system. In the meantime, the FASB and the IASB continue to deliberate key convergence projects, which they plan to finalize in the latter half of 2012.

Although the future of IFRS in the US financial reporting system is uncertain, IFRS already affects US companies today due to cross-border mergers and acquisitions, business dealings with non-US customers and vendors, and because of the adoption of IFRS for statutory purposes by non-US subsidiaries.

The current economic crisis highlighted the interconnected nature of global business and financial capital markets, which makes the need for global accounting standards even more apparent. IFRS can play this role. Nevertheless, IFRS are still inconsistently applied worldwide[25] and the cost of its implementation in a difficult economic context makes its adoption a harder process. Figure 4 depicts the IFRS implementation worldwide, updated March 2011, by levels of acceptance/ adoption.

[25] A very interesting interactive map depicting the current IFRS adoption by country: http://www.pwc.com/us/en/issues/ifrs-reporting/country-adoption Updated March, 2011

Analyzing figure 4 some other interesting considerations shall be pointed out concerning the main world economies. Next it is included a regional analysis describing the current situation of IFRS adoption in the most important world regions. Spain is also included as the evaluation realised in this work is focused on a Spanish corporation.

2.1.1. United Kingdom

The United Kingdom (UK) requires the IFRS only for consolidated financial statements and permits them for the standalone/separate financial statements. The UK Accounting Standards Board (UK ASB) has incorporated some IFRS into UK GAAP. Certain of the standards apply only to some entities. For example, the UK equivalent of IAS 39 (Financial Instruments: Recognition and Measurement) is only mandatory for those who want to use the fair value option and for listed entities. The UK ASB has issued an exposure draft of a comprehensive standard that will fundamentally change corporate reporting for UK entities that are not currently applying EU-adopted IFRS. The ASB proposes a three-tier structure based on public accountability rather than size of entity, along with reduced disclosure concessions for qualifying subsidiaries:

- Tier 1 is the publicly accountable entities that apply EU-adopted IFRS.
- Tier 2 is all other entities that apply UK-adopted IFRS for SMEs or IFRS.
- Tier 3 is small entities eligible to apply FRSSE (Financial Reporting Standard for Smaller Entities).

The exposure draft comment period ended on April 30, 2011. A final standard is expected in mid 2011 and is expected to be effective for periods starting on or after 1 July 2013. Early adoption will be permitted.

IFRS adoption. Updated March 2011

Countries/territories

North & Central America		South America	Asia		
Antigua and Barbuda	Honduras	Argentina	Afghanistan	Kyrgyz Republic	Turkey
Aruba	Jamaica	Bolivia	Armenia	Lebanon	United Arab Emirates
Bahamas	Mexico	Brazil	Azerbaijan	Macao SAR	Uzbekistan
Barbados	Nicaragua	Chile	Bahrain	Malaysia	Vietnam
Bermuda	Panama	Colombia	China	Mongolia	West Bank/Gaza
Canadá	St. Kitts and Nevis	Ecuador	Hong Kong	Oman	
Cayman Islands	St. Lucia	Paraguay	India	Pakistan	
Costa Rica	Trinidad and Tobago	Peru	Indonesia	Philippines	
Dominican Republic	United States	Uruguay	Israel	Qatar	
Dutch Caribbean		Venezuela	Japan	Saudi Arabia	
El Salvador			Jordan	Singapore	
Guatemala			Kazakhstan	Sri Lanka	
			Korea	Taiwan	
Europe			Kwait	Thailand	
Albania	Greece	Montenegro			
Austria	Greenland	Netherlands	**Africa**		
Belarus	Hungary	Norway	Algeria	Madagascar	Zambia
Belgium	Icelan	Poland	Angola	Malawi	Zimbabwe
Bosnia and Herzegovin	Ireland	Portugal	Botswana	Mauritius	
Bulgaria	Isle of Man	Romania	Cameroon	Morocco	
Cyprus	Italy	Russian Federation	Chad	Mozambique	
Czech Republic	Latvia	Serbia	Cote D'Ivore	Namibia	
Denmark	Kosovo	Slovack Republic	Dem. Rep. Congo	Nigeria	
Estonia	Lithuania	Slovenia	Egypt	Rep. of Congo	
Finland	Luxembourg	Spain	Equatorial Guinea	Senegal	
France	Macedonia	Sweden	Gabon	South Africa	
Georgia	Malta	Switzerland	Ghana	Swaziland	
Germany	Moldova	Ukraine	Guinea Conakry	Tanzania	
		United Kingdom	Kenya	Tunisia	
			Libya	Uganda	

Level of acceptance/adoption of IFRS

Oceana	
Australia	Wide level of acceptance: coexistence; moving towards convergence; small differences.
French Polynesia	Medium level of acceptance: coexistence; moving towards convergence in the short term; differences.
New Caledonia	Low level of acceptance: plans to converge in the medium/long term; material differences.
New Zealand	No concrete plans to converge: IFRS may be applied, but reviewed by the local authority; IFRS not applied

Figure 4. Source: IFRS adoption by country. PricewaterhouseCoopers LLP publication. 2011

2.1.2. United States of America

U.S. allows to foreign private issuers the use of IFRS as issued by the IASB. Companies using standards other than US GAAP or IFRS as issued by the IASB must reconcile back to US GAAP. Convergence process in the U.S. has been already explained. A comparison between IFRS and US GAAP is later discussed in this work.

2.1.3. People's Republic of China

China does not permit the utilization of IFRS. However, Chinese Accounting Standards (CAS) have somewhat converged with IFRS. However, it is not a direct translation of IFRS. The China standard setter issued the Chinese Accounting Standards in 2006 (effective from January 1, 2007) and, in many ways, these standards are converged with IFRS. While there are still some differences between CAS and IFRS, the Ministry of Finance have plans to further converge CAS with IFRS in the near future. Note that the China standard setter has not announced any adoption or convergence plans to IFRS for SMEs.

2.1.4. India

In India, listed companies having subsidiaries have a choice of presenting their consolidated financial results either in accordance with Indian GAAP or in accordance with IFRS. This is subject to change in the near future once India converges to IFRS. The Ministry of Corporate Affairs (MCA), a part of the Government of India, had announced in January 2010 a multi-phase plan for transition beginning April 1, 2011 to the new Converged Indian Accounting Standards (Indian version of IFRS, referred to as "IndAS", which is an attempt to converge but has carve outs that distinguish it from IFRS). The MCA has finalized thirty-five IndAS in February 2011. The actual date of application of these IndAS is yet to be notified[26]. These standards will need to be incorporated into law by amendments to the Companies Act, which is yet to happen. While these standards are similar to IFRS, a few additional exemptions/changes have been made to some of them, which may result in differences between IFRS and IndAS for some companies.

Until the applicability of IndAS is determined, companies must continue to report under Indian GAAP. The original transition plan is as follows (pending clarification on revisions to the date of application):

[26] "The converged Indian Accounting Standards (IndASs) hosted by MCA. The date on which these will come into force is yet to be notified…" as stated in the Institute of Chartered Accountants of India website http://www.icai.org/post.html?post_id=7543 Updated November, 2011.

- Phase I (date to be clarified):
  - Companies on the BSE Sensex 30[27] and NSE Nifty 50[28].
  - Companies having listed securities outside of India.
  - Companies having net worth in excess of Rs. 1000 crores (USD 222 million approx) as computed on March 31, 2009, computed based on standalone entity financial statements per original Indian GAAP. Insurance companies are scheduled to transition on April 1, 2012.
- Phase II (Companies moving from April 1, 2013 as scheduled):
  - Companies with net worth in excess of Rs. 500 crores (USD 111 million approx).
  - Non Banking finance companies ("NBFC") on the NSE – Nifty 50 or BSE – Sensex 30, non listed NBFC with net worth above Rs. 1000 crores (USD 222 million approx)
  - Commercial banks and urban co-operative banks with net worth above Rs. 300 crores (USD 67 million approx).
- Phase III (Companies moving from April 1, 2014, as scheduled):
  - Listed companies having net worth of Rs. 500 crores (USD 109 million approx) or less.
  - Urban co-operative banks having a net worth in excess of Rs. 200 crores (USD 44 million approx), but not exceeding Rs.300 crores (USD 67 million approx)

2.1.5. Japan

Japan allows to listed companies, which meet certain requirements ("Specified Companies"), to use IFRS for their consolidated financial statements ending on or after March 31, 2010. As per the roadmap released by the Financial Services Agency of Japan in June 2009, mandatory adoption of IFRS may start in 2015 or 2016, subject to the final decision, which is to be made around 2012. Standalone/separate financial statements are prepared in accordance with Japanese GAAP.

[27] Bombay Stock Exchange. More details http://www.bseindia.com/about/abindices/bse30.asp
[28] National Stock Exchange of India. Further details http://www.nseindia.com/

2.1.6. Russian Federation

Russian Federation permits IFRS for consolidated financial statements. A new Law on consolidated financial statements was adopted on July 27, 2010. The Law requires that all consolidated financial statements should be prepared in accordance with IFRS, but actually, companies will be obliged to prepare consolidated statements in accordance with IFRS as of the end of the year following the year of IFRS's official adoption in Russian Federation. IFRS is not adopted so far. This change does not affect standalone financial statements of Russian entities.

Statement of the Russian Government number 107 as of February 25, 2011 has defined the procedure of official adoption of IFRS in the Russian Federation. IFRSs are translated into Russian language by IFRS Foundation and then handed over to RF Ministry of Finance. Ministry of Finance adopts the IFRS by coordination with the Central Bank of the Russian Federation and the Federal Service for Financial Markets. If it is decided that some provisions of IFRS are not applicable in the Russian Federation, then certain IFRS is adopted except for such provisions.

2.1.7. Spain

On January 1, 2005 entered into force the IFRS. These standards were firstly mandatory only for consolidated financial statements of listed companies and any other company willing to adhering them, as well as credit institutions as prescribed by the Circular 4/2004 published by the Bank of Spain adapting the International Standards to the banking sector (Serrano 2005).

Nowadays, IFRS are required for consolidated financial statements for listed companies. The recently published Ministerial Order JUS/1698/2011, of June 13, approving the models for presentation on the Mercantile Registry of the consolidated financial statements modified the templates of the financial statements, in order to enhance the convergence with the IFRS models. All companies adopted a revised Spanish GAAP from January 1, 2008, which was a partial convergence with IFRS. The national regulations have been amended in line with IFRS, while maintaining the legal

structure of the Spanish accounting system. All companies must apply Spanish GAAP in their standalone financial statements, which is essentially IFRS based, although presents some differences in accounting and disclosure requirements. IFRS for SMEs is prohibited. Spain IFRS for SMEs are not expected to be permitted in the medium-term, as reforms of Spanish accounting law have been carried out from 2008 to 2010 and no debate has begun regarding its applicability. As IFRS as adopted by the EU develops, subsequent changes of Spanish GAAP will be expected with the objective of converging to IFRS.

This changeable current and future scenario in Spain is supported by other authors. Fitó points out that while this is a general adaptation to the international standards, this is done with some remarkable exceptions, since the Spanish regulator has maintained, in some cases, different outcome measures than those established in international regulations (Fitó Bertrán, Gómez Valls et al. 2010). For example, assets as buildings, properties, investments, etc. shall be included in the opening balance sheet at the carrying amount contained before the implementation of the new Spanish GAAP, and punctual revaluation is not allowed as a transition cost, alternative allowed under international standards application. The Spanish regulator has not allowed the application of alternative assessment provided for in certain assets and liabilities in international standards, e.g. business combinations.

2.2. Will IFRS be adopted in the United States?

As pointed out by Mr. Gregory Jonas, Managing Director at Morgan Stanley in the roundtable on International Reporting Standards in the United States celebrated on July 7, 2011 in Washington in the US SEC, “diversity in reporting standards obviously creates unnecessary diversity in reported statements. This fact undermines comparability, which, of course, is a pre-requisite for quality financial analysis. Diverse languages are great for human culture, but are troublesome, obviously, for analysts.”

It is broadly assumed by the stakeholders of the convergence process that a common reporting standard will never eliminate reporting diversity, but can reduce it.

The position adopted by American stakeholders in the convergence process can be briefly depicted as follows: incorporating IFRS enables continued U.S. influence over IFRS. This is the main key: the influence in the convergence process. If the U.S. were going their own way, in accordance with Mr. Jonas, it would greatly reduce U.S. influence over IFRS development: "could Americans expect the rest of the world to forever embrace heavy U.S. influence when they would have rejected IFRS, themselves? To stay in the IFRS endeavour, they need to commit to the IFRS endeavour."

Many American stakeholders support the already named concept of *condorsement*, which brings the idea that the adoption of the IFRS by the US companies will be done through endorsement but keeping control on the US GAAP more than moving from national standards to IFRS straight forward as the EU did.

The decision was expected from the U.S. SEC later in 2011 as confirmed by Mary Schapiro, U.S. SEC chairman. As part of its consideration, the U.S. SEC staff released a paper in late May 2011, depicting a possible incorporation framework: a blend of convergence and endorsement i.e. *condorsement*. The FASB would work toward eliminating differences between US GAAP and IFRS over a transition period.

The paper suggested that the transition period could extend, as an estimate, to five or seven years. During this period referred to as *condorsement* (convergence- endorsement mixture), the FASB would work through a process to endorse international standards into the US framework, i.e. keeping control on the US GAAP. This approach would allow some flexibility for the FASB to modify or supplement IFRSs when necessary in order to protect the interests of US investors. The U.S. SEC believes this approach could also provide some relief from the costs associated with a "big bang" adoption. However, some risks must be pointed out. Considering this approach, it will require a well thought-out and flexible transition plan, and complexity and confusion due to the extended transition period could arise as the undesired side effects of the process.

November 16, 2011 the Securities and Exchange Commission Staff published the paper ("Staff Paper") "*Work Plan for the Consideration of Incorporating International*

Financial Reporting Standards into the Financial Reporting System for U.S. Issuers. An Analysis of IFRS in Practice". This Staff paper contributes to the execution of the Work Plan by presenting the Staff's observations regarding the application of IFRS in practice, in order to provide the Commission with information to assist it in its future determination. This Staff Paper is not intended to, and does not, compare the application of IFRS to the application of U.S. generally accepted accounting principles. Accordingly, similar observations may be present among companies reporting under U.S. GAAP.

In addition, the observations included in this Staff Paper are not intended to be determinative as to whether or not IFRS is positioned for incorporation into the financial reporting system for U.S. issuers. This Staff Paper is one component of extensive efforts, forming part of the Work Plan, to facilitate the Commission's consideration of the incorporation of IFRS. Without any doubt, some of the obtained conclusions are very interesting.

The Staff of the Division of Corporation Finance and the Office of the Chief Accountant analyzed the most recent annual consolidated financial statements of 183 companies, including both U.S. SEC registrants and companies that are not U.S. SEC registrants, which prepare financial statements in accordance with IFRS. The Staff based its selection of companies on the 2009 Fortune Global 500[29], which is an annual ranking of the top 500 corporations worldwide by revenue, as compiled and published by Fortune magazine (FG500). Specifically, the Staff selected all companies from this list that prepare their financial statements in accordance with IFRS and make their financial statements available to the public in English.

The 183 companies were domiciled in 22 countries. Approximately 80% of the companies were domiciled in the European Union, with companies from Germany, France, and the United Kingdom representing slightly more than half of the companies.

The companies in the analysis were from the following countries:

[29] Available at: http://money.cnn.com/magazines/fortune/global500/2009/full_list/

Country	No. Of Companies
Germany	35
France	34
United Kingdom	26
China	14
Spain	11
Netherlands	10
Australia	9
Switzerland	9
Italy	8
Sweden	6
Belgium	5
Other (represents 11 countries)	16
Total	183

Table 2: Source "*Work Plan for the Consideration of Incorporating International Financial Reporting Standards into the Financial Reporting System for U.S. Issuers. An Analysis of IFRS in Practice"* produced by the Securities and Exchange Commission Staff

The companies in the analysis represented the following 36 industries (as categorized by the FG500):

Industry	No. of Companies
Banking	38
Petroleum Refining	14
Telecommunications	12
Food and Drug Stores	11
Utilities	11
Engineering and Construction	10
Motor Vehicles and Parts	10
Insurance	9
Mining and Crude Oil Production	6
Building Material and Glass	5
Chemicals	5
Energy	5
Pharmaceuticals	5
Other (represents 23 industries) 12	42
Total	**183**

Table 3. Source: Work Plan for the Consideration of Incorporating International Financial Reporting Standards into the Financial Reporting System for U.S. Issuers. An Analysis of IFRS in Practice" produced by the Securities and Exchange Commission Staff

The purpose of this analysis was to evaluate the manner in which IFRS is applied in practice, with a focus on the recognition and measurement of transactions in a company's financial statements. IFRS, like U.S. GAAP, consists of standards relating both to how transactions are to be reflected in a company's financial statements and to disclosures provided in the notes to the financial statements. Similarly, IFRS, like U.S. GAAP, generally does not have explicit requirements for a company to explain how it

satisfied a particular accounting standard. Rather, the accounting standards generally require a company to explain the accounting policies selected. However, as a regulator, the Staff also seeks to promote compliance with the accounting standards and, as such, the Staff's comments to a company can at times focus on how a company complied with a relevant accounting standard.

The Staff's observations in this regard were limited to that which was apparent from a company's presentation and disclosures. As part of this analysis, the Staff did not have the opportunity to provide comments on the financial statements or inquire the company officials as to how companies reflected transactions in their financial statements or why companies made certain determinations in the application of IFRS. As a result, in many circumstances, the Staff was unable to determine the manner in which companies reflected transactions in their financial statements or confirm that the accounting complied with IFRS.

In some cases, the Staff was unable to determine the manner in which companies applied IFRS because disclosures did not discuss certain aspects of the guidance. For example, in some cases, the Staff was unable to determine the basis for a company's classification of financial instruments as debt or equity, the basis for the recognition of deferred tax assets, and whether intercompany transactions were eliminated in consolidation. In addition, the Staff was unable to determine the basis for materiality assessments and whether the use of practical expedients was materially consistent with IFRS.

In other cases, the Staff was unable to obtain clarification regarding the disclosures that were provided. For example:

- Some companies referred to home country GAAP for particular types of transactions, but the specifics of the home country requirements and their consistency with IFRS were unclear. In addition, the reasons for reference to home country GAAP were also unclear. For example, in some cases the references to local guidance may have been due to the manner in which a particular country incorporated IFRS into its financial reporting system or a

company's determination that IFRS does not contain guidance specifically applicable to a transaction. In the latter case, it also was unclear whether companies had appropriately applied the accounting policy selection and application criteria in IFRS, or not.

- Some companies used terms that were inconsistent with the terminology in the applicable IFRS. The Staff recognizes that varying terminology is a natural consequence of a cross-border environment, which operates in multiple languages. Nonetheless, because the Staff did not obtain further information, the Staff was unable to determine whether the differing terminology resulted from translation differences or noncompliant accounting.
- The Staff noted several instances in which companies highlighted only certain recognition or measurement criteria related to a standard, without an explanation of their significance, when multiple criteria must be satisfied. In the Staff's experience with U.S. GAAP, similar partial policy disclosures have sometimes been indicative of noncompliant accounting. However, due to the limitations of this analysis, the Staff was unable to determine whether this was also the case with companies in the analysis.

The Staff found that company financial statements generally appeared to comply with IFRS requirements. This observation, however, should be considered in light of the following two themes that emerged from the Staff's analysis:

- First, across topical areas, the transparency and clarity of the financial statements in the sample could be enhanced. For example, some companies did not provide accounting policy disclosures in certain areas that appeared to be relevant to them. Furthermore, many companies did not appear to provide sufficient detail or clarity in their accounting policy disclosures to support an investor's understanding of the financial statements, including in areas they determined as having the most significant impact on the amounts recognized in the financial statements. Some companies also used terms that were inconsistent with the terminology applicable under IFRS. In addition, some companies referred to local guidance, the specific requirements of which were often unclear. Consequently, certain disclosures presented challenges to understanding the

nature of a company's transactions and how those transactions were reflected in the financial statements.

- Second, diversity in the application of IFRS presented challenges to the comparability of financial statements across countries and industries. This diversity can be attributed to a variety of factors. In some cases, diversity appeared to be driven by the standards themselves, either due to explicit options permitted by IFRS or the absence of IFRS guidance in certain areas. In other cases, diversity resulted from what appeared to be noncompliance with IFRS.

The diversity arising from the standards themselves was sometimes mitigated by guidance from local standard setters or regulatory bodies that narrowed the range of acceptable alternatives already permitted by IFRS or provided additional guidance or interpretations. This diversity also was mitigated by a tendency by some companies to carry over their previous home country practices in their IFRS financial statements.

While country guidance and carryover tendencies may promote comparability within a country, they may diminish comparability on a global level.

The next section includes a current comparison between the US GAAP and the IFRS. It is also included the items considered more transcendent by the two accounting bodies as they are the main developed projects

2.3. IFRS and. US GAAP: an actual comparison.

This section has been developed using the information contained in the document "*IFRS and US GAAP: similarities and differences"* published in October 2011 by PricewaterhouseCoopers LLP. It is not the intention to deeply study the whole of the differences between the two accounting sets, as changes are expected to come in several projects, as depicted below. Instead, this section leads the reader to a comprehensible framework of the current situation of the main projects carried out within the process of convergence.

The recent economic crisis highlighted the interdependency of global business and the financial and capital markets that make the necessity for one set of global accounting standards more apparent. As the own US SEC recognized the IFRS are better positioned to play that role. Nevertheless, in the US, companies are still focusing on overcoming the current crisis and the business context remains unfavourable. Couple this with the challenges relating to the inconsistent application of IFRS outside the U.S., and the cost of their implementation inside the U.S., results in more uncertainty about the application of the IFRS in the U.S.

However, and in order to understand deeply what efforts have to be faced by the IASB and FASB in this complex process, next it is included a comparison between the US GAAP and the IFRS.

The impact of the accounting changes due to the convergence between IFRS and US GAAP will be significant and will imply broad-based implications. Even without the full IFRS adoption, IFRS have already affected US GAAP. This effect will increase throughout the following years. Under the Memorandum of Understanding, both boards are working jointly to develop standards that will converge and improve IFRS and US GAAP in different areas. The standard setters modified their convergence strategy and prioritized their agendas during 2010 and 2011. They focus now only on a few projects, postponing several other projects, but not abandoning them.

Priority joint projects are financial instruments, revenue recognition and leases. As the boards want to improve the final standards, they have agreed to re-expose the exposure drafts for revenue and leases, expecting to issue the final standards in the second half of 2012. The financial instruments project is effectively three projects: classification and measurement, impairment and hedge accounting, for which convergence has been more difficult to attain (expected in 2012 or later).

2.3.1 IFRS 1 -IFRS first-time adoption

It is clear that such a regulation does not exist in the US GAAP. Despite its content, which mainly orientates and facilitates the IFRS new adoption by a corporation,

experience with conversions in Europe and Asia indicates that are important underestimated challenges by companies making the change to IFRS, including:

Consideration of data gaps: the opening IFRS balance sheet may require the calculation or collection of information not previously required by the US GAAP.

Consolidation of additional entities: IFRS consolidation principles differ from those of US GAAP. It might cause some companies to consolidate entities that were not consolidated under US GAAP. Subsidiaries that previously were excluded from the consolidated financial statements are to be consolidated as if they were first-time adopters on the same date as the parent.

Consideration of accounting policies choices: a number of IFRS allow companies to choose between alternative policies. Corporations should carefully select the accounting policies to be applied to the opening balance sheet and have a full understanding of the implications to current and future periods.

2.3.2. Revenue recognition.

US GAAP revenue recognition guidance is extensive and includes a significant number of standards issued by diverse institutions and accounting bodies as the FASB, US SEC, American Institute of Certified Public Accountants[30] (AICPA) and the Emerging Issues Task Force[31] (EITF). The guidance tends to be highly detailed and is often industry-specific.

IFRS has two primary revenue standards and four revenue-focused interpretations. The broad principles laid out in the IFRS are generally applied without further guidance or exceptions for specific industries.

Due to the industry-specific US GAAP orientation, similar transactions (associated to revenue recognition) may have diverse treatment depending on the industrial sector they belong. Besides, meanwhile US GAAP is based on a fixed or determinable pricing criterion, which results in contingent amounts generally not being recorded as revenue

[30] Further details in http://www.aicpa.org/Pages/Default.aspx
[31] Further details in http://www.gasb.org/jsp/FASB/Page/SectionPage&cid=1218220137512

until the contingency is resolved, the IFRS look to the probability of economic benefits associated with the transaction flowing to the entity and the ability to reliably measure the revenue in question, including any contingent revenue. This could lead to differences in the timing of revenue recognition, with revenue potentially being recognized earlier under IFRS.

Two of the most common revenue recognition issues relate to:

- the determination of when transactions with multiple derivables should be separated into components, and
- the way revenue gets allocated to the different components.

US GAAP guidance has recently changed in this area. Although the new guidance eliminates a current difference between US GAAP and IFRS, i.e. the ability to estimate value based on cost plus a reasonable margin, another new difference is created: the elimination of the residual method under US GAAP.

Regarding the accounting for customer loyalty programs may result in different figures. Under IFRS there exists a requirement to treat these programs as multiple-element arrangements: consideration is allocated to the goods or services and the award credits based on the fair value through the eyes of the customer. US GAAP applies the incremental cost model that differs from the multi-element approach. Generally, IFRS result in the deferral of more revenue.

US GAAP prohibits use the cost-to-cost percentage-of-completion method for service transactions. Instead, the service transactions are accounted under a proportional-performance model (except for construction or production contracts). IFRS requires use of the percentage-of-completion method in recognizing revenue in service arrangements.

The joint FASB/IASB revenue recognition project employs an asset and liability approach and determines when revenue is earned through a single contract-based model where revenue recognition is based on changes in contract assets (rights to receive consideration) and liabilities (obligations to provide a good or perform a service). The

revenue is the recognized when the performance of the obligation is satisfied. Entities applying the proposed model would follow a five-step process:

i. identify the contract with a customer,
ii. identify the separate performance obligations in the contract,
iii. determine the transaction price,
iv. allocate the transaction price to the separate performance obligations, and
v. recognize revenue when each performance obligation is satisfied.

2.3.3. Expense recognition

2.3.3.1. Expense recognition - share-based payments

IFRS and US GAAP are very similar in this concern from a general point of view. However, differences arise at application level. The broader scope under IFRS leads to differences associated with awards made to nonemployees, affecting both the measurement date and total value of expense to be recognized. In this sense, companies that adopt IFRS will apply a single standard to all share-based payments, regardless of whether the counterparty is a nonemployee.

Differences within the two frameworks may result in differing grant dates and/or different classification of an award as a component of equity or as a liability. Once an award is classified as a liability, it has to be reassessed to fair value at each period through earnings, which introduces earnings variability and affects balance sheet metrics and ratios. Besides, certain types of awards are likely to have equity-versus-liability classification conclusions under the two frameworks.

In addition, issuers of awards with graded vesting (e.g., awards that vest ratably over time, such as 25 percent per year over a four-year period) may encounter accelerated expense recognition and potentially a different total value to be expensed under IFRS.

The deferred income tax accounting requirements for share-based payments vary significantly from US GAAP. Companies can expect to have greater variability in their effective tax rate over the time of share-based payment awards under IFRS. The

variability is driven by the requirement to remeasure and record through earnings the deferred tax attributes each reporting period.

The proposed guidance in this concern is still to be defined. The IFRS Interpretation Committee decided in March 2011 not to add this issue to its agenda because addressing the Committee's concern would require an amendment to IFRS 2. Instead, the Committee recommended including it in a future IASB agenda proposal for IFRS 2.

2.3.3.2. Expense recognition - employee benefits

There are important differences between US GAAP and IFRS in regard to record for pension and other postretirement and postemployment benefits. Some differences will result in less earnings instability, while others will result in greater earnings instability. The net effect depends on the individual facts and circumstances for a given company. The FASB and the IASB use the term postemployment differently:

- The IASB uses the term postemployment to include pension, postretirement, and other postemployment benefits.
- The FASB includes in the term postretirement the postretirement benefits, other than pensions and other postemployment benefits, and the term postemployment benefits to include benefits before retirement.

Under IFRS, enterprises can adopt a policy that would allow recognition of gain/losses in other comprehensive income statement, thus no subsequently recycled through the income statement, reducing the volatility of the pension expense. Other policy elections available under IFRS are similar to those under US GAAP, but recently these elections have been removed by the publication in June, 2011 of the amendments to IAS 19.

US GAAP permits the use of a calculated asset value in the determination of expected returns on plan assets. IFRS prohibits the use of a calculated value and requires the actual fair value of plan assets at each measurement date be used.

Under IFRS companies are allowed to present components of net pension cost within different line items on the income statement. This flexibility can result in different

classifications of a plan as a defined benefit or a defined contribution plan under IFRS and US GAAP, thus generating differences to the balance sheet presentation.

The IASB amendment to IAS 19 *Employee benefits* includes significant changes to the recognition, presentation and disclosure of long-term employee benefit plans. The FASB's project in this area is not active, but the board is monitoring the IASB work. The IASB has indicated an intention to perform a comprehensive review of defined benefit accounting including measurement issues. The timetable for the review has not yet been set.

2.3.4. Assets

2.3.4.1. Nonfinancial assets

There exist some significant differences under IFRS and US GAAP concerning guidance to nonfinancial assets: intangibles, property, plant and equipment, inventory and investment property, containing potential far-reaching implications.

IFRS permits the revaluation of certain nonfinancial assets to fair value, whereas US GAAP generally does not.

Impairment recognition might be earlier under IFRS as they require the use of entity-specific discounted cash flows or a fair value measure in tests for recoverability of an asset. By comparison, US GAAP uses a two-step model that begins with undiscounted cash flows. It can make a difference in whether an asset is impaired. Additional differences exist, such as what qualifies as an impairment indicator or how recoveries in previously impaired assets are treated.

The recognition and measurement of intangible assets could differ significantly under IFRS. With limited exceptions, US GAAP prohibits the capitalization of developments costs, whereas development costs are capitalized under IFRS if certain criteria are met.

Under US GAAP, indefinite-lived intangible assets shall be grouped only with other indefinite-lived intangible assets; under IFRS, the impairment test likely will be performed at the cash-generating unit (CGU) level.

IFRS prohibits the use of the last in, first out (LIFO) costing method to assess the inventories. US GAAP permits it.

Both boards are currently developing the lease guidance and they are expected to issue a final standard in 2012, which would significantly change lease accounting.

Spin-off transactions can result in significantly different income statement implications under the two frameworks. US GAAP accounts for spin-off transactions based on the carrying value of the nonmonetary assets, with the distributions recorded against owner's equity and no gain/loss recorded in income (despite the possible impairments). IFRS requires that dividends payable be recorded at the fair value of the nonmonetary asset to be distributed. Upon settlement, the difference between the carrying value of the dividend payable and the carrying amount of the nonmonetary assets, if any, is recorded in the income statement.

2.3.4.2. Financial assets

The FASB and IASB are working in a joint project on financial instruments that is intended to address the recognition and measurement of all financial instruments, including impairment and hedge accounting. The new guidance will replace all of the FASB's and IASB's respective financial instruments guidance. Timing points from 2013 to 2015 the earliest.

Currently under US GAAP the legal form of the financial asset drives the classification. Not under IFRS which drives the classification attending to the nature of the instrument.

Financial assets carried at amortized cost also differ: both IFRS and US GAAP use the effective interest rate method. Under IFRS, the effective interest rate based on estimated future cash payments or receipts through the expected life of the financial instrument. Under US GAAP, generally the effective interest rate is calculated based on the contractual cash flows through the contractual life of the financial asset.

For available-for-sale debt instruments, the impairment models for financial assets may result in different impairment triggers and different impairment measurement criteria.

Additional differences around reversals of impairment losses and impairment of equities also must be considered.

Potentially write-off financial assets fundamentally differ under the two frameworks:

- Under US GAAP, derecognition can be achieved even if the transferor has significant ongoing involvement with the assets, such as the retention of significant exposure to credit risk.
- Under IFRS, full derecognition can be achieved only if substantially all of the risks and rewards are transferred or the entity has neither retained nor transferred substantially all of the risks and rewards and the transferee has the practical ability to sell the transferred asset.
- Under IFRS, if the entity has neither retained nor transferred substantially all of the risks and rewards and if the transferee does not have the practical ability to sell the transferred asset, the transferor continues to recognize the transferred asset with an associated liability in a unique model known as the continuing involvement model, which has no equivalent under US GAAP.

2.3.5. Liabilities

2.3.5.1. Taxes

After releasing an exposure draft in 2009 and receiving comments thereon, the IASB decided to amend and narrow its project on income tax accounting. Next are some of the more important remaining differences between the two frameworks:

- US GAAP includes guidance for uncertainty in income taxes. Such guidance is not included in IFRS, though in the amended IASB's project on income taxes, accounting for uncertain tax positions is included.
- Under US GAAP, any income tax effects resulting from intragroup profits are deferred at the seller's tax rate and recorded upon sale to a third party. IFRS bases the recording on the buyer's tax rate at the time of the initial transaction.
- Under IFRS a single asset or liability may have more than one tax basis. Generally, there would be only one tax basis under US GAAP.

Presentation differences related to deferred taxes could affect the calculation of certain ratios from the face of the balance sheet -including a company's current ratio- because IFRS requires all deferred taxes to be classified as noncurrent.

2.3.5.2. Nonfinancial liabilities

Under both frameworks, there exists a difference in the interpretation of the term "probable". US GAAP defines it as "likely to occur", meanwhile IFRS refers to it as "more likely than not". This could lead companies to record provisions earlier under IFRS and it might also lead to increased or earlier expense recognition.

Concerning restructuring provisions, prior communication to employees is only required under US GAAP, thus earlier recording could happen under the American framework. At the same time, IFRS does not have the concept of an ongoing termination plan, whereas severance is recognized under US GAAP once probable and reasonably estimable. This could lead companies to record restructuring provisions in periods later than they previously would have under US GAAP.

Threshold for recognition of reimbursements for recognized losses by requiring that they be virtually certain of realization is higher under IFRS.

In February 2010, the IASB published a working draft of a proposed new IFRS titled Liabilities that would introduce significant new recognition and measurement differences between IFRS and US GAAP. The timing of any new guidance in this area is unclear so far.

2.3.5.3. Financial liabilities and equity

The US GAAP definitions or requirements for the classification of an instrument as financial liability is narrower under US GAAP, which results in more instruments being considered as equity than under IFRS.

For hybrid instruments that contain equity conversion options, IFRS generally require split accounting of the equity conversion feature and the debt host. Under US GAAP there are circumstances that also require split accounting, but there exist circumstances

under which a singular accounting model is followed. It can create a significantly different balance sheet presentation while also influencing earnings, mainly due to recognition expense at the market rate at inceptions as opposed to any contractual rate within the compound arrangement.

Differences exist concerning financial liabilities carried at amortized cost. Both frameworks use the effective interest method using the effective interest rate calculated at initial recognition of the financial instrument. Under IFRS, the effective interest rate is calculated based on estimated future cash flows through its expected life. Under US GAAP, the effective interest rate is generally calculated based on the contractual cash flows through the contractual life of the financial liability.

Joint project on this area is delaying for both financial instruments classified as liabilities and financial instruments with characteristics of equity. Views from the stakeholders are sought and, as both boards have acknowledged, they do not have the capacity currently to devote the time necessary to deliberate the project issues.

2.3.6. Consolidation

IFRS is a principles-based framework. IFRS states indicators of control, some of which individually determine the necessity to consolidate. However, when control is no apparent, consolidation is based on an overall assessment of all the relevant facts. The provided indicators help the issuer company in making that assessment. Under IFRS consolidation is required when an entity has the ability to govern the financial and operating policies of another entity to obtain benefits.

US GAAP has a two-tiered model for consolidation: one focused on voting rights and the second focused on a qualitative analysis of power over significant activities and exposure to potentially significant losses or benefits. Even in cases for which both frameworks look to voting rights to drive consolidation, differences can arise including cases in which de facto control exists and how the two sets of rules address potential voting rights.

While under US GAAP it is allowed to apply different accounting policies within a consolidation group (due to certain specialized industries), this exception does not exist under IFRS.

For jointly controlled entities, the proportional method is permitted under US GAAP. The recently published IFRS 11 *Joint arrangements*, eliminates this choice.

2.3.7. Other accounting and reporting topics

In addition to the areas previously discussed, differences exist in multitude of other standards, including translation of foreign currency, calculation of earnings per share, disclosures concerning operating segments, and discontinued operations treatment. However, both frameworks are largely converged in the business combination area: both standards are close in principle and language, with two major exceptions: full goodwill and requirements concerning recognition of contingent assets and contingent liabilities.

IFRS currently contains a different definition of a discontinued operation than does US GAAP. Requirements under the latter are broader.

It is important to remark at this point that regardless the U.S. SEC's decision to incorporate IFRS into the US financial reporting system, ongoing convergence projects (financial instruments, hedge accounting…) and new standards will change and influence beyond financial reporting. Contract terms, tax policy and cash flow, financial planning, systems requirements, communications with stakeholders are some of the areas will change. Couple this with the new regulation caused by the financial crisis, and the continued global adoption of the IFRS, will result in an extended period of changes for corporations.

3. XBRL: implementation and precedents, what is XBRL, main characteristics & key elements.

eXtensible Business Reporting Language (XBRL) is the new international standard for financial data interchange widely deployed (Valentinetti, Rea 2011). According to The Futurist, XBRL is one of seven cutting-edge technologies that will have a big impact on business and revolutionize corporate performance, as pointed out by Baldwin (Baldwin, Trinkle 2011). The Securities and Exchange Commission (SEC) has forced U.S. companies to publish their accounts in XBRL, starting with large companies in mid-2009. Other countries have similar plans, such as the UK, where thousands of companies are presenting their filings in XBRL, which became mandatory in 2011. In Asia, XBRL has an early adoption in the capital markets of China, Japan, Singapore and South Korea, forcing these countries to use XBRL. The governments of Australia, the Netherlands and New Zealand have made commitments for reducing the burden of corporate compliance using XBRL as part of the efforts included in the financial reporting standard.

Focusing on Spain, XBRL was promoted by the Bank of Spain[32], the Spanish National Market Securities Commission[33] (CNMV), recommended by the Spanish Accounting

[32] Bank of Spain is integrated in the Eurosystem, is the national central Bank and supervisor of the Spanish banking system http://www.bde.es/webbde/es/

[33] The *Comisión Nacional del Mercado de Valores* (CNMV) is the Spanish government agency responsible for regulating the financial securities markets in Spain. It is an independent agency that falls under the Ministry of Economy and Finance of Spain. http://www.cnmv.es/index.htm

and Business Administration Association[34] (AECA), and, of course, the Spanish XBRL Association[35], among others.

Under the Mercantile Registry regulations, electronic filings were covered by Article 366.2 of the existing regulations of the Mercantile Registry, as approved by Royal Decree 1784/1996 of July 19. It was the subject of the development of the Instruction of the General Directorate of Registrars and Public Notaries[36] of May 26, 1999, later extended with the electronic filing on December 30 of that year (Boletín Oficial del Estado 1996)

This electronic approach was generally accepted, not only in the light of the new possibilities offered by the quick evolution of technology, but by the need to adapt the systems as required by Directive 2003/58/EC of the European Council and Parliament of July 15 amending the previous Directive 68/151/EEC (Official Journal of the European Union 2003). It establishes the obligation for EU member states to ensure for the companies and other required individuals to publish, among others, the accounting records for each financial year through electronic means from January 1, 2007. This demand is fully consistent with the regime of electronic access for citizens to public services approved by Law 11/2007 of 22 June (Boletín Oficial del Estado 2007a).

On June 2006, the Spanish Senate, in a formal motion, asked the government to promote the use of XBRL in collaboration with regional and local governments and the private sector.

The motion, that passed unanimously, also required the government to create an appropriate body for the development of taxonomies to enable Spanish companies and public authorities adopting the use of XBRL. The Senate motion was preceded by a

[34] The *Asociación Española de Contabilidad de Administración de Empresas* (AECA) is the issuing profesional institution of Generally Accepted Accounting Principles and Standards, pronouncements and studies on best practices in corporate governance in Spain. http://www.aeca.es/

[35] The aims of the Spanish XBRL association are the implementation, adoption and development of the XBRL. http://www.xbrl.es/asociacion/asociacion.html

[36] As well referred to as the Ministry of Justice's Directorate-General of Registries and Notarial Affairs http://www.mjusticia.es/cs/Satellite/es/1215197982464/Estructura_P/1215198295156/Detalle.html#id_1215198053502

successful introduction of XBRL by the Bank of Spain (Boletín Oficial del Estado 2004) and the CNMV (Boletín Oficial del Estado 2005).

On February 10, 2009, the Government of Spain published in the Official State Bulletin (BOE) the Ministerial Order JUS/206/2009[37] concerning the filing of separate annual financial statements under the new Spanish GAAP. This Order refers to the XML taxonomies, which actually refers to XBRL, as specified in the technical annexes[38] that contain all the details for the presentation. It has two main purposes: in the first place, to reduce the burden caused by the compulsory annual filings and, in second place, to include Spain in the international standardization process and, in particular, in the European standardization process (Boletín Oficial del Estado 2009).

Besides, Law 16/2007 of 4 July, for the reform and adaptation of commercial law in accounting issues for international harmonization based on the European Union regulations, helped the implementation of XBRL in Spain (Boletín Oficial del Estado, 2007b). It introduced among others, major changes in the structure and content of the standalone financial statements and other information that companies must provide (Boletín Oficial del Estado 2007b).

This has led to a need to adapt the templates of the documents that required companies must submit to the Mercantile Registry[39], based on the templates defined on the third part of the Spanish GAAP (Royal Decree 1514/2007 of November 16) and the Spanish GAAP for SMEs (Royal Decree 1515/2007 of 16 November). The aim of the adaptation is to obtain an easier understanding of their content and improve the simplification of the whole process, information storage and publication by the Mercantile Registry as set out in the first final provision of the law mentioned above.

[37] The mentioned Order has been recently complemented with the publication of the Ministerial Order JUS/1698/2011, of June 13, approving the models for presentation on the Mercantile Registry of the consolidated financial statements.

[38] Annexes modified by Orders JUS/1291/2009 of January 28, and resolutions from the General Directorate of Registrars and Public Notaries of April 6, 2010 & February 28, 2011 respectively.

[39] The *Registro Mercantil* is an administrative institution which aims the advertising of legal positions of the employers on this list https://www.registradores.org/mercantil/jsp/home.jsp

The approved templates have a dual mode: traditional paper presentation or the latest, in accordance with the progress of technology, electronic filing which, moreover, facilitates the transmission through electronic means.

The delay in the clarification of the European regulations regarding business combinations and consolidation of the financial statements, pull that the Spanish GAAP entered into force on January 1, 2008 without the approval of a Royal Decree, which revised the standards for the elaboration of the consolidated financial statements approved by the Royal Decree 1815/1991 of December 20. Nevertheless, Law 16/2007 of July 4, Commerce Code, and standard number 19 for registration and assessment of business combinations, ruled some aspects of the accounting techniques concerning consolidation, or aspects that could be brought to bear by analogy on this process. Therefore, it was possible to elaborate the consolidated financial statements during these years with an adequate degree of juridical safety, having as a reference the doctrine from the Spanish Institute of Accounting and Accounts Auditing[40] (ICAC) included in the Note published on its Bulletin number 75, of September, 2008. As stated in the mentioned Note, making this decision, considered the consolidation criteria contained in the Spanish Commerce Code and its unrepealed provisions, conforming an adequate and sufficient regulatory system for the elaboration of the consolidated financial statements, being very similar to the international standards in force in that precise moment.

On June, 2009 was approved the Commission[41] Regulations (EC) No 494/2009 and 495/2009 of June 3, 2009 modifying the Commission Regulation (EC) No 1126/2008 of 3 November 2008 adopting certain international accounting standards in accordance with Regulation (EC) No 1606/2002 of the European Parliament and of the Council,

[40] The Instituto de Contabilidad y Auditoria de Cuentas (ICAC - Institute of Accounting and Accounts Auditing) is an independent body attached to the Ministry of the Economy and Taxes, regulated by the Accounts Auditing Act 19/1988, dated 12 July, Royal Decree 1636/1990, dated 20 December, by which it is implemented, and Act 44/2002, dated 22 November, on Measures for the Reform of the Financial System, which amends various articles of Act 19/1988.
More info http://www.icac.meh.es/seccion.aspx?hid=2

[41] The European Commission is the executive body of the European Union. The body is responsible for proposing legislation, implementing decisions, upholding the Union's treaties and the general day-to-day running of the Union. More info http://ec.europa.eu/index_en.htm

concerning IAS 27 Consolidated and separate (standalone) financial statements, and IFRS 3 Business combinations, among others.

Entry into force of such regulations has identified a new set of principles for listed companies in formulating their consolidated financial statements for financial years beginning on or after January 1, 2010. This circumstance suggests addressing the review of the standards for the preparation of consolidated financial statements in order to make available to the other companies an accounting framework harmonized with Community law.

This review has been recently implemented in the Ministerial Oder JUS/1698/2011 of June 13, approving the model for presentation at the Mercantile Registry of the consolidated financial statements. The model adopted has a dual mode, as used for the presentation in the traditional paper-based or in electronic format (also known as digital), facilitating the electronic presentation. This form continues the already established format by the Ministry of Justice JUS/206/2009 Order of January 28, incorporating XBRL taxonomy, in order to minimize the reporting burden, which falls upon incorporated companies, and to include Spain in the global standardization process that uses this standard as the electronic standard for the financial information. The official version of the taxonomy, open and freely accessible, will be available to all stakeholders in the website of the Institute of Accounting and Accounts Auditing (ICAC)[42].

As the Spanish Professional College of Registrars anticipated, the use of XBRL, as the digital standard for the presentation of the annual statements, is now mandatory in Spain.

3.1. WHAT IS XBRL?

XBRL is not only a subject of Information Technology (IT). It improves the efficiency of the markets and information flows between social and economic agents. These

[42] http://www.icac.meh.es/Taxonomia%5CPgc2007%5CTaxonomia.aspx

benefits derive from its characteristics of flexibility, integrity and speed (Quetglás 2006).

XBRL is a XML[43]-based vocabulary for electronic transmission of business and financial data. XBRL is an open standard maintained by XBRL International, a global-non profit consortium of over 550 major companies, organizations and government agencies and it is compound of about 27[44] jurisdictions worldwide.

XBRL was created to assist in the markup of the commonly reported business facts using a consistent methodology, in order to translate the accounting information into a machine-readable language. Therefore, computers are able to communicate accounting information while identifying the concepts and facts.

The aim of XBRL is to standardize the structure, content and representation of data, so the same piece of data means the same in any language and to any computer, person or organization.

Traditionally, one of the solutions to incorporate others application's data (or external organization's data) has been the exportation to an *American Standard Code for Information Interchange* file (ASCII) - where delimiters separate each data field - in order to import the ASCII file later on the application that is going to incorporate the external data. This solution is time consuming because it is frequent that modifications are requested, because the exportation delimiters are frequently not recognized by the importer application.

The need of a digital standard for the electronic transmission of the accounting information is accentuated when integrating different annual statements from various different formats: paper documents, PDF (Portable Document Format), XLS (Microsoft Excel), HTML (HyperText Markup Language), DOC (Microsoft Word), etc. Integration of documents is a very time consuming task that decreases the time available for

[43] Extensible Markup Language (XML) is a flexible way to create common information formats and share both the format and the data on the World Wide Web, intranets, and elsewhere.
[44] Information updated May, 17 2011, from http://www.xbrl.org/jurisdictions.aspx

analyzing the information, in addition to the likely errors committed while gathering the information required.

This new digital standard or Business Report Language (BRL) or financial standard should provide for:

- Human and software agent use.
- Information disclosures mandated by national and/or international regulators complying with the corresponding set of standards.
- Financial and non-financial disclosures.
- Multiple languages, including automatic translation of primary accounting nomenclature and multiple currencies.
- A common set of accounting nomenclature with pointers to national/regional differences.
- Attestation by auditors or other information quality intermediaries of complete reports or parts of reports.

The BRL should be based on open standards. Any specifications for the standard should be in the public domain and subject to license-free usage by interested parties (such as national regulators): XBRL complies with all this requirements theoretically.

XBRL provides an identifying *tag* for each individual element or item of data, so it can be easily understood and processed by computers, instead of treating the financial information as a whole block of text, as in a traditional paper document or web page. The *tags* enable automated processing by the computer's software recognising the information contained in the XBRL file, thus facilitating their processing and analysis. XBRL greatly increases the speed of handling of financial data, reduces the chance of error and permits automatic checking of information.

XBRL has been created to facilitate the electronic exchange of business reporting data across various computer platforms in a free and open manner, as it is free of licence fees

and publicly accessible. Besides, XBRL facilitates *Business Intelligence*[45] (BI) automation by enabling machine-to-machine communication and data processing of financial information.

XBRL is one of a family of eXtensible Markup Languages (XML). XML has become the standard language for exchanging data over the Internet as foreseen by Amagasa (Amagasa, Yoshikawa et al. 2000) .

XBRL has been developed for business reporting purposes. Under XBRL, financial information is tagged in order to be easily processed and understood by computers, e.g., the asset *Land* need to be tagged as follows: <Land>20000</Land>. The word *Land* together with brackets "<" and ">" is called *tag*. There exist *opening tags*: <…> and *closing tags*: </…>. Between the *opening* and *closing tag* there is a value.

What computers will understand from the previous example is that something called *Land* has the content "20000". However, how do computers know what the asset *Land* means?

At this point is necessary to use computer science concept of *metadata*. Briefly explained, *metadata* is data about data. The computer has to be instructed about what kind of values could be assigned to the term Land and how it should understand this concept. In order to do so, the programmer will have to provide the computer with data including pertinent information regarding the concept Land to be adequately handled by the machine.

Following the previous example, from the accountancy point of view, *Land* has to have a monetary value. The machine knows it by setting the `type` attribute to `monetary` value (see section 3.2.1. Element).

In the same way, the machine has to be told that *Land* balance nature is debit. The programmer has to explain to the machine the basic rule of double entry accounting where Assets and Expenses have normal balance of a `debit` while Equity, Liabilities

[45] Business intelligence includes different technologies as data mining, business performance management, text mining… http://en.wikipedia.org/wiki/Business_intelligence

and Revenues have a normal balance of a `credit` setting the `balance` attribute accordingly (see section 3.2.1. Element).

Besides, another characteristic of *Land* is that it is included within the assets and it is available to a corporation at a particular point in time. Therefore, the machine has to know that *Land* appears on the balance sheet, which is a snapshot of an entity's financial position at a specified date: `instant`. In this sense for the machine, a *`flow`*, which occurs during a period, is the opposite of a resource presented at a point of time (see section 3.2.1. Element).

The description above shows that information about three characteristics must be provided to a computer so that it can understand <`Land`> in an accounting manner. Other elements or concepts may need more/less characteristics to be informed to the machine in order to be adequately "understood" by the computer.

In accountancy, there are many concepts that could be described using XBRL. Of course, XBRL not only indicates computers what Land is. Moreover, XBRL allows the inclusion of different regulations concerning financial reporting which means that the definition of Assets under IFRSs could be different to the one provided by some national GAAP.

Therefore, XBRL permits to describe interactions between financial concepts for each domestic regulation of GAAP. This is to define whether or not there is any relation between Land and for example Payables and if there is, how it looks in terms of accounting knowledge and create references for elements to express to which accounting act they apply to. XBRL uses a technology called XML Linking (XLink[46]) to do that.

Finally, and in order to summarise this introduction, and once XBRL is fully established the following benefits will be fully available:

I. Cost savings: less manual entry and greater opportunities to automate tasks.
II. Improved data accuracy: less manual entry, data cleansing and human error.

[46] Or extended links.

III. Accelerated processes: greater efficiency in data entry, publishing, reporting, sharing and analysis.

IV. Greater transparency: easier and more standardized exchange of business information; less time devoted to creation means more time available for analysis and decision making

The following section describes the components of XBRL and the interactions among them to better understand how XBRL works.

3.2. COMPONENTS OF XBRL

Briefly, the current epigraph includes an explanation of the concepts included in these key XBRL features:

- information on what Land is and how a computer should treat it, is provided in schema files[47] (*taxonomy;* see section 3.2.2);
- relationships are described in *linkbases* which are segregated into different categories depending on what is described and how it is done (*taxonomy*);
- values between tags (for example `<Land>20000</Land>`) are found in *instance documents*.

The following graph includes the different elements, the interactions among them and the structure of a XBRL documents set.

[47] Schema files contain the description of the structure of a document

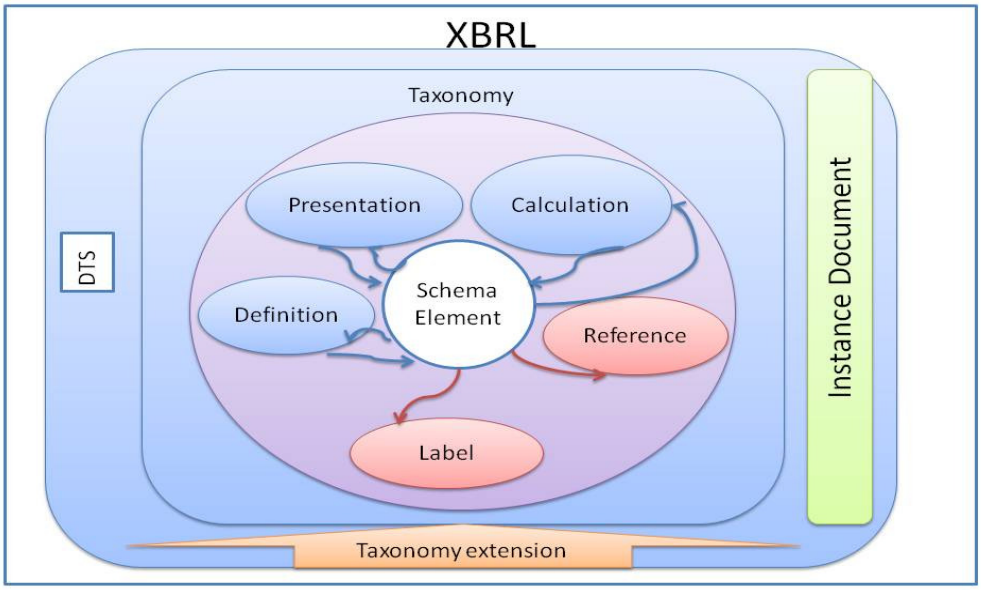

Figure 5. Based on http://www.ifrs.org/XBRL/Resources/Fundamentals.htm

3.2.1. Element

A XBRL element (see section 4.1. Elements) is a *business concept* (such as Assets, Liabilities, Income…) presented to a computer in a way that the machine could learn its main characteristics. To achieve this, definitions of elements, which appear in schemas (see section 3.2.2.1. XBRL Schema), are constructed according to a specific set of rules. The elements (<element>) are used to define reporting concepts: cash, payables, etc.

Elements always have:

- a `name` (1)[48], which identifies the concept,
- a `type` (2), which describes the kind of Values for the concept (`item`, `monetary`, `string`, `boolean`…). The `type` can also point to a complex type indicating that the element is a container for other concepts (`tuple`).
- a `substitutionGroup` (3), which defines that the element can appear where the substituted element is.

In addition, optional attributes for elements are:

[48] Numbers in brackets are only included for explanation purposes. They are not part of the XBRL syntax.

- `id` (4): used to uniquely identify a concept. `id`'s have to be unique within a XBRL taxonomy file.
- `balance` (5): used for concepts representing a monetary fact. It says if the concept will normally have a `debit` or `credit` balance. There are only two options for balance.
- The "`true`" value for the attribute `nillable` (6) indicates that the element can have a null value
- The "`instant`" value for the `periodType` (7) attribute sets that the concept value is just valid for a determined moment and it is not valid for a period of time ("`flow`").

Example

```
(4)<element id="bc_Building" (1)name="Building"
 (2)type="xbrli:monetaryItemType" (3)substituionGroup="xbrli:item"
 (6)nillable="true" (5)xbrli:balance="debit"
 (7)xbrli:periodType="instant"/>
```

3.2.2. Taxonomy

A taxonomy consists of the core part which is a schema (or more schemas) and linkbases. If you compared it to the physique of a spider, the schema would be its head and trunk (where all the major organs are situated) and the linkbases would be its limbs. Of course, a schema could exist without linkbases in the same way as that a spider could live without limbs, but in order for the spider to survive and for the taxonomy to be optimal, both parts of the body are necessary.

The purpose of a XBRL taxonomy document is to define the concepts for a business report (elements) and the relationships between the concepts. It is similar to the fifth part of the Spanish GAAP[49] where account definitions and the relations among them are included. There are two parts to an XBRL taxonomy document:

[49] or Plan General Contable.

- The first part contains the definitions of the concepts used in the business report: XBRL schema.
- The second part contains both, the relationships among concepts and between concepts and other resources: XLinks (Schipper 2005).

Therefore, a taxonomy can be acknowledged as a dictionary of concepts. Concepts in taxonomies are used by instance documents[50] to communicate fact values. The taxonomy usually comprises a number of physical XML files that define XBRL concepts.

Taxonomies are supplemented by additional information contained in the linkbases. The linkbases are classified in two different types:

- *Relation* type linkbases contain relation information: presentation, calculation, and definition.
- *Resource* type linkbases contain additional information: labels and references.

Next, the explanation of the different parts forming taxonomies.

3.2.2.1. XBRL Schema (part of the taxonomy)

XBRL schema stores information about taxonomy elements (their `names`, `id`'s and other characteristics), as a XML schema document[51]. Each one lists the elements and describes the kind of content that can be associated with the element. Moreover, the taxonomy includes the description of the relations among these elements through the linkbase files. XBRL provides with an exhaustive detailed description of the structure of the document through its syntax. The machine has a clear picture of how to interpret the values that will constitute a specific XBRL report. Therefore, the main purpose of XBRL schemas is to provide the computer with information on how it has to represent and process the accounting terms (elements), e.g. Cash, Payables, etc. XBRL schemas are files with the extension .xsd

[50] See section 3.2.3. Instance documents
[51] File that the describes the structure of a XML document.

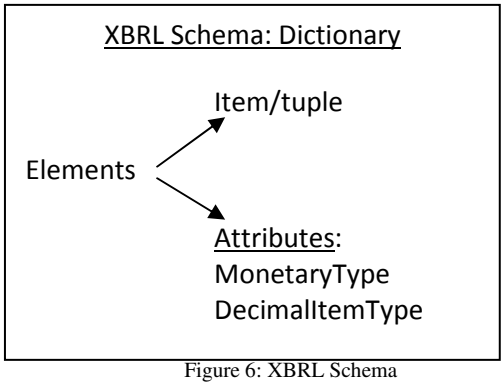

Figure 6: XBRL Schema

An example of how the elements are declared in a taxonomy is included in the annex 1

3.2.2.2. Linkbases (part of the taxonomy)

Linkbases are used to extend the information about concepts (elements) and capture the relationship data. Linkbases are collections of *extended links* (XLinks), and they provide the computers with further information about the meaning of the concepts by expressing relationships among them (inter-concept relationships) and by associating concepts to their documentation (Lara, Cantador et al. 2006). It is a network of relations. An extended link is used to separate and classify relations into different networks if needed for processing of say calculations or for the convenience of the taxonomy creator to make the taxonomy more visually appealing. XLink Linkbases are files with the extension .xml.

3.2.2.2.1. How links relate to concepts

XLinks have two components:

- XLink defines locators `<loc xlink:type="locator">` which identifies or locates the reporting concept (`<element>`) within a taxonomy file. It consists of two parts separated by a hash (#): the first part is the name of the file that contains the element to be referenced by the locator, and the second part refers to the specific element in the file (`id`). Locators have label attribute to identify them for use in an arc.

- Arcs use the labels of the locators to link them: the “from” locator label with the “to” locator label.

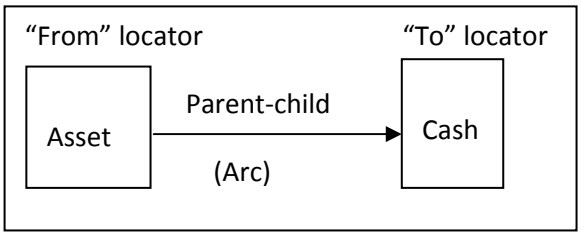

Figure 7: Description of a XLink

Extended links are usually placed inside a <linkbase> element in a separate file (.xml extension). <linkbase> element could be the root element of that file.

It is considered good practice to separate the relationships from the concepts definitions. This makes it easier to extend and to reuse taxonomies. It is also a good idea to put each of the types of relationship in separate relationship files. This also helps its extensibility.

The five most common linkbases are classified by their function as follows.

3.2.2.2.2. Relational linkbases: defining relationships between concepts.

3.2.2.2.2.1. Presentation linkbase

These relationships define how concepts should be presented or displayed. Presentation arcs have the same attributes as definition links[52] plus the *order* attribute. This is used to indicate in which order the immediate children of an element should be displayed. They are expressed as arcs, but they do not define a relationship between two concepts. They contain relations such as parent-child that are exclusively used for presentation purposes e.g. a given element will be shown as the subordinate of some other.

An example of how the presentation linkbase is declared is included in the annexe 2.

[52] See section 3.2.2.2.1.3. Dimension/Definition linkbase

3.2.2.2.2.2. Calculation linkbase:

Define how concepts participate in summations, e.g. current assets and non-current assets sum up total assets. Calculation arcs work in much the same way as the definition links and have the same roles parent-child/child-parent.

It is a good practice to state both arcs changing the 'from' and 'to' attribute. The calculation arc is always interpreted as the child summing to the parent or an equivalency relation (the element is copied in the dimension and vice versa).

Arc Role Rules for Calculation Arcs	
Role	*Summation*
child-parent	The value of the "from" is summed into the value of the "to"
parent-child	The value of the "to" is summed into the value of the "from"
dimension-element	The value in the "to" is copied from one of the values in the "from" across all calculation arcs that have this arcrole and for the concept referenced in the "to"
element-dimension	The value in the "from" is copied into the value of the "to"

Table 4: Arc Role Rules for Calculation Arcs

Example for the parent-child: **Gross Profit = Total Revenue - Cost of Goods Sold**

```
<calculationArc xlink:type="arc"
 xlink:arcrole="http://www.xbrl.org/2003/arcrole/summation-
item"
 xlink:from="GrossProfit" xlink:to="RevenueTotal"
 order="1" weight="1" use="optional"/>

<calculationArc xlink:type="arc"
 xlink:arcrole="http://www.xbrl.org/2003/arcrole/summation-
item"
 xlink:from="GrossProfit" xlink:to="CostOfSales"
 order="2" weight="-1" use="optional"/>
```

The example shows that there are defined two calculation arcs providing details concerning relations between Gross profit, Revenue and Cost of Sales. In Income Statements, Gross profit is a difference between the other two.

Calculation roles have an additional attribute called *weight*. This indicates the multiplier to be applied to the child when summing up to the value. A *weight* of one means that a 100% of the value of the child is to be summed into the parent

For the role (or arc role) dimension-element/element-dimension the value is copied in the 'to' attribute.
An example of a calculation linkbase is included in the annexe 3

3.2.2.2.2.3. Dimension/Definition linkbase

This relationship defines how one element relates to another element. We state the inherent relationship existing between both elements. There are four standard arcroles from the XBRL specification:

http://www.xbrl.org/linkprops/arc/child-parent
http://www.xbrl.org/linkprops/arc/parent-child
http://www.xbrl.org/linkprops/arc/element-dimension
http://www.xbrl.org/linkprops/arc/dimension-element

Child-parent (parent-child) roles are used to create relationships where one concept is a generalization of another, e.g. assets and cash.

Element-dimension (dimension-element) expresses an equivalency relationship, e.g. breaking assets down by geography and again by product line: total assets by geography should be the same as total assets by product line.

3.2.2.2.3. Resource linkbases: adding information to an element.

3.2.2.2.3.1. Label linkbase

Labels allow including a human readable text in the elements. Elements have name attribute and ID's but these two attributes are intended for machines. The label will be displayed with the element on a report. To create a label it is necessary to create first a label resource (somewhat similar to locators). The label resource will contain the text of the label (`<label>`). It is not an element. Label resource provides with information in

natural language with the purpose of facilitating the understanding of data by a human user. XBRL is equipped with multilingual support and enables the user to associate labels in different languages to the same element.

To connect the label resource to the concept we need a <labelArc> element. It works exactly the same way as the definition, calculation and presentation arcs: linking the locator of the element with the label resource.

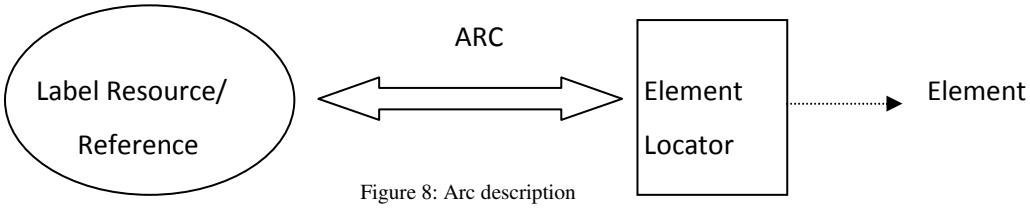

Figure 8: Arc description

Example:

```
<reference xlink:type="resource"
xlink:role="http://www.xbrl.org/2003/role/presentationRef"
xlink:label="CashFlowsFromUsedInOperationsTotal_ref">
        <ref:Name>IAS</ref:Name>
        <ref:Number>7</ref:Number>
        <ref:Paragraph>14</ref:Paragraph>
</reference>
```

3.2.2.2.3.2. Reference linkbase

References link a *resource* to an element. The *resource* in this type of linkbase could be a reference in a legal text (article, section, paragraph...). Reference linkbases provide some helping information to understand better or clarify the corresponding element. The element is linked to a reference in a published document (mainly authoritative statements). References work in a similar way as labels do.

A *reference* resource is created to contain the index information of where the authoritative text can be found in the published document. This *reference* resource is then related to the concept by means of a reference arc as the label arc. The major difference between the label and the reference is the content of the resource.

The locators, resources and arcs are usually placed under extended links. Extended links are used to contain the locators, resources and arcs needed to fully describe the relationships.

Therefore, the five kinds of extended links for XBRL taxonomies are:

<definitionLink>
<calculationLink>
<presentationLink>
<labelLink>
<referenceLink>

After having explained the components of the taxonomy, it follows the explanation of the instance document that contains the *economic facts*.

3.2.3. Instance document

The taxonomy defines reporting concepts but does not contain the actual values of facts based on the defined concepts. These values are included in XBRL instances (Lara, Cantador et al. 2006). Instances contain business-reporting data that is marked up based on the taxonomy elements specified in the taxonomy documents. Instance documents are files with .xbrl extension.

Taxonomy document + instance document = report

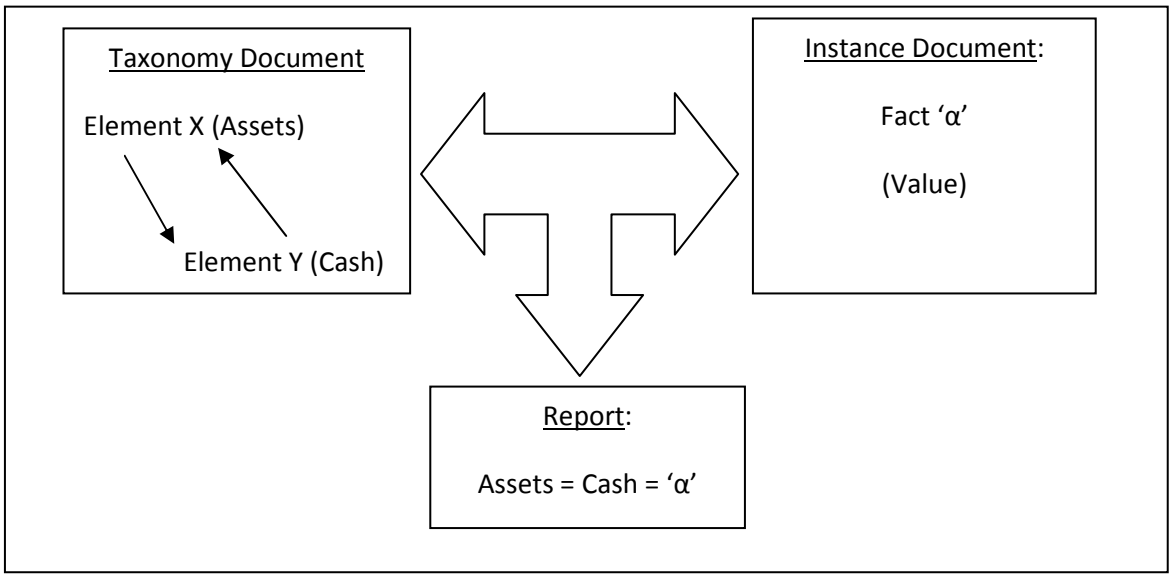

Figure 9: How a report is built in XBRL

An example of a fragment of an instance file is included in the annexe 4 and at this point, it is important to explain the following concepts included in the example:

The instance document includes the declaration of the facts detailed in the Consolidated Balance Sheet corresponding to the years 2008 and 2009 from Telefónica S.A. as presented before the U.S. SEC, but using the elements contained in the IFRS Taxonomy 2011 published by the IASB on March 25, 2011.

Regarding the facts declaration and reproducing as an example the first element in the referred document:

```
<ifrs:NoncurrentAssets decimals="0" contextRef=" S22009_A-28015865_icc" unitRef="EUR">84310549000</ifrs:NoncurrentAssets>
```

`ifrs`: is the namespace prefix

`NoncurrentAssets`: is the name of the element

`decimals`: indicates the number of decimals the figure will include (zero in this example)

`contextRef`: XBRL has been designed in order to allow the exchange and recombination of documents, so a determined fact does not lose its meaning when it passes on others hands. Therefore, it accompanies the fact with information that

contextualizes it. This information pretends to locate the data in a multidimensional context (period of time, issuer identification, etc) thus, the fact will be always correctly placed and understood under any circumstance (Quetglás 2006).

In the example above, the identifier for the context is composed by the year `2009` and the Spanish Tax Registration Number (called VAT number in other countries) of the Corporation: `A-28015865`.

`unitRef:` sets the currency (Euro).

The main benefits of having a taxonomy file separated from the instance file are:

- *Reuse*: in the future, creating additional business reports will only require a new instance file as the concepts and relationships, therefore the taxonomy, will stay the same.
- *Compatibility*: when a report uses concepts from the same taxonomy, we know that the values and facts are comparable.

3.3. XBRL limitations.

However, XBRL has already shown some limitations:

I.- The taxonomy should include validations that involve the evaluation of information items in different contexts, i.e. expressing some mathematical relation between the same information elements. However, the current XBRL specification does not allow for this kind of validation, and calculation links are defined between information items independently of their context.

II.- XBRL calculation links only allow for the summation of items. However, there are analytical values whose calculation from descriptive values is more complex, involving the use of other mathematical operators (Lara, Cantador et al. 2006). This situation has been partially solved through the FORMULAE[53] extension. This extension permits programmers to include any mathematical calculation. Although this extension is stable and has shown its validity, it is still narrowly applied. Besides, it only permits

[53] More info in www.eurofiling.info/data/presentations/9Workshop/VMorillaFormulaeBdE.ppt

calculations within the same taxonomy, not permitting sophisticated calculations among different taxonomies.

III.- A study developed in North Carolina State University in April 2009, which evaluated the accuracy of XBRL filings for 22 companies participating on the U.S. SEC's voluntary XBRL filing program, revealed multiple errors in signage, amounts, labelling, and classification and considered the errors as serious since XBRL data is computer-readable and users will not visually recognize the errors.(Bartley, Chen et al. 2010)

IV.- Another limitation of the XBRL regards the way links establish the relations between elements. XBRL taxonomies define and nest financial concepts through Linkbases. The Linkbase is a XML document containing XLink elements that define offline links, so no online relationships among elements are possible (García, Aguilera et al. 2006).

V.- XBRL tools have limitations for cross analysis, inherited from the technologies lying beneath.(García, Gil 2010), (García, Gil 2009).

An Ontology[54] provides with a layer of conceptual relations that may overlap a taxonomy. The ontology allows creating a logical net among the concepts, defining the internal structure of a complex element (tuple) and the degree of the relationship, among others.

Through an ontology it is possible to define in an easy way relations among concepts as belonging, or cardinality, or establishing equivalencies among different classes which would not be easy to define with Linkbases (García, Aguilera et al. 2006). More details about ontologies and Semantic Web technologies are provided in section 5.

[54]Ontology is a term borrowed from Philosophy and refers to the science that depicts the kind of entities in the world and how they are related to one another (Antoniou 2004), (Curras 2005).

4. eXtensible Markup Language (XML): What is XML, how it works …

In this chapter, it is included an overview of the basis of the eXtensible Markup Language (XML) to give a general idea to the reader in order to better understand how XBRL works. It is not the intention of this work to describe deeply all functionalities and characteristics of the XML, but it is explained why the XBRL is extensible and how this standard supports different languages (see section 4.10.4.). Besides the reader can get a glimpse of the limitations derived from this technology, which were previously discussed when explaining the XBRL limitations.

"XML is expected to become the next generation standard language for exchanging data over the Internet." (Amagasa, Yoshikawa et al. 2000). This idea is supported by many other authors (Tatarinov, Viglas et al. 2002), (Florescu, Kossmann 1999), (Deutsch, Fernandez et al. 1999). *Extensible Markup Language* (XML) is a simple, *very flexible text format* derived from SGML[55] (ISO[56] 8879). XML is a standard (Holzner 2000)(Holzner, 2000), not an implementation in the sense that *it is just a message format/syntax* to exchange information between machines, and it has not been designed for any other purpose or to overcome other technologies limitations (Holzner 2000).

Originally designed to meet the challenges of large-scale electronic publishing, XML is also playing an increasingly important role in the exchange of a wide variety of data on the Web and elsewhere. XML provide a tag-based syntax for data organization and apply mark-ups to documents.

XML consists of several components. The main ones are:

1. *Element*: is the basic form of the information content.
2. *Namespace*: is the scope or range of a determined group of elements.

[55] The Standard Generalized Markup Language (ISO 8879:1986 SGML) is an ISO-standard technology for defining generalized mark-up languages for documents. To know more about SGML visit http://www.isgmlug.org/sgmlhelp/g-index.htm

[56] The organization which today is known as International Organization for Standardization (ISO) began in 1926 as the International Federation of the National Standardizing Associations (ISA)

3. *Attributes*: adds extra information (characteristics) about an element.
4. *Processing instructions*: are commands or instructions given to the machine on what to do with the corresponding information.
5. *CDATA sections*: displays text blocks containing characters not to be analyzed or processed by the machine in any way.

Besides other components and facts that complete the XML syntax are later explained:

6. The *XML declaration*.
7. *Well-formed* XML documents; *non well-formed* XML documents.
8. *Valid* XML documents.
9. Comparing *DTD* and *XSD*.
10. *XSD elements*.

4.1. Elements

Elements typically form the majority of the content of an XML document. They are the basic information, i.e. the unit of the information. Elements have a name and may have children. Children may be other elements, processing instructions, comments, CDATA sections[57], or characters. Elements may have attributes as well. Meanwhile, children are ordered, attributes are not. Namespace declarations may be associated to the elements.

Elements are serialized, i.e. written in a text format, as a pair of tags: an *opening tag* is the less than character (<) immediately followed by the name of the element, which is the *tagname,* followed by the greater than character (>). The *closing tag* is the character sequence </ immediately followed by the tagname and the greater than character. Children of an element must be placed between the opening and closing tag.

Example

[57] The term CDATA, meaning character data, is used for distinct, but related, purposes in the mark-up languages SGML and XML. The term indicates that a certain portion of the document is general character data, rather than non-character data or character data with a more specific, limited structure. In an XML document or external parsed entity, a CDATA section is a section of element content that is marked for the parser to interpret as only character data, not mark-up.

```
<Person>
      <name>María</name>
      <age>39</age>
</Person>
```

In the example above, we define the element Person, which has two children, two other elements, *name* and *age* with the values of María and 39 respectively. The names of the elements (and attributes) are chosen by the creator of the XML document, but must respect some conventions: names must start with a letter or an underscore (_). The initial character may be followed by any number of letters, digits, number, periods (.), hyphens (-), underscores (_) or colons (:). However, colons should not be used as they conform part of the namespaces, so only can be used under determined conditions.

An empty element would have the following syntax:

```
<Age></Age>
```

Shortcut to declare empty elements:

```
<Age/>
```

4.2. Namespaces

Namespaces are the scope for all elements associated to it. They let distinguish between elements with the same local name but belong to different vocabularies. Remember that XML allows the creator (programmer) to choose the names for the elements.

Namespaces names are set in the start tag of the elements and are Uniform Resource Identifiers (URIs) and are unique, thus they do not need to be differentiated.

Example of syntax for namespace:

```
xmlns:prefix='URI'
```

A namespace declaration is in the scope for the element on which it is declared and all of that element's descendants. Name elements may be qualified (are in a namespace) or unqualified (they are not in any namespace).

Examples

Qualified

```
<pre:Person xmlns:pre='urn:example-org:People' >
      <pre:name>María</pre:name>
      <pre:age>39</pre:age>
</pre:Person>
```

Children have a prefix and are in the namespace (scope) 'urn:example-org:People'. Thus, they are *qualified*.

Unqualified

```
<Person xmlns='urn:example-org:People >
      <name xmlns=''>María</name>
      <age xmlns=''>39</age>
</Person>
```

Children have no prefix and they are not in any namespace. They do not belong to any scope, thus they are *unqualified*.

4.3. Attributes

Attributes are serialized (written as text) inside the start tag of the corresponding element. Attributes provide actual data about an element (extra information about the element). Attributes are written as name/value pairs separated by an equal sign (=).

Example

Data attributes

```
<Person name='María' age='39' />
```

In the example above the element person has two attributes name and age and no children elements as in the previous example. Attributes are used to include more information about the element where they are included. Attributes and namespaces have the same relation except for the unprefixed attributes, which are not in any namespace, even if a default namespace declaration is in scope.

There is a very important attribute *standalone*, which will set if the document can be parsed, or the data tree can built with just the own document (when standalone='yes'), or if the document need other external sources/documents to be parsed or to build the data tree (standalone='no'). The default setting is standalone='no', so it is rarely stated in the declaration as the majority of the documents will need external sources. It is

important to remark here that XBRL documents (explained in section 4.1.) will always need external resources (other documents) to be correctly managed, thus the *standalone* attribute will not be declared, i.e. *standalone*='no'.

4.4. Processing instructions (and comments).

Processing instructions

Processing instructions provide the information to the *application* (software) to process the XML document. A brief schema of an *XML application* is depicted in figure 10:

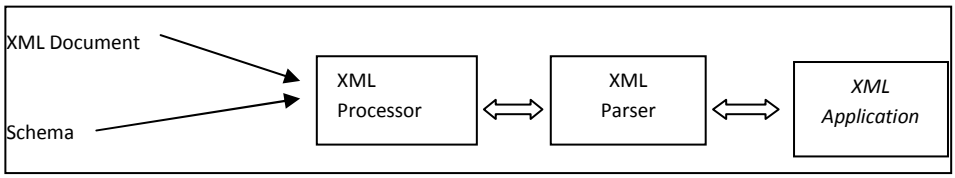

Figure 10: Description of the XMLapplication

The *XML processor* is the software that access to the content and structure of the XML document. The *XML parser* is a component needed by the processor to both, determine the structure of a XML document, and validate the document with a Document Type Definition (DTD) or XML-Schema[58]. The *XML application* uses a XML processor to access the content and structure of a XML document.

Processing instructions may include information about how to process the document, what has to be displayed, etc. The syntax is <?target data?>

Example

```
<?display table-view?>
```

In the example above the application is told to display a table.

Comments

[58] DTD and XML Schema are used to include restrictions in the structure of the content of the XML document. They will be explained below.

Comments are processing instructions that include human-readable information about the content of the XML document. Comments are not used to encode data. Comments begin with the character sequence <!-- and end with the sequence -->

Example

```
<!-- I really like to see my friends.-->
```

4.5. CDATA sections

CDATA sections are used to express text blocks containing characters that expressed in any other way would be recognized as labels (usually used to include text that could be analyzed). The XML processor will display its content, but annotations contained will not be parsed. The CDATA section syntax starts with the character sequence <![CDATA[and ends with the character sequence]]>. Between the two character sequences, the XML processor will ignore all markup character such as <, > and &. The only markup XML processor will recognize inside a CDATA section is the closing character sequence]]>.

Example

```
<sometext>
<![CDATA[ They say “x < y” & that “z > y” so I guess that means
“x < z”]]>
</sometext>
```

In the example above the characters < and > will not interpreted by the machine as opening/closing tags, as they are included in the CDATA section.

4.6. The XML declaration

It is very important when managing XML documents. It says to the machine that the document which is about to manage is an XML document. XML document can contain a XML declaration that, if present, must be the first construct in the document. The XML declaration consists of pairs name/value syntactically equal to attributes: version and encoding.

Example:

```
<? xml version='1.0' encoding='UTF-8'?>
```

Note this declaration is a processing instruction, which indicates the used version of XML and information about the encoding character standard. The attribute version will have a value 1.0. XML documents are inherently Unicode, even when stored in a non-Unicode encoding. The XML recommendation establishes different possibilities for the encoding attribute. In the example UTF-8 is a subgroup of the Unicode named UTF-8 (parsers use it by default). It is recommended to use the encoding names registered with the Internet Assigned Numbers Authority[59] (IANA).

4.7. Well-formed XML documents, non well-formed XML documents

A well-formed XML document is a syntactically correct document: one top-level element, open tags have the corresponding closing tags and they are correctly nested; when appropriate, attributes of the same element have different names and/or when namespace qualified the combination of namespace name and local name are different, etc. Well-formed XML documents permit its solid, correct and efficient management.

Examples

Well-formed XML document

```
<?xml version='1.0' encoding='UTF-8' ?>
<p:Person xmlns:p='urn:example-org:People'>
      <name>Ana</name>
      <!-- my sister in law -->
      <age>42</age>
</p:person>
```

Non well-formed document

```
<?xml version='1.0' encoding='UTF-8' ?>
<p:Person>
      <name='Carmen'>My sister<b>in</b>law</name>
      <age units='years' units='yrs' >42</age>
</p:Person>
<p:Person/>
```

[59] http://www.iana.org/

It is a non well-formed document because it is syntactically incorrect: it has two top elements, the <b> tag is inside the name element overlap, the *age* element has duplicate unqualified attribute names and the namespace prefix *p* is not in the scope.

4.8. Valid XML document

An XML document may be a well-formed XML document, but may be not a *valid* document. In order to obtain a *valid* XML document, it must be adhered to a scheme: either Document Type Definition (DTD) or XML Schema (or Schema).

Key differences between DTD and XML Schema are:

- DTDs have specific syntax, while XML Schemas use XML syntax.
- XML Schemas can be handled as any other XML document.
- There are many more tools to work with for DTDs than for Schemas.
- Schemas may contain different types of data (integral, date…), while DTDs handle data as strings.
- DTD only allows one association between the document and its DTD.

4.8.1. DTD (Document Type Definition)

The DTD provides with the actual schema to the XML document. It provides the syntax for describing/constraining the logical structure of the document:

- DTD defines types of elements, attributes, entities and annotations, declares which are legal and establishes where they can be placed, e.g. what elements are allowed as children of an element, and so on.
- DTD is important to perform a solid processing of the document.

The XML document relates to its DTD through the Document Type Declaration: DOCTYPE, ENTITY, ELEMENT, NOTATION… It has to be placed at the top of the XML document to associate it with a set of declarations.

Example:

```
<!DOCTYPE invoice SYSTEM
"http://wwww.website.com/dtd/invoice.dtd">
110
```

This example includes a DOCTYPE declaration with external declarations (it refers to an external resource, which is the URI http://wwww.website.com/dtd/invoice.dtd that contains the declarations). DOCTYPE may include internal and external declarations.

Example:

Internal and external declarations

```
<!-- National.dtd-->
<!ELEMENT name (#PCDATA)>

<-- people.xml -->
<!DOCTYPE people SYSTEM "National.dtd" [<!ELEMENT people (name)>
]>
<people>
      <name> Yolanda </name>
</people>
```

The ELEMENT declaration defines an element of the specified name with the specified content model. There are different content model possibilities:

ANY - any child is allowed within the element.
EMPTY - No children are allowed within the element.
(#PCDATA) - Only text is allowed within the element.
(child1, child2 …) - Only the specified children in the order given are allowed within the element.
(child1|child2|…) - Only one of the specified children is allowed within the element.

ATTLIST declaration starts with character sequence <!ATTLIST followed by the identification of the element referred to and the attributes allowed in the given element. Each attribute has a name, type and a default declaration. There are different types of attributes:

Type	Description
CDATA	arbitrary character data
ID	a name that is unique in the document
IDREF	a reference to an ID value in the document
ENTITY	the name of an uparsed entity declared in the DTD
NMTOKEN	a valid XML name
etc…	

Table 5: Types of attributes

After the attribute type, the default value must be set:

Declaration	Description
"value"	default value for the attribute
#REQUIRED	attribute is required
#IMPLIED	attribute is optional
#FIXED "value"	attribute always has the specified fixed value.

Table 6: default values for attributes

Example:

```
<!ELEMENT message (from, to, text)>
<!ATTLIST priority message (normal|urgent) “normal”>
<!ELEMENT text (#CDATA)>
<!ATTLIST language CDATA #REQUIRED
infosource CDATA “REUTERS”
numwords CDATA #IMPLIED>
```

In the example above the element `message` has to have the elements `from`, `to` and `text`; the attribute “`priority message`” can have the value “`normal`” or “`urgent`”. If it is not specified the value will be “`normal`”. The element `text` is defined as CDATA so any string of characters is allowed. The `ATTLIST` (AttributesList) declaration includes the attribute “`language`” which is compulsory, the attribute “`infosource`” that has the default value “`REUTERS`” and the attribute “`numwords`” which is optional.

The ENTITY declaration can be defined as the atomic unit of information. Entities are used to construct logic XML documents and DTDs. An ENTITY may be general or parameter, internal or external, and parsed or unparsed:

General -referenced in an XML document	Parameter -referenced in the DTD
Internal - value defined inline	External -value defined in an external resource
Parsed - parsed by a processor	Unparsed - not parsed by a processor

Table 7: Types of ENTITY declarations

There are five types of ENTITY declarations as depicted in the following figure:

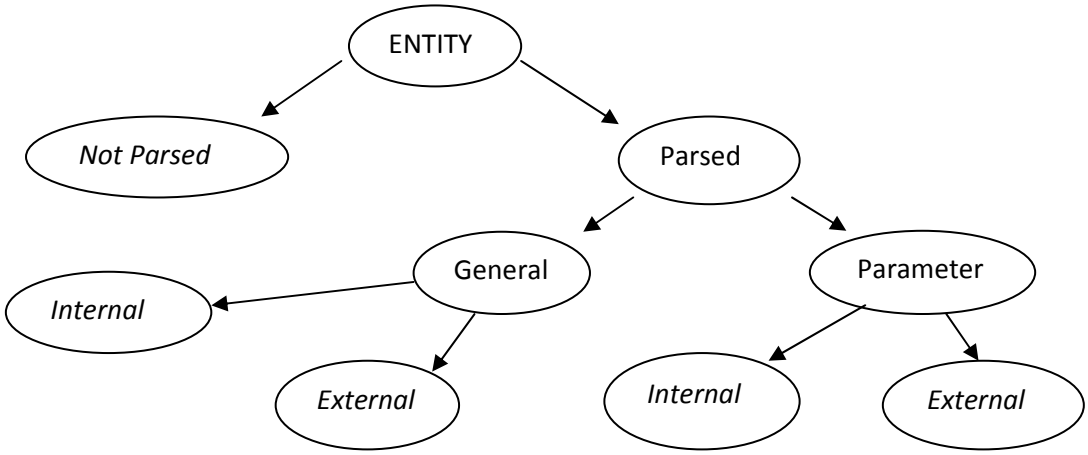

Figure 11: Types of ENTITY declarations

Internal parameter ENTITY declarations parameterize parts of the DTD or may contain one or more complete declarations. Internal parameter entities are always parsed. A reference to an internal parameter entity "`%name`" is replaced with the parsed content.

Example of internal parameter ENTITY

```
<!ENTITY % dimensions "height, width, length">
```

In the DTD the reference will be:

```
<!ELEMENT wall (%dimensions;)>
<!ELEMENT ceiling (%dimensions;)>
```

External parameter entities are used to include declarations from external resources. External parameter entities are always parsed. A reference to an external parameter entity "`%name`" is replaced with the parsed content.

Example

```
<!-- person-declar.dtd -->
<!ELEMENT person (name,town)>
<!ELEMENT name (#PCDATA)>
<!ELEMENT town (#PCDATA)>

<!-- person.xml -->
<!DOCTYPE person [<!ENTITY % declar SYSTEM "person-
declar.dtd">%declar;]>
<person>
```

```
      <name>Pepe Perez</name>
      <town>Madrid</town>
</person>
```

Internal general entities are always parsed and are included in the prologue of the document. The parsed content is always placed in the logical XML document everywhere it is referenced (`&name;`).

Example

```
<!DOCTYPE text […
      <!ENTITY cnmv "Comisión Nacional del Mercado de Valores">]>
<text><title> La &cnmv; … </title></text>
```

External general ENTITY declarations obtain their content anywhere else of the system (file, website, …). They may be parsed (XML content) or may be not (text, binary data…).

External general parsed entities are used the same way as the internal general entities except for the fact they are not defined inline. Their content becomes part of the logical of the XML document wherever they are referenced "`&name;`".

Example

```
<!DOCTYPE person [
      <!ENTITY n SYSTEM "name.xml">
      <!ENTITY t SYSTEM "town.xml">
]>
<person>
      <name>&n;</name>
      &t;
</person>
```

Unparsed ENTITY declarations are always general and external. They simply point to a resource via the resource's public or system identifier. The exclusive NDATA declaration must be included in the entity declaration.

Example

```
<!ENTITY pspic SYSTEM "pspic.jpeg" NDATA JPEG>

<!ELEMENT person EMPTY>
```

```
<!ATTLIST person name CDATA #REQUIRED
picture ENTITY #IMPLIED>

<person name="Marta Martín" picture="&pspic;"/>
```

4.8.2. XML Schema

XML Schema describes the structure of an XML document. The XML schema is also referred to as XML Schema Definition (XSD). It is the choice used by the XBRL.

DTDs have some limitations, as mentioned above, compared to XML Schemas, among others:

- Definition of data is not allowed.
- Namespaces are not allowed.
- DTDs are limited to a textual content.

In order to avoid these limitations it is proposed a schema with:

- XML syntax more complex and less legible than DTDs.
- XML Schema with data type support (primitives and derived).
- Object-oriented programming concepts introduction.

The XML Schema:

- defines attributes that can appear in a document
- defines which elements are child elements
- defines the order of child elements
- defines the number of child elements
- defines whether an element is empty or can include text
- defines data types for elements and attributes
- defines default and fixed values for elements and attributes

Two of the big advantages of the XML Schema are its capacity to be **extensible** to future additions (this is the choice used by the XBRL), and the support of data types. With support for data types:

- It is easier to describe allowable document content
- It is easier to validate the correctness of data
- It is easier to work with data from a database
- It is easier to define data facets (restrictions on data)
- It is easier to define data patterns (data formats)
- It is easier to convert data between different data types

XML Schemas are written in XML. With an **extensible** Schema definition, it is possible to:

- Reuse your Schema in other Schemas
- Create your own data types derived from the standard types
- Reference multiple schemas in the same document

4.9. Comparing DTD and XSD

The following example is a DTD file called "note.dtd" that defines the elements of the XML document above ("fax.xml"):

```
<!ELEMENT fax (to, from, heading, body)>
<!ELEMENT to (#PCDATA)>
<!ELEMENT from (#PCDATA)>
<!ELEMENT heading (#PCDATA)>
<!ELEMENT body (#PCDATA)>
```

The first line defines the *fax* element to have four child elements: "`to`, `from`, `heading`, `body`".

Lines 2-5 define the "`to`, `from`, `heading`, `body`" elements to be of type "#PCDATA".

4.9.1. XML Schema

The following example is an XML Schema file called "`fax.xsd`" that defines the elements of the XML document above ("fax.xml"):

```
<?xml version="1.0"?>
<xs:schema xmlns:xs="http://www.myexample.org/2011/XMLSchema"
targetNamespace="http://www.mytarget.com"
```

```
xmlns="http://www.mytarget.com"
elementFormDefault="qualified">

<xs:element name="fax">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="to" type="xs:string"/>
      <xs:element name="from" type="xs:string"/>
      <xs:element name="heading" type="xs:string"/>
      <xs:element name="body" type="xs:string"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>

</xs:schema>
```

The fragment `<xs:schema xmlns:xs="http://www.myexample.org/2011/XMLSchema"` indicates that data types and elements used in the schema come from `"http://www.myexample.org/2011/XMLSchema"` namespace. It also specifies that the elements and data types that come from the `"http://www.myexample.org/2011/XMLSchema"` namespace should be prefixed with "`xs`".

The fragment `targetNamespace="http://www.mytarget.com"` indicates that the elements defined by the schema (`fax`, `to`, `from`, `heading`, `body`) come from the `"http://www.mytarget.com"` namespace.

The fragment `xmlns="http://www.mytarget.com"` indicates that the default namespace is `"http://www.mytarget.com"`.

Fragment `elementFormDefault="qualified"` indicates that any element used by the XML instance document declared in this schema, must be namespace qualified.

The `fax` element is a **complex type** because it contains other elements. The other elements (`to`, `from`, `heading`, `body`) are **simple types** because they do not contain other elements.

4.9.2. A Reference to a DTD

This XML document has a reference to a DTD:

```
<?xml version="1.0"?>
<!DOCTYPE note SYSTEM
"http://www.myexample.com/dtd/note.dtd">
<note>
  <to>Juan</to>
  <from>María</from>
  <heading>Reminder</heading>
  <body>Don't miss me!</body>
</note>
```

4.9.3. A Reference to a XML Schema

This XML document has a reference to a XML Schema:

```
<?xml version="1.0"?>
<fax xmlns="http://www.myexample.com"
xmlns:xsi="http://www.myexample.org/2011/XMLSchema-instance"
xsi:schemaLocation="http://www.myexample.com fax.xsd">
  <to>Juan</to>
  <from>María</from>
  <heading>Reminder</heading>
  <body>Don't miss me!</body>
</fax>
```

The fragment `xmlns="http://www.myexample.com"` specifies the default namespace. This declaration tells the schema-validator that all the elements used in this XML document are declared in the `"http://www.myexample.com"` namespace.

Once the XML Schema instance document is available:
`xmlns:xsi="http://www.myexample.org/2011/XMLSchema-instance"`
the `schemaLocation` attribute can be used:
`xsi:schemaLocation="http://www.myexample.com fax.xsd"`

This attribute has two values. The first value is the namespace to use and the second value is the location of the XML schema to use for that namespace.

The XML Schema Definition language (XSD). overcame Document Type Definition (DTD) limitations and provided several advanced features, such as the ability to build new types derived from basic ones, manages relationships between elements (similar to relational databases) and combine elements from several schemata (Leal 2009).

4.10. XSD Elements

4.10.1. Simple Elements <xs:element name="xxx" type="yyy"/>

A simple element only contains text. It will not contain any other elements or attributes. The content (text) can be of the many different types included in the XML Schema definition (Boolean, string, date, etc.) or it can be customized. Adding facets (restrictions) to require data to match a pattern is allowed.

Example:

```
<famname>Sánchez</famname>
<age>39</age>
<datebirth>1971-10-24</datebirth>
```

The elements definitions will be:

```
<xs:element name="famname" type="xs:string"/>
<xs:element name="age" type="xs:integer"/>
<xs:element name="datebirth" type="xs:date"/>
```

The most common elelment types are:

- xs:string
- xs:decimal
- xs:integer
- xs:boolean
- xs:date
- xs:time

Simple elements may have default values or fixed values.

Example

```
<xs:element name="smell" type="xs:string" default="apricot"/>
<xs:element name="flavour" type="xs:string" fixed="orange"/>
```

Attributes of the elements <`xs:attribute name="xxx" type="yyy"/>`

Attributes help to define the characteristics of the element. XML Schema has many built-in data types. The most common types are:

- xs:string
- xs:decimal

- xs:integer
- xs:boolean
- xs:date
- xs:time

Example

Declaration of the XML element:

```
<famname lang="ES">Sánchez</famname>
```

Declaration of the attribute:

```
<xs:attribute name="lang" type="xs:string"/>
```

As seen for the XML simple elements, attributes may have default and fixed values:

```
<xs:attribute name="lang" type="xs:string" default="ES"/>
<xs:attribute name="lang" type="xs:string" fixed="ES"/>
```

Attributes are optional by default, but using the "use" attribute they can be set to "required":

```
<xs:attribute name="lang" type="xs:string" use="required"/>
```

4.10.1.1. Restrictions on Content

When an XML element or attribute has a data type defined, it sets restrictions on the element's or attribute's content. If an XML element is of type "xs:date" and contains a string like "Hola María", the element will not be validated. With XML Schemas, adding own restrictions to the XML elements and attributes is possible. These restrictions are called *facets*.

Examples

```
<xs:element name="age">
  <xs:simpleType>
    <xs:restriction base="xs:integer">
      <xs:minInclusive value="18"/>
      <xs:maxInclusive value="65"/>
    </xs:restriction>
  </xs:simpleType>
</xs:element>
```

The element `age` is limited on its value, from 18 to 65.

```
<xs:element name="gender">
  <xs:simpleType>
    <xs:restriction base="xs:string">
      <xs:pattern value="male|female"/>
    </xs:restriction>
  </xs:simpleType>
</xs:element>
```

The element `gender` has a restriction on a series of values: the only acceptable values are `male` or `female`.

These are the restrictions for the different data types:

Facet	Description
enumeration	Defines a list of acceptable values
fractionDigits	Specifies the maximum number of decimal places allowed. Must be equal to or greater than zero
Length	Specifies the exact number of characters or list items allowed. Must be equal to or greater than zero
maxExclusive	Specifies the upper bounds for numeric values (the value must be less than this value)
maxInclusive	Specifies the upper bounds for numeric values (the value must be less than or equal to this value)
maxLength	Specifies the maximum number of characters or list items allowed. Must be equal to or greater than zero
minExclusive	Specifies the lower bounds for numeric values (the value must be greater than this value)
minInclusive	Specifies the lower bounds for numeric values (the value must be greater than or equal to this value)
minLength	Specifies the minimum number of characters or list items allowed. Must be equal to or greater than zero
Pattern	Defines the exact sequence of characters that are acceptable
totalDigits	Specifies the exact number of digits allowed. Must be greater than zero
whiteSpace	Specifies how white space (line feeds, tabs, spaces, and carriage returns) is handled

Table19: Facet (restriction) types. Based on http://www.w3schools.com/schema/schema_facets.asp

4.10.2. Complex elements

Complex elements are elements containing other elements and/or attributes. There exist the following complex element types:

- Empty elements (cannot have content, only attributes):

```
<order pod="1357"/>
```

- Elements containing other elements (and only elements):

```
<lecturer>
  <givenname>Pilar</givenname>
  <famname>Pérez</famname>
</lecturer>
```

- Elements containing only text

```
<food type="starters">Greek salad</food>
```

- Elements containing other elements and text

```
<body>
He arrived on <date lang="Spanish">03.03.99</date> ....
</body>
```

There are two different ways to define a complex element:

```
<xs:element name="lecturer">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="givenname" type="xs:string"/>
      <xs:element name="famname" type="xs:string"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Using this way to define the complex element, only the element "`lecturer`" can use the specified complex type as the declaration `xs:complexType` is only declared for the element "`lecturer`". The `<sequence>` indicator sets the order the child elements must be declared.

```
<xs:element name="lecturer" type="personid"/>

<xs:complexType name="personid">
  <xs:sequence>
    <xs:element name="givenname" type="xs:string"/>
    <xs:element name="famname" type="xs:string"/>
  </xs:sequence>
</xs:complexType>
```

Using this second way the "lecturer" element has a type attribute "personid" which refers to the name of the complex type to use. We are able to use the complex type for different elements:

```
<xs:element name="lecturer" type="personid"/>
<xs:element name="student" type="personid"/>
<xs:element name="pas" type="personid"/>

<xs:complexType name="personid">
  <xs:sequence>
    <xs:element name="givename" type="xs:string"/>
    <xs:element name="famname" type="xs:string"/>
  </xs:sequence>
</xs:complexType>
```

A complex element may contain other complex elements:

```
<xs:element name="lecturer" type="fullpersonid"/>

<xs:complexType name="personid">
  <xs:sequence>
    <xs:element name="givenname" type="xs:string"/>
    <xs:element name="famname" type="xs:string"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="fullpersonid">
  <xs:complexContent>
    <xs:extension base="personid">
      <xs:element name="campus" type="xs:string"/>
      <xs:element name="faculty" type="xs:string"/>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
```

4.10.3. Indicators

These are the indicators:

Order	Occurrence	Group
All	maxOccurs	Group name
Choice	minOccurs	attributeGroup name
Sequence		

Table 8: Indicators. Source: http://www.w3schools.com/

The <all> indicator sets that the child elements can appear in any order and that they occur only once:

```
<xs:element name="employee">
  <xs:complexType>
    <xs:all>
      <xs:element name="firstname" type="xs:string"/>
      <xs:element name="lastname" type="xs:string"/>
    </xs:all>
  </xs:complexType>
</xs:element>
```

The <choice> indicator specifies that one child element or another can occur. The <sequence> indicator establishes a specific order for the children elements to occur.

<maxOccur> sets the maximum number of times an element can occur, and the minimum is set by the <minOccur> indicator:

```
<xs:element name="personaldetails">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="full_name" type="xs:string"/>
      <xs:element name="child_name" type="xs:string"
      maxOccurs="5" minOccurs="0"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

The group indicators define a related set of elements.

Example

```
<xs:group name="lecturergroup">
  <xs:sequence>
    <xs:element name="givename" type="xs:string"/>
    <xs:element name="famname" type="xs:string"/>
    <xs:element name="campus" type="xs:date"/>
  </xs:sequence>
</xs:group>
```

After defining the group, it can be referenced in another declaration:

```
<xs:element name="lecturer" type="lecturerdetails"/>

<xs:complexType name="lecturerdetails">
```

```
  <xs:sequence>
    <xs:group ref="lecturergroup"/>
    <xs:element name="faculty" type="xs:string"/>
  </xs:sequence>
</xs:complexType>
```

The `attributeGroup` declaration defines the attributes for the group:

```
<xs:attributeGroup name="lecturerattrgroup">
  <xs:attribute name="givename" type="xs:string"/>
  <xs:attribute name="famname" type="xs:string"/>
  <xs:attribute name="campus" type="xs:string"/>
</xs:attributeGroup>
```

After the `attributeGroup` is defined it can be referenced in other definitions:

```
<xs:element name="lecturer">
  <xs:complexType>
    <xs:attributeGroup ref="lecturerattrgroup"/>
  </xs:complexType>
</xs:element>
```

4.10.4. Elements <any> and <anyAttribute>

The <any> element allows to extend the XML document with *any* element not specified in the schema. And the <anyAttribute> element does similar but with attributes.

Example

A fragment of a XML schema called "`department.xsd`":

```
<xs:element name="lecturer">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="givenname" type="xs:string"/>
      <xs:element name="famname" type="xs:string"/>
    </xs:sequence>
    <xs:anyAttribute/>
  </xs:complexType>
</xs:element>
```

To extend the "`lecturer`" element with a `gender` attribute, a schema file called "attr.xsd" is used:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
targetNamespace="http://www.mytarget.com"
```

```
xmlns="http://www.mytarget.com"
elementFormDefault="qualified">

<xs:attribute name="gender">
  <xs:simpleType>
    <xs:restriction base="xs:string">
      <xs:pattern value="male|female"/>
    </xs:restriction>
  </xs:simpleType>
</xs:attribute>
```

The XML file below called "`mydepartment.xml`" refers to two different schemas, "`department.xsd`" and "`attr.xsd`":

```
<?xml version="1.0" encoding="ISO-8859-1"?>

<deptcomponents xmlns="http://www.mydomain.com"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:SchemaLocation="http://www.mydomain.com department.xsd
http://www.mytarget.com attr.xsd">

<lecturer gender="male">
  <givename>Pepe</givename>
  <famname>Perez</famname>
</lecturer>

<lecturer gender="female">
  <givename>Marisa</givename>
  <famname>Gutierrez</famname>
</lecturer>

</deptcomponents>
```

The line "`xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"`" indicates the XML parser that this document should be validated against a schema. And the following line above "`xsi:SchemaLocation="http://www.mydomain.com department.xsd"`" indicates where the schema resides.

XML Schemas allow substituting one element with another element, i.e. the names for the XML elements in English and Spanish. First, the head element is declared, then the other elements may be substituted by the head element:

```
<xs:element name="name" type="xs:string"/>
<xs:element name="nombre" substitutionGroup="name"/>
```

The "name" element is the head element and the "nombre" element is substitutable for "name":

```
<xs:element name="name" type="xs:string"/>
<xs:element name="nombre" substitutionGroup="name"/>

<xs:complexType name="lecturerdetails">
  <xs:sequence>
    <xs:element ref="name"/>
  </xs:sequence>
</xs:complexType>

<xs:element name="lecturer" type="lecturerdetails"/>
<xs:element name="profesor" substitutionGroup="lecturer"/>
```

A valid XML document, according the schema above:

```
<lecturer>
  <name>Mike Read</name>
</lecturer>
```

Another valid XML document is:

```
<profesor>
  <nombre>Menganito Sánchez</nombre>
</profesor>
```

To create a XML schema document the `xs:schema` element is used:

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
...
</xs:schema>
```

In the schema above the first line is the standard XML declaration, the second line includes the standard namespace (`xs`), and the URI associated with this namespace is the Schema language definition, which has the standard value of "`http://www.w3.org/2001/XMLSchema`".

5. Semantic web: what is the Semantic Web, history, structure and focus on ontologies (OWL): main characteristics and components.

5.1. What is the Semantic Web and brief history.

The Web has deeply changed the way humans communicate, do business and work. Communication worldwide at any time and with a low cost is possible nowadays. Economic transactions are carried on through the Internet. Access to millions of resources independently of the geographic location and language is available. All these factors have contributed to the Web's success. However, while these same factors have contributed to its success, they have become its main handicaps: information overload and heterogeneity of the information sources with the consequent problem of interoperability.

The Semantic Web helps to resolve these two key problems allowing users to delegate part of them in the software. Thanks to the semantics in the Web, i.e. metadata depicting the properties and/or relations of the elements, software is able to process its content, combine and reason about it, (inference) to solve everyday problems automatically.

The semantic web can be defined as a long-term vision, which pursues the development of technologies that facilitate the automated manipulation of data published on the Web. Leaded by the World Wide Web Consortium[60], a number of semantic web technologies have appeared, like Resource Description Framework (RDF) to describe *resources*[61] using a graph model, Ontology Web Language (OWL) to define ontologies based on description logics, and Simple Protocol and RDF Query Language (SPARQL), to define

[60] More info in http://www.w3.org/

[61] "In the Semantic Web we refer to the things in the world as *resources*: a *resource* can be anything that someone might want to talk about. This is admittedly a pretty odd use of the word *resource*, but alternatives like entity or thing, which might be more accurate, have their own issues. In any case, *resource* is the word used in Semantic Web standards. In fact, the name of the base technology in the Semantic Web (RDF) uses this word in an essential way".(Allemang 2008)

queries over RDF graphs. One important aspect of these technologies is that they can be neatly combined using several tools and even allow the system to infer new knowledge using reasoning capabilities (Méndez, Labra et al. 2008)

In order to give a glimpse to the meaning and use of the technologies mentioned above, we use RDF to define resources like "Cash", and the attributes and relations among them (attributes and relations are called properties of the resource). However, given the huge amount of resources it becomes necessary to organize and classify them somehow: it is declared via the definition of ontologies (OWL). Finally, once the whole range of resources and their relationships have been defined and organized, the user of the information can retrieve the information required, writing queries over the whole set of knowledge. These queries are written in SPARQL.

Berners-Lee defines the "*Semantic Web* as an evolution of the World Wide Web (www) where the semantics of the information and services are defined, making it possible for the Web to understand and satisfy the needs of the users and machines for utilizing the web."(Berners-Lee, Hendler et al. 2001). The same author already proposed in 1989 a web where named concepts would allow the unification of information management tasks. Due to the limited volume of information available at the beginning of the web, this aspect was not prioritized.

The Semantic Web is not the first attempt to achieve computers manage knowledge through semantics. In the Artificial Intelligence (AI) area some examples can be enumerated, e.g the Memex of Vannevar Bush in 1945. New trends were arising from early 90's oriented towards the development of technologies based on ontologies, machine readable, which improve the current Web with explicit descriptions of contents and functionalities. Their aim is to improve the means for processing, sharing and reuse through the applications, by humans and machines[62].

Nowadays the situation has changed: the web size and the lack of a global organization are creating an obstacle for users and developers. Current standards do not facilitate a solution to solve this problem. The standards provide with an inadequate support to

[62] More info http://nets.ii.uam.es/

depict what the resources are, or what the services do, which is necessary for the automated process and effective searches.

The Semantic Web is a web of data: data about data (also known as *metadata*). Most information is now weakly structured in the Web due to its format and/or display, thus various technology limitations arise when searching, extracting and maintaining information. The aim of the Semantic Web is to allow enhanced Knowledge Management (acquiring, accessing, and maintaining knowledge), organizing the knowledge by its meaning and maintaining information with automated tools, which will extract new knowledge (infer) from the explicit one. Query answering will replace the keyword-based search and information will be retrieved and extracted from several sources.

Nevertheless, the difference now is in the infrastructure, Internet, which is worldwide and includes a huge amount of data. Research in the field of the Knowledge Reasoning and Representation[63] is often oriented to methods that provide with high-level descriptions that can be used to build intelligent applications. In this context, intelligence refers to the capability of the system to find implicit consequences (to infer) via the explicit represented knowledge. Therefore, these systems are characterized as knowledge-based systems (Baader, Calvanese et al. 2007).

The Semantic Web is an *extended* Web that includes annotations about the meaning of the resources described, thus more explicit semantics, where any Web user will find answers to his/hers questions in a faster and easier way, thanks to a better-defined information. Solutions to usual information searching problems can be solved thanks to the utilization of common structures, sharing, processing and transferring information easily.

Semantic Web is not different from the current WWW. It is an enhancement that gives it far greater use. Semantic Web is not a separated web, but an *extension* of the current one, in which information is given well-defined meaning (Berners-Lee, Hendler et al.

[63] Knowledge representation (KR) is an area of artificial intelligence research aimed at representing knowledge in symbols to facilitate inferencing from those knowledge elements, creating new elements of knowledge. further details in http://www.webkb.org/doc/papers/iccs02/iswc02.pdf

2001). It is an *extension* because through the semantics the functionalities of the Web are extended, for instance, automated reasoning can be reached.

Thereby, Semantic Web is not *document oriented* as the current Web, where documents containing several concepts or terms are the information unit and they are related to one another through hyperlinks. Instead, the Semantic Web is "concept", or "term", or *resource oriented*. This is a much finer-grained approach as a Web document might talk about hundreds of thousands of resources. In addition, resources are related to one another through properties[64]. It definitely enhances the comparability and interoperability of crossed information, as well as permits the automated inferences deployed by the software, establishing new inferred relationships among resources via relationships and/or properties: transitive, injective, etc. The resulting framework can provide uniform access to information and more reporting and query permutations, thereby facilitating more comprehensive and timely business reporting.

Within an accounting context, it would be as trying to analyze "in one fell swoop" two whole sets of Financial Statements based on different domestic GAAP, or trying to analyze the concepts "one by one" throughout all the documents: land, receivables, etc (Semantic Web). The definition of the information used on the second procedure is more exhaustive, thus, benefits obtained are definitely greater.

"Even beyond its formal definition, what Web 3.0[65] will mean for the world is that the Internet will be transformed into a massive, universally searchable database and our place in it will be to organize this well-spring of information into slices that are palatable to us." (Spalding 2007).

Much of the work in this area has so far focused on the technologies that make it possible, as this work does, while little has been done about the user interface. Two main reasons can explain it: the immaturity of the discipline, and the fact that it is a

[64] The way documents are linked in the current web is different from the way resources are interrelated in the Semantic Web. The similarity has been used only for explanatory purposes. More info http://www.w3.org/2001/sw/SW-FAQ#whatarebuildingblocks

[65] Web 1.0 where the user was a mere spectator (only could access contents). Web 2.0 where the user participates in the creation of content as in the social networks, blogs, etc. (includes Web 1.0). Web 3.0 or Semantic Web is an extension of the web 2.0 (more sophisticated).

proposal that looks for facilitating the access to the information from the Web to computers, thus many have forgotten that the ultimate real consumers of the Semantic Web are people. This is true even if, thanks to the Semantic Web, people can delegate a greater workload on computers when interacting with the vast amount of information available. People are who will consume the results of these tools, instruct them to meet their needs, and so on. Therefore, a more practical approach becomes indispensable in order to solve one of the main barriers for adopting these technologies: the difficulty arising from the fact that many of the existing tools have been created by and for developers and not for final users (García , Gil 2009).

This work aims to provide a practical solution to a problem: improve the comparability and timeliness of the financial information available in the Web, through the application of the Semantic Web technologies, so final users, i.e. accountants, investors, etc. can feel the potential of the mentioned technologies.

5.2. Semantic Web Structure

On its core, the Semantic Web contains a set of *designing principles*, a variety of *enabling technologies* and *collaborative workgroups*. They pretend to provide a formal description of the resources and their relationships within a given knowledge domain.

The Semantic Web follows the *design principles* of the Web in order to permit a worldwide growth. The key element is the utilization of web addresses (URIs) to name things, so the Web is used to establish a global naming context and the framework to share the semantic descriptions of the entities those URIs stand for.

Briefly explained, the *enabling technologies* that make the Semantic Web possible are:

- a common language for representing data that can be understood by all kinds of software agents[66];
- ontologies -set of statements- that translate information from disparate databases into common terms;

[66] A software agent is a piece of software that acts for a user or other program in a relationship of agency, which derives from the Latin *agere* (to do). Agents are pieces of software that work autonomously and proactively.(Antoniou, G. 2004)

- and rules that allow software agents to reason about the information described in those terms.

Nevertheless, it is not possible to fully understand the development of the Semantic Web without the intervention of *collaborative workgroups*. The World Wide Web Consortium -an ad hoc organization of more than 400 companies and universities co-hosted by the Massachusetts Institute of Technology in the U.S., the European Consortium in Informatics and Mathematics in France, and Keio University in Japan- has already released the Semantic Web languages and technologies needed to cross such boundaries, and large companies are already exploiting them (Feigenbaum, Herman et al. 2007). The collaborative workgroups are parallel to the development of the Semantic Web.

The Semantic web tends to overcome the current web limitations as pointed out by García, R. (García 2007):

- Resource location: due to web's huge size, finding resources with simple free text and keyword search is becoming clearly inefficient and it is worsening as the web continues to grow. Results are highly sensitive to vocabulary.
- Users: the resources are evolving to be used not only by humans but also by machines. Higher automation is essential to build meaningful automatic filters for final users, as there is an unaffordable amount of information contained in the web for exclusive human consumption. Besides, the emergence of new devices encourages the separation between content and presentation of the information, facilitating and improving its integration and exploitation.
- Web tasks and services: from the place where to find things, the Web is evolving to the place where to do things.

The following section includes a deeper description of the main components of the Semantic Web.

5.2.1. Components of the Semantic Web

The Semantic Web Stack

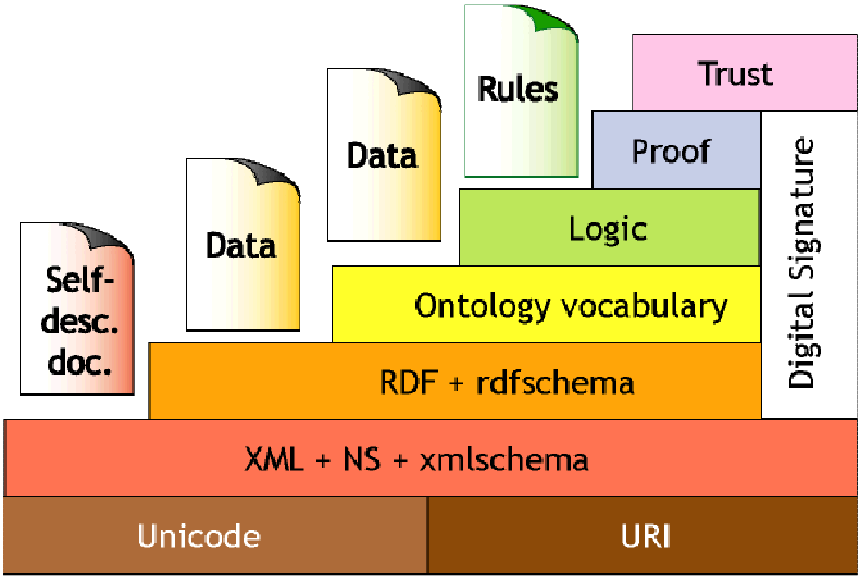

Figure 12: "Layer cake" or "Semantic Web Stack" due to Tim Berners-Lee.

The semantic web comprises the standards and tools of XML, XML Schema, RDF, RDF Schema and OWL that are organized in the *Semantic Web Stack* above. The function and relationship of each of these components of the Semantic Web are:

- *URI* provides global unique identifiers and *UNICODE* is a character-encoding standard that supports international characters.

- *eXtensible Markup Language* (XML) provides an elemental syntax for content structure within documents, though associates no semantics with the meaning of the contents. XML is a machine-way to write information. We would declare cash, receivables, payables…and their main characteristics.

- *XML Schema* is a language for providing and restricting the structure and content of elements contained within XML documents (lays out the structure of the XML documents). Using XML Schema it is defined the way (structure) the elements previously declared with the XML, are ordered/organized/displayed in the piece of information exchanged, e.g. cash will be displayed below current assets…but no semantics are included, so the relationships defined between them are only syntactical, as shown by the XML-S. The relationships that define the elements are only valid for the XML-S. Thereby, it cannot be inferred any

automated new knowledge from the document. No explicitly stated relationships in the XML-S exist.

- *Resource Data Framework* (RDF) is a simple language for expressing data models, which refers to objects or resources and their relationships. It is the base language, and the first step or layer of the Semantic Web Stack, specifically developed for the Semantic Web. Any data model or data language that uses RDF is a part of the Semantic Web. RDF is the basic framework that the rest of the Semantic Web is based on, and provides a mechanism for allowing anyone to make a basic statement about anything, layering these statements into a single model. It is a language used for describing data, metadata (data about data), and even other data languages. RDF uses a graph data model, in contrast to relational data model (such as most databases, which are based on tables) and hierarchical data formats (such as XML: trees). In the Semantic Web, things in the world are referred to as *resources*: a *resource* can be anything that someone might want to talk about. It is the word used in Semantic Web standards. In fact, the name of the base technology in the Semantic Web (RDF) uses this word in an essential way (Allemang, Hendler 2008).

The basic building block for RDF is called triple. If the resources were displayed in a spreadsheet cell, the identifier for the row is called *subject* of the triple (following the notion from elementary grammar, since the subject is the thing that a statement is about). The identifier for the column is called the *predicate* of the triple (since columns specify properties of the entities in the rows). The value in the cell is called *object* of the triple (Allemang, Hendler 2008).

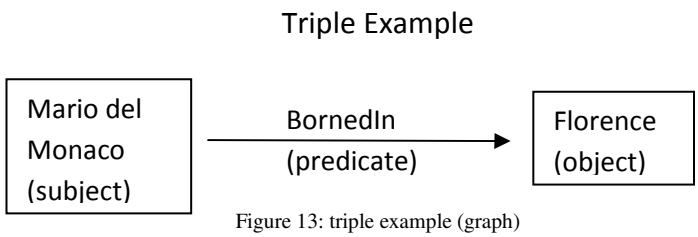

Figure 13: triple example (graph)

The RDF graph is based on the idea that every data item should have a unique Web identifier, called Uniform Resource Identifier (URI[67]), and that every data item (resource) can be connected to every other item (*relation property*), i.e. related to another resource, and/or can have attributes (*attribute property* which specifies an specific characteristic of the resource). The same way a human person is defined through its own characteristics (attributes: blue eyes, temperamental, etc.) and the relations with other human persons (relation: fatherOf, memberOf, part of, etc.). RDF makes URI relationships between data items the central characteristic of the over-all data model. Semantic Web programmers create data with URIs and link them together using properties that are also named with URIs. In this way, an interconnected set of data may be distributed at global scale across the Internet (Pollock 2009). RDF-based models are represented in a graph model, which is not capable to be saved in a digital file or be exchanged in the Web via the HTTP[68] protocol. In order to do that, the information has to be serialized, i.e. written as a text. The use of XML for that purpose, allows reusing existing XML tools, although it is not the only choice.

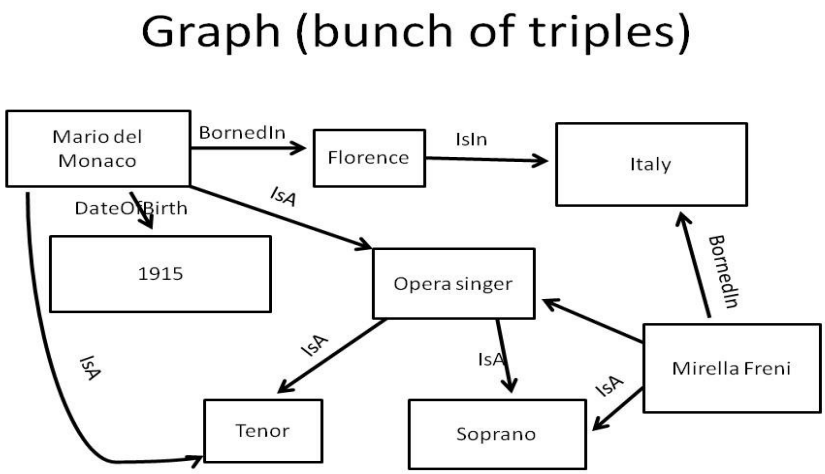

Figure 14: graph (bunch of triples) example

[67] An Universal Resource Identifier (URI) is different from Uniform Resource Locator (URL) in that an URI may refer to either a Web name (URI) or a location (URL); an URL refers only to actual Web locations (URL only).

[68] The Hypertext Transfer Protocol (HTTP) is a networking protocol for distributed, collaborative, hypermedia information systems. HTTP is the foundation of data communication for the World Wide Web. More info http://www.w3.org/Protocols/History.html

- Once the volume of resources described in RDF format becomes big enough, the necessity to order and/or classify them somehow is essential to ease the handling of the information. *RDF Schema* (RDF-S) is a vocabulary for describing properties and classes of RDF-based resources, with semantics (and this is the main difference about XML-S, which is only a message format with no semantics) for generalized-hierarchies of such properties and classes. It provides mechanisms for describing groups of related resources and the relationships between these resources. RDF Schema vocabulary descriptions are written in RDF. These resources are used to determine characteristics of other resources, such as the domains and ranges of properties. The RDF-S is a language with the expressivity to describe the basic notions of familiar commonality and variability: classes, subclasses and properties (Allemang, Hendler 2008). In the example above, we could define a class of "OperaSinger" which will include all the opera singers defined in the triples: Mirella Freni, Mario del Monaco. "OperaSinger" could be also a subClassOf another class named "Singer", and so on. Inference becomes available: if MarioDel Monaco is included in the class "OperaSinger", it can be inferred automatically that MarioDelMonaco is a Singer, given that "OperaSinger" is a SubClassOf "Singer". Below two tables are included presenting an overview of the vocabulary of RDF drawing together vocabulary originally defined in the RDF Model and Syntax specification with classes and properties that originate with RDF Schema.

RDF classes

Class name	comment
rdfs:Resource	The class resource, everything.
rdfs:Literal	The class of literal values, e.g. textual strings and integers.
rdf:XMLLiteral	The class of XML literals values.
rdfs:Class	The class of classes.
rdf:Property	The class of RDF properties.
rdfs:Datatype	The class of RDF datatypes.
rdf:Statement	The class of RDF statements.
rdf:Bag	The class of unordered containers.
rdf:Seq	The class of ordered containers.
rdf:Alt	The class of containers of alternatives.
rdfs:Container	The class of RDF containers.
rdfs:ContainerMembershipProperty	The class of container membership properties, rdf:_1, rdf:_2, ..., all of which are sub-properties of 'member'.
rdf:List	The class of RDF Lists.

Table 9: RDF classes. Source: http://www.w3.org/TR/rdf-schema/

RDF properties

Property name	comment	domain	range
rdf:type	The subject is an instance of a class.	rdfs:Resource	rdfs:Class
rdfs:subClassOf	The subject is a subclass of a class.	rdfs:Class	rdfs:Class
rdfs:subPropertyOf	The subject is a subproperty of a property.	rdf:Property	rdf:Property
rdfs:domain	A domain of the subject property.	rdf:Property	rdfs:Class
rdfs:range	A range of the subject property.	rdf:Property	rdfs:Class
rdfs:label	A human-readable name for the subject.	rdfs:Resource	rdfs:Literal
rdfs:comment	A description of the subject resource.	rdfs:Resource	rdfs:Literal
rdfs:member	A member of the subject resource.	rdfs:Resource	rdfs:Resource
rdf:first	The first item in the subject RDF list.	rdf:List	rdfs:Resource
rdf:rest	The rest of the subject RDF list after the first item.	rdf:List	rdf:List
rdfs:seeAlso	Further information about the subject resource.	rdfs:Resource	rdfs:Resource
rdfs:isDefinedBy	The definition of the subject resource.	rdfs:Resource	rdfs:Resource
rdf:value	Idiomatic property used for structured values	rdfs:Resource	rdfs:Resource
rdf:subject	The subject of the subject RDF statement.	rdf:Statement	rdfs:Resource
rdf:predicate	The predicate of the subject RDF statement.	rdf:Statement	rdfs:Resource
rdf:object	The object of the subject RDF statement.	rdf:Statement	rdfs:Resource

Table 10: RDF properties. Source: http://www.w3.org/TR/rdf-schema/

- *Ontology Web Language* (OWL) is intended to be used when the information contained in documents needs to be processed by applications, as opposed to situations where the content only needs to be presented to humans. Ontologies will be mainly used by agents due to its complexity. OWL was adopted as a recommendation by the W3C in 2003 and is used to represent explicitly the meaning of resources in vocabularies and the relationships among those resources. This representation of resources and their interrelationships is called *ontology*. OWL has more facilities for expressing meaning and semantics than XML (thus XBRL), RDF, and RDF-S. Moreover, OWL goes beyond these languages on its ability to represent machine interpretable content on the Web. RDF-S could be seen as simple, basic ontologies; meanwhile OWL allows the definition of more sophisticated ontologies.

OWL brings the expressivity of *logic*[69] to the Semantic Web. Logic in this context has to be considered as the discipline, which studies the formalization

[69] In philosophy, Logic (from the Greek λογική logikē) is the formal systematic study of the principles of valid inference and correct reasoning.

methods of the human knowledge. As depicted by Gayo[70], there are two types of logic: propositional (true/false statements) and predicative (objects and their relations). The predicative logic is the one used by OWL allowing modellers to express detailed constraints between classes, entities and properties. Altogether, OWL adds more vocabulary for describing properties and classes: among others, relations between classes (e.g. disjointness), cardinality (e.g. "exactly one"), equality, richer typing of properties, properties characteristics (e.g. symmetry), and enumerated classes.

One advantage of OWL ontologies is the availability of tools that can reason about them. An ontology differs from an XML schema in that it is a knowledge representation, not a message format. “The ontology provides a domain theory and not the structure of a data container” (García 2007)

These models are used to build applications that take advantage of information distributed over the Web.

Briefly explained the main Ontology components are:

- *Classes*: are the main elements or concepts that define a domain. I.e: in the domain ‘family’, Father and Brother will be classes.
- *Properties*: can be relations or attributes. Relations connect two classes. Attributes are specific for a concept. I.e: name or parentOf

Classes and properties (relations or attributes) are used in order to represent concepts of the domain. Ontologies work on three different representation levels:

1.- As a representation language: defines the blocks of construction of the ontology.

2.- Concepts level: the ontology itself represents the types of entities and their relationships within the working domain.

3.- Instances level: the concrete concepts or facts depicted. (García, Gil 2009)

[70] GAYO, J.E.L. and LANVIN, D.F., Lógica de Predicados.

OWL provides three increasingly expressive sublanguages designed for use by specific communities of implementers and users:

- *OWL Lite* supports those users primarily needing a classification hierarchy and simple constraints. For example, while it supports cardinality constraints, it only permits cardinality values of 0 or 1. It should be simpler to provide tool support for OWL Lite than its more expressive relatives, and OWL Lite provides a quick migration path for thesauri and other taxonomies. OWL Lite also has a lower formal complexity than OWL DL. The list of OWL Lite language constructs is given below:

RDF Schema	(In)Equality:	Property Characteristics:
Class (Thing, Nothing)	equivalentClass	ObjectProperty
rdfs:subClassOf	equivalentProperty	DatatypeProperty
rdf:Property	sameAs	inverseOf
rdfs:subPropertyOf	differentFrom	TransitiveProperty
rdfs:domain	AllDifferent	SymmetricProperty
rdfs:range	distinctMembers	FunctionalProperty
Individual		InverseFunctionalProperty

Property Restrictions:	Restricted Cardinality:	Header Information:
Restriction	minCardinality (only 0 or 1)	Ontology
onProperty	maxCardinality (only 0 or 1)	imports
allValuesFrom	cardinality (only 0 or 1)	
someValuesFrom		

Class Intersection:	Versioning:	Annotation Properties:
intersectionOf	versionInfo	rdfs:label
	priorVersion	rdfs:comment
	backwardCompatibleWith	rdfs:seeAlso
	incompatibleWith	rdfs:isDefinedBy
	DeprecatedClass	AnnotationProperty
	DeprecatedProperty	OntologyProperty
Datatypes		
xsd datatypes		

Table 11: OWL Lite language. Source: http://www.w3.org/TR/owl-features/

- *OWL DL* supports those users who want the maximum expressiveness while retaining computational completeness (all conclusions are guaranteed to be computable) and decidability (all computations will finish in finite time). OWL DL includes all OWL language constructs, but they can be used only under certain restrictions (for example, while a class may be a subclass of many classes, a class cannot be an instance of

another class). OWL DL is so named due to its correspondence with description logics, a field of research that has studied the logics that form the formal foundation of OWL.

- *OWL Full* is meant for users who want maximum expressiveness and the syntactic freedom of RDF with no computational guarantees. For example, in OWL Full a class can be treated simultaneously as a collection of individuals and as an individual in its own right. OWL Full allows an ontology to augment the meaning of the pre-defined (RDF or OWL) vocabulary. It is unlikely that any reasoning software will be able to support complete reasoning for every feature of OWL Full. The list of OWL DL and OWL Full language constructs that are in addition to or expand those of OWL Lite is given below:

Class Axioms:	Boolean Combinations of Class Expressions:
oneOf, dataRange disjointWith equivalentClass (applied to class expressions) rdfs:subClassOf (applied to class expressions)	unionOf complementOf intersectionOf

Arbitrary Cardinality:	Filler Information:
minCardinality maxCardinality cardinality	hasValue

Table 12: OWL Full language. Source: http://www.w3.org/TR/owl-features/

- *Protocol and RDF Query Language* (SPARQL) is a protocol and query language for semantic web data sources. Once the information has been described and organized, the way to retrieve the required information is done through SPARQL. It is the way the machine is told what information is needed. It is similar to the popular everyday used search engines as Google Search, Yahoo Search, etc; but more sophisticated, as SPARQL will take into account the semantics of the concepts searched for and not only vocabulary and statistics matching criteria.

- The *logic* layer contains the rules for the inference process based on mathematical principles and requires from the knowledge representation language some characteristics:

- Vocabulary including logical symbols e.g.: ∀, ∃, ∃!, constants, variables and punctuation.
- Syntax that establishes the way the symbols shall be combined in order to build a well-formed sentence.
- Semantics: meaningful statements are required. It is necessary to define how resources relates to one another.
- Inference: adequate inference rules allow reasoning mechanism automation.

- The *rules* allow the *proof* layer. The Semantic Web use "inference engines[71]", based on the rules and logic layers, which provide proofs of the inference process. The inference engine can be asked why it gets that conclusion or assertion.

- Finally, at the top of the Semantic Web Stack we find the *Trust* layer where signed assertions will be trusted depending on the signer. This level is complemented with digital signature, digital certificate, among other technologies.

5.2.2. Modelling Practices

In order to obtain a good model using RDF, RDF Schema, or OWL it is a good practice to begin the modelling process by determining what questions the model will need to answer. Besides, the model has to be designed not only for a particular engineering setting, but also for a variety of anticipated settings (it is impossible to anticipate all the uses to which a model might be applied). To determine whether a model satisfies some intent, we need an objective way to know what a model means. There are two ways a Semantic Web model answers questions. The first one is having the appropriate data

[71] An inference engine is a computer program that tries to derive answers from a knowledge base.

indexed in a way that can be directly accessed to answer the question. The second way is by inferencing: given some initial information, the following new information can be derived.

Once the advantages of semantic web have been explained, the next section discusses existing technologies to transform information written in XML syntax into OWL.

6. Transforming XBRL financial data into OWL.

6.1. Related work

The U.S SEC provides with some online tools that allow interacting with the data available in XBRL form. We highlight the Interactive Financial Reports and the Financial Explorer. The first one allows viewing and charting companies financial information and permits some functionality that allows comparing different filings and different companies, but it is hard to use and very sensitive to even the slightest differences between the compared filing facts. The second one permits some analysis but just from one company at a time.

Besides, there are some other XBRL tools, most of them proprietary and with quite high licensing cost. Among them, the Fujitsu XBRL Tools are the most popular available for XBRL Consortium members and academic users. The tools comprise taxonomy and instance editors, viewers and validators. The most powerful tool in this set is the Instance Dashboard, which permits using multiple instance documents and, by specifying a base taxonomy, users can perform some comparison analysis, thus limited to facts in a taxonomy that appears in all the filings. It is still in beta version.

As it can be noted from the previous analysis, the main limitation of XBRL tools is their limited support for cross analysis of financial information, not just among data based on different taxonomies, even when comparing filings for different companies based on the same taxonomies.

This limitation is inherited from the technologies underlying XBRL, especially from XML (García and Gil 2010).

Charles Hoffman, the father of XBRL considers the semantic standards “as the next logical step in the natural progression of information technology to seek a higher value proposition” (Hoffman 2006).

This interest is spreading, and the combination of XBRL and the Semantic Web has been analyzed in different blogs[72], mailing lists and web groups. The first attempts to combine both technologies focused on specific for some parts of XBRL. For instance, there is an ontology about financial information based on XBRL that is specific for investment funds (Lara, Cantador et al. 2006) and, though it is generated using a generic XBRL taxonomy to OWL ontology algorithm, there is not and equivalent tool that maps generic XBRL instance data.

Another quite specific tool maps quarterly and semester accounting information submitted to the Spanish securities commission (CNMV) to RDF (Núñez, Gayo et al. 2008). Both approaches are based on procedural code specially developed in order to extract specific patterns from the XBRL data. Consequently, they are difficult to scale to the whole XBRL specification and sensible to minimal changes in it.

More recent attempts have widened and generalised their scope. For instance, eTEN was an European Community programme providing funds to help make e-services available throughout the European Union. This programme ended in 2006. Within this programme there was the WINS project: Web-based Intelligence for common-interest fiscal Networked Services.

WINS provides a Web-based Business Intelligence (BI) Service to public and pri-vate Financial Institutions by integrating BI products and knowledge discovery tools to produce new financial knowledge on companies from information gathered through interoperable information services. Within the WINS context, Declerk and Krieger (Declerk, Krieger 2006) pointed out some limitations encountered in the XBRL schema documents mainly due to the lack of reasoning support over XML-based data. They proposed the "ontologization" or process to translate XBRL taxonomies into OWL to overcome these limitations.

The "ontologization" starts from the WINS information extraction (IE) task, which gathers financial facts from PDF files and converts them into XBRL documents. From

[72] Raggett, D. XBRL and RDF. In: Dave Raggett's Blog, (2008). Available from http://people.w3.org/~dsr/blog/?p=8. DuCharme, B. Changing my mind about XBRL again. In: Bob DuCharme's weblog, bobdc.blog, (2008). Available from http://www.snee.com/bobdc.blog/2008/08/changing_my_mind_about_xbrl_ag.html

these document, the process continues based on a hand-made translation of XBRL facts into OWL ontologies that then helps classifying the facts into higher-level concepts like Balance Sheet or Statement of Income. However, the ontologies are not exploited beyond this point in order to facilitate the comparability of the financial facts across different accounting standards.

Another example of mapping from XBRL to Semantic Web technologies is OpenLink XBRL Sponge, which maps generic XBRL instance data to RDF (Erling, Mikhailov 2008). However, in this case, there is not and associated mapping from the taxonomies instance data is based on to ontology languages. Therefore, it is not easy to facilitate the comparability of the financial facts by working at the conceptual level provided by the ontologies.

Bao et al. (Bao et al. 2010) do consider the comparability issue and they point out the tremendous human cognitive effort that must be done when comparing financial data written in XBRL. Their proposal is to overcome this problem by defining the logic model of XBRL reports using the Web ontologies language OWL to design ontologies that capture the meaning of the reports beyond just their structure. They transform concepts into classes and arcroles into properties. However, the possibilities of the logic models generated are not put into practice in comparability scenarios that involve different accounting regulations.

Finally, latest approaches start to focus on comparability and attempt to profit from Semantic Technologies and Linked Data principles to attain it (O'Riain et al. 2012). For instance, the XBRL European Business Registry[73] (xEBR) is an XBRL Europe project to create a list of concepts, which are common across the various European business registries. The concepts encompass basic financial data as well as company profiles. However, this Project is still limited by the fact that there is no common regulation for Business Registries in Europe. Therefore, many Registries in Europe have built their own set of taxonomies.

[73] Further details in http://www.monnet-project.eu/Monnet/Monnet/English/Navigation/XBRLEuropeanBusinessRegisterxEBR

Our evaluation, as detailed in the next sections, focuses on facilitating comparability at the semantic level, where it is easier to establish the equivalences among financial facts independently of the particular taxonomies and associated accounting standards they come from. In order to do that, we propose an approach that, instead of directly processing XBRL data, takes profit from the fact that it is expressed using XML and specified using XML Schemas. The instance XML documents are translated into RDF that models the financial facts and refers to the concepts modelled in ontologies generated from the schemas. From this point, it is now possible to establish equivalences that facilitate comparability at the ontology level use inference to benefit from this knowledge at the instance level.

6.2. Data analysis

The spreadsheet is based in the Telefónica S.A. financial statements, filed to the Spanish CNMV and the US SEC[74], more specifically the consolidated Balance Sheet for the years 2009 and 2008. The reason is purely pragmatic. Telefónica is one of a few Spanish Corporations that fills their financial statements to the Spanish National Securities Commission (CNMV) in XBRL format, and have filed their statements to the American Securities Exchange Commission (US SEC) too. The period 2009 was the last period available in the CNMV and SEC websites, at the time of the elaboration of the present work.

The elaboration of the financial statements filed to the CNMV has been done under the Spanish GAAP regulations[75], i.e. Plan General de Contabilidad, issued in 2007, which is highly adapted to the IFRS. Meanwhile, financial information filed to the US SEC was elaborated under the IFRS, as it is declared at the beginning of the statement and it follows the U.S. SEC's provisions for foreigner corporations. Therefore, it could be expected that both sets of financial information would be the same or highly similar at

[74] The whole documents can be displayed in the following URLs:
- CNMV's consolidated balance sheet can be retrieved from the CNMV's website: http://www.cnmv.es/ipps/default.aspx
- SEC's consolidated balance sheet: http://www.sec.gov/Archives/edgar/data/814052/000095010310000881/dp16939_20f.htm#it17 item 18.

[75] Models recently modified by Ministerial Oder JUS/1698/2011 of June 13, approving the model for presentation at the Mercantile Registry of the consolidated financial statements

the worst. However, as the spreadsheets below show, there are some differences mainly due to the different level of dissaggregation. Totals coincide but not the figures contained under the different sections of the balance sheets. As the Spanish models for the consolidated financial statements have been recently reformed, it is no possible to know so far what level of coincidence will exist between them and the IFRS ones, from now on.

The spreadsheets below (tables 13 & 14) highlight the accounts where quantity differences are found including in the two right-hand columns the explanation of the differences. Example:

In the year 2009 U.S. SEC's balance sheet "Non-current financial assets" amounts 5,988 millions of Euros, meanwhile in the CNMV's balance sheet "Inversiones financieras a largo plazo" (long-term financial investments) amounts 5,499 millions and "Otros activos no Corrientes" (Other non-current assets) amounts 489 millions. Both CNMVs accounts sum up 5,988 millions. Differences for the previous period are calculated in the same way.

Telefónica S.A. Balance sheet filled before **US SEC** in thousands of euros

ASSETS	2009	2008
A) NON-CURRENT ASSETS	84,311	81,923
Intangible assets	15,846	15,921
Goodwill	19,566	18,323
Property, plant and equipment	31,999	30,545
Investment properties	5	1
Investments in associates	4,936	2,777
Non-current financial assets	5,988	7,376
Deferred tax assets	5,971	6,98
B) CURRENT ASSETS	23,83	17,973
Inventories	934	1,188
Trade and other receivables	10,622	9,315
Current financial assets	1,906	2,216
Tax receivables	1,246	970
Cash and cash equivalents	9,113	4,277
Non-current assets held for sale	9	7
TOTAL ASSETS (A + B)	**108,141**	**99,896**

Table 13: Assets section Telefónica's Balance Sheet filed to the US SEC

Telefónica S.A. Balance sheet filled before **Spanish CNMV** in thousands of euros

ACTIVOS	2009	2008	Differen. 2009	Differen. 2008
A) ACTIVO NO CORRIENTE	84.311 €	81.922 €		
1. Inmovilizado intangible:	35.412 €	34.244 €		
a) Fondo de comercio	19.566 €	18.323 €		
b) Otro inmobilizado intangible	15.846 €	15.921 €		
2. Inmovilizado material	31.999 €	30.545 €		
3. Inversiones inmobiliarias	5 €	1 €		
4. Inversiones en empresas del grupo y asociadas a largo plazo	4.936 €	2.777 €		
5. Inversiones financieras a largo plazo	5.499 €	7.084 €	5.988 €	7.376 €
6. Activos por impuesto diferido	5.971 €	6.980 €		
7. Otros activos no corrientes	489 €	292 €		
B) ACTIVO CORRIENTE	23.830 €	17.974 €		
1. Activos no corrientes mantenidos para la venta	9 €	7 €		
2. Existencias	934 €	1.188 €		
3. Deudores comerciales y otras cuentas a cobrar:	9.718 €	9.679 €		
a) Clientes por ventas y prestaciones de servicios	8.288 €	7.920 €	10.622 €	9.315 €
b) Otros deudores	2.334 €	1.395 €		
c) Activos por impuesto corriente	- 903 €	365 €		
4. Otros activos financieros corrientes	1.906 €	2.216 €		
5. Otros activos corrientes	2.150 €	605 €		
6. Efectivo y otros activos líquidos equivalentes	9.113 €	4.277 €		
TOTAL ACTIVO (A + B)	**108.141 €**	**99.896 €**		

Table 14: Assets section of Telefónica's Balance Sheet filed to the CNMV

In the assets sections of the balance sheets, differences are easily identified as they correspond only to a different level of disaggregation (orange-coloured lines): where equalities can be calculated, they are shown (they are the same calculations for the two

years; for clarity purposes only 2009 figures are displayed). Green-coloured lines indicate equalities between the assets sections for both balance sheets. However, in the liabilities and owner's equity sections the differences are not only due to the level of disaggregation (orange-coloured lines). Red-coloured lines include the accounts where differences are due to different figures allocation within the different sections of the balance sheet. Green colour indicates equalities between the two liabilities and owner's equity sections (equality concerning the amount).

Telefónica S.A. Balance sheet filled before **US SEC** in thousands of euros

EQUITY AND LIABILITIES	2009	2008
A) EQUITY	24.274 €	19.562 €
Equity attributable to equity holders of the parent	21.734 €	17.231 €
Non-controlling interests	2.540 €	2.331 €
B) NON-CURRENT LIABILITIES	56.931 €	55.202 €
Non-current interest-bearing debt	47.607 €	45.088 €
Non-current trade and other payables	1.249 €	1.117 €
Deferred tax liabilities	3.082 €	3.576 €
Non-current provisions	4.993 €	5.421 €
C) CURRENT LIABILITIES	26.936 €	25.132 €
Current interest-bearing debt	9.184 €	8 €
Current trade and other payables	14.023 €	13.651 €
Current tax payables	2.766 €	2.275 €
Provisions	963 €	1.106 €
TOTAL EQUITY AND LIABILITIES (A+B+C)	**108,141**	**99,896**

Table 15: Equity and Liabilities section of Telefónica's Balance Sheet filed to the US SEC

Telefónica S.A. Balance sheet filled before **Spanish CNMV** in thousands of euros				
PASIVO Y PATRIMONIO NETO	**2009**	**2008**	Differen. 2009	Differen. 2008
A) PATRIMONIO NETO (A.1 + A.2 + A.3)	24.274 €	19.562 €		
A.1) FONDOS PROPIOS	22.323 €	20.212 €	22.323 €	20.212 €
1. Capital	4.564 €	4.705 €	21.734 €	17.231 €
a) Escriturado	4.564 €	4.705 €		
b) Menos: Capital no exigido	- €	- €		
2. Prima de emisión	460 €	460 €		
3. Reservas	12.328 €	11.929 €		
4. Menos: Acciones y participaciones en patrimonio propias	- 527 €	- 2.179 €		
5. Resultados de ejercicios anteriores	- €	- €		
6. Otras aportaciones de socios	- €	- €		
7. Resultado del ejercicio	7.776 €	7.592 €		
8. Menos: Dividendo a cuenta	- 2.277 €	- 2.296 €		
9. Otros instrumentos de patrimonio neto	- €	- €		
A.2) AJUSTES POR CAMBIOS DE VALOR	- 589 €	- 2.981 €		
1. Activos financieros disponibles para la venta	- 39 €	- 566 €		
2. Operaciones de cobertura	804 €	1.413 €		
3. Diferencias de conversión	- 1.373 €	- 3.611 €		
4. Otros	19 €	- 216 €		
PATRIMONIO NETO ATRIBUIDO A LA ENTIDAD DOMINANTE (A.1 + A.2)	21.734 €	17.231 €		
A.3) INTERESES MINORITARIOS	2.540 €	2.331 €		
B) PASIVO NO CORRIENTE	56.931 €	55.202 €		
1. Subvenciones	101 €	52 €		
2. Provisiones no corrientes	4.993 €	5.421 €		
3. Pasivos financieros no corrientes	47.607 €	45.088 €		
a) Deudas con entidades de crédito y obligaciones u otros valores negociables	47.607 €	45.088 €		
b) Otros pasivos financieros	- €	- €		
4. Pasivos por impuesto diferido	3.082 €	3.576 €		
5. Otros pasivos a largo plazo	1.148 €	1.066 €	1.249 €	2.172 €
C) PASIVO CORRIENTE	26.936 €	25.132 €		
1. Pasivos vinculados con activos no corrientes mantenidos para la venta	- €	0 €		
2. Provisiones corrientes	963 €	1.106 €		
3. Pasivos financieros corrientes	9.184 €	8.100 €		
a) Deudas con entidades de crédito y obligaciones u otros valores negociables	9.184 €	8.100 €		
b) Otros pasivos financieros	-	- €		
4. Acreedores comerciales y otras cuentas a pagar:	9.611 €	10.238 €		
a) Proveedores	7.078 €	7.939 €	14.023 €	
b) Otros acreedores	1.661 €	1.426 €		
c) Pasivos por impuesto corriente	872 €	873 €		
5. Otros pasivos corrientes	7.178 €	5.688 €		
TOTAL PATRIMONIO NETO Y PASIVO (A + B + C)	**108.141 €**	**99.896 €**		

Table 16: Equity and Liabilities sections of Telefónica's Balance Sheet filed to the CNMV

Trying to find the explanation of the red marked differences is not a straight-forward task. Checking the eighteenth U.S. SEC's explanatory note, *Taxes payable* are disaggregated as follows:

Taxes payable (millions of euros)	**2009**	**2008**
Tax withholdings	118	91
Indirect taxes	897	704
Social security	178	187
Current income taxes payable	872	873
Other	701	420
Total	**2766**	**2275**

Table 17: Taxes payable disaggregation. Source: note no. 18 U.S. SEC's filed financial statements by Telefónica

As shown in the previous table, the taxes included in the U.S. SEC balance sheet include more concepts than the included in the CNMV balance sheet, which only includes the current income taxes payable line (red line above). This fact, together with the different level of disaggregation, explains the differences between balance sheets.

Nevertheless, numeric differences are not the only ones. As previously said, the information contained in the CNMV website has XBRL file format. The XBRL file has been elaborated in accordance with the CNMV taxonomy: "Taxonomía IPP, Circular 1/2008 de 30 de Enero de 2008"[76]. Meanwhile, due to the US SEC's current provisions, the information provided in their website is not a XBRL file, but a text file: foreigner corporations' filings to the U.S. SEC have to fulfil the IFRS in the elaboration of their financial statements (allowed from year 2007) and XBRL is not allowed so far.

In the short term, it is very likely to happen that foreign corporations will be allowed to fill their financial statements to the US SEC in XBRL format. Besides, as previously said, these companies will have to fill their statements accordingly to the IFRS. The IASB has recently issued a new taxonomy on 25 March 2011[77]. Corporations producing their financial statements under the IFRS regulations and willing to fill their statements to the US SEC, presumably will have to use the mentioned 2011 IASB taxonomy.

If a corporation as Telefónica was willing to do so, the need to adapt their XBRL specifications to the new IASB taxonomy will rise once the US SEC allows the XBRL filing format for foreigner corporations. And once again, the comparability among Telefónica financial statements will become impaired as a consequence of the new terminology included in the new IASB taxonomy compared with the one currently provided by the CNMV.

Furthermore, diving in the instance document and specifically in the consolidated balance sheet declaration more differences appeared due to the following causes:

- The way an instance document must theoretically be built, differs from the way existing instance documents are done.

[76] http://www.cnmv.es/Portal/xbrl/xbrl.aspx?lang=es
[77] http://www.ifrs.org/XBRL/IFRS+Taxonomy/IFRS+Taxonomy+2011/IFRS+Taxonomy+2011.htm

- The instance document from Telefónica filed to the Spanish CNMV includes names for each concept one by one. Some of them include the Spanish terminology: ipp-gen namespace. Other terms include the international one ifrs-gen namespace and they do not coincide with the terms specified in the IASB taxonomy. Other elements only include the Spanish name, e.g. ipp-gen:TotalActivoNiif.

An instance document using the new terms included in the 2011 IASB taxonomy, has been self-created, in order to illustrate the differences and comparability impairment would rise between the consolidated balance sheet instance document filed to the CNMV (annexe 5), which follows the CNMV's taxonomy, and the hypothetical consolidated balance sheet instance document would be filed to the U.S. SEC, once the XBRL would be allowed, under the 2011 IASB taxonomy specifications (annexe 4). Comparability between the consolidated balance sheets of the same corporation and different periods, in XBRL format, is far to be achieved.

Both, numerical and terminological differences, despite the possible errors committed during the elaboration of the documents, decrease dramatically the comparability of the two consolidated balance sheets.

The spreadsheet below (table 18) includes the following data: column A includes the names corresponding to the terms used in the CNMV taxonomy for the Telefónica consolidated balance sheet. Column B includes the names of the terms included in the 2011 IASB taxonomy. Column C includes the terms from 2011 IASB taxonomy that are included in the CNMV balance sheet but not in the U.S. SEC's balance sheet (terms not disaggregated in the U.S. SEC's balance sheet). Column C also includes the existing quantity differences explained through the name of the concepts from the taxonomies. Finally, column D includes, if any, the mathematic formula that identifies the differences between the two balance sheets, e.g.:

ifrs:TradeAndOtherCurrentReceivables(IASB) =
ifrs-gp:TradeAndOtherReceivablesNetCurrent (CNMV) — ifrs-gp:CurrentTaxReceivables (CNMV)

Name equivalences			
(A)	(B)	(C)	(D)
CNMV	IFRS		
Assets			
ipp-gen:ActivoNoCorrienteNiif	ifrs:NoncurrentAssets		
ifrs-gp:IntangibleAssetsNet	N/A		
ifrs-gp:IdentifiableIntangibleAssetsNet	ifrs:IntangibleAssetsOtherThanGoodwill		
ifrs-gp:GoodwillNet	ifrs:Goodwill		
ifrs-gp:PropertyPlantAndEquipmentNet	ifrs:PropertyPlantAndEquipment		
ifrs-gp:InvestmentProperty	ifrs:InvestmentProperty		
ifrs-gp:EquityMethodAccountedInvestmentsTotal	ifrs:InvestmentAccountedForUsingEquityMethod		
ifrs-gp:OtherFinancialAssetsNonCurrent + ifrs-gp:OtherAssetsNonCurrent	ifrs:OtherNoncurrentFinancialAssets		
ifrs-gp:DeferredTaxAssets	ifrs:DeferredTaxAssets		
ipp-gen:ActivoCorrienteNiif	ifrs:CurrentAssets		
ifrs-gp:NonCurrentAssetsAndDisposalGroupsHeldForSale	ifrs:NonCurrentAssetsOrDisposalGroupsClassifiedAsHeldForSale		
ifrs-gp:Inventories	ifrs:Inventories		
ifrs-gp:TradeAndOtherReceivablesNetCurrent=ipp-gen:ClientesVentasPrestacionesServicios+ipp-gen:OtrosDeudores	ifrs:TradeAndOtherCurrentReceivables *	ifrs-gp:TradeAndOtherReceivablesNetCurrent≠ ifrs:TradeAndOtherCurrentReceivables**	ifrs:TradeAndOtherCurrentReceivables= ifrs-gp:TradeAndOtherReceivablesNetCurrent - ifrs-gp:CurrentTaxReceivables
ifrs-gp:OtherFinancialAssetsCurrent	N/A		
ifrs-gp:CurrentTaxReceivables = ipp-gen:OtrosActivosCorrientes + ifrs-gp:CurrentTaxReceivables	ifrs:CurrentTaxAssets		
ifrs-gp:CashAndCashEquivalents	ifrs:CashAndCashEquivalents		
ipp-gen:TotalActivoNiif	**ifrs:TotalAssets**		
Liabilities			
ipp-gen:PatrimonioNetoNiif	ifrs:Equity		
ifrs-gp:EquityAttributableToEquityHoldersOfParent *	ifrs:EquityAttributableToOwnersOfParent	ifrs-gp:EquityAttributableToEquityHoldersOfParent = ipp-gen:FondosPropiosNiif + ipp-gen:AjustesValoracionNiif	
ipp-gen:FondosPropiosNiif*	N/A	ipp-gen:FondosPropiosNiif = ifrs-gp:IssuedCapital + SharePremiumTotal + ifrs-gp:OtherReserves + ifrs-gp:TreasuryShares + -be-fs:ResultadoAtribuidoGrupoBalance + es-be-fs:MenosDividendosRetribuciones + es-be-fs:OtrosInstrumentosCapitalFondosPropios	
es-be-fs:CapitalFondoDotacion = ifrs-gp:IssuedCapital			
ipp-gen:AjustesValoracionNiif	N/A	ipp-gen:AjustesValoracionNiif = ifrs-gp:AvailableForSaleReserves + ipp-com:OperacionesCobertura + ipp-gen:DiferenciasConversion + ipp-com:OtrosAjustesValoracion	
ifrs-gp:MinorityInterest	ifrs:NoncontrollingInterests		
ipp-gen:PasivoNoCorrienteNiif	ifrs:NoncurrentLiabilities		
ifrs-gp:GovernmentGrantsNonCurrent	N/A		
ifrs-gp:ProvisionsNonCurrent	N/A		
ipp-gen:DeudasLargoPlazo = ipp-gen:DeudasEntidadesFinancierasLargoPlazo	ifrs:OtherNoncurrentFinancialLiabilities		
ifrs-gp:DeferredTaxLiabilities	ifrs:DeferredTaxLiabilities		
ifrs-gp:ProvisionsNonCurrent	ifrs:NoncurrentProvisions		
ifrs-gp:OtherLiabilitiesNonCurrent	N/A		
ipp-gen:PasivoCorrienteNiif	ifrs:CurrentLiabilities		
ipp-gen:DeudasEntidadesFinancierasCortoPlazo = ipp-gen:DeudasCortoPlazo	ifrs:OtherCurrentFinancialLiabilities		
ipp-gen:AcreedoresComercialesOtrasCuentasPagar	N/A		
ifrs-gp:TradeAndOtherPayablesCurrent	N/A		
ipp-gen:OtrosAcreedores	N/A		
ifrs-gp:CurrentTaxPayables	N/A		
ifrs-gp:OtherLiabilitiesCurrent	N/A		
ifrs-gp:ProvisionsCurrent	ifrs:CurrentProvisions		
ipp-gen:TotalPasivoPatrimonioNetoNiif	**ifrs:TotalEquityAndLiabilities**		
ifrs-gp:IssuedCapi	N/A		
ipp-gen:AjustesValoracionNiif	N/A		
ifrs-gp:LiabilitiesIncludedInDisposalGroupsClassifiedAsHeldForSale	N/A		

Table 18: Name terminological equivalences between CNMV & IASB taxonomies.

Once we have identified the equalities and differences between the two consolidated balance sheets, next it is discussed the way XBRL documents (XML syntax) are transformed into Semantic Web data (RDFs and OWL). From there, it will be easier to formalise these similarities so the computer can be taught about them and can provide true and automated comparability between these two balance sheets.

6.3. Methodology

In order to get this information in the Semantic Web format, it is needed that the information is written in RDF and OWL format. Fortunately, this process can be done automatically in a two-step process, as depicted by García (García, Gil 2010):

- Mapping from XBRL taxonomy to Semantic XBRL: XSD2OWL.
- Mapping instance documents into RDF: XML2RDF

The mentioned process is based on the ReDeFer project[78] and permits an extensive transfer of XML data to the Semantic Web in a general and transparent way as pointed by García (García, Gil 2010), taking advantage from the semantics implicit in the XML Schemas.

6.3.1. XBRL Schemas to OWL ontologies: XSD2OWL.

The XBRL Schema[79] to OWL mapping is responsible for capturing and transforming the implicit semantics existing in the XML Schema, depicted by the different mixture of XML Schema constructs (elements, attributes, types, etc). The mapping transformation is based on translating these XML constructs into the OWL ones that best capture and fit their intended meaning (García, Gil 2010).

The XBRL Schema to OWL mapping is quite transparent and captures most of the XML Schema semantics. The names used for XML constructs are the same used for OWL, although in the new namespace defined for the ontology. XSD and OWL constructs names are identical; this usually produces uppercase-named OWL properties

[78] http://rhizomik.net/html/redefer/
[79] See section 3.2.2.1. XBRL Schema

because the corresponding element name is uppercase, although this is not the usual convention in OWL. The table below shows and example of the XSD2OWL Mapping.

XML Schema	OWL (Abstract Syntax)
<complexType name="**contextOrganisationType**"> <complexContent> <extension base= "**contextEntityType**"> <sequence> <element name="**Country**" type="**CountryType**"/> </sequence> </extension> </complexContent> </complexType>	Class (**contextOrganisationType** complete **contextEntityType** restriction(**Country** allValuesFrom(**CountryType**) cardinality(1)))

Table 19: Example of XML Schema to OWL mapping

In the example above, it is shown how the complex element[80] included in the XBRL taxonomy (XML Schema) **contextOrganisationType** is transformed into an OWL class keeping the attributes and characteristics stated in the XML Schema. This complex element provides the machine with extra information concerning the organization element, in fact the country; or in a more natural expressiveness: the nationality of the organization.

The XML Schema establishes that the element **contextOrganisationType** includes the element **contextEntityType**, which must include the attribute **Country**, whose data type is CountryType. So analyzing the XML syntax, the machine is told that within the context information (additional information regarding one element) the country of the organization must be stated. The *intended* XML semantics (depicted by the XML Schema tree structure) are now translated into OWL.

The right column of the previous table, displays the OWL transformation, where there exist a class named **contextOrganisationType**. A class in OWL defines a group of individuals that belong together because they share some properties. The class is equivalent to the class **contextEntitytype** when it includes the restriction: allValuesFrom. This restriction, allValuesFrom is stated on a property (Country) with respect to a class (**contextEntitytype**). It means that this property on this particular class has a local range

[80] See section 4.10.2. Complex Elements

restriction associated with it. Thus, if an instance of the class is related by the property to a second individual, then the second individual can be inferred to be an instance of the range class. In the example above the restriction obliges to include Country, which must be CountryType. Finally, the cardinality attribute stated in the property is provided as a convenience when it is useful to state that a property on a class has both minCardinality 0 and maxCardinality 0 or both minCardinality 1 and maxCardinality 1. In the example, cardinality equals to one as the organization must have just one nationality as a maximum and a minimum.

As shown, the translation is very similar to the original (XML Schema) but in the OWL output the semantics are explicitly stated and will be available for reutilization by other users and/or agents.

The same process is used for translating the whole set of XML Schemas into OWL and these transformations will be used in the second-step process (XML2RDF) in order to keep the semantics underlying the instantiations[81], depicted by the tree structure of the XML Schemas. In order to get a brief view of the whole process table 20 depicts the translations from XBRL Schemas into OWL constructs.

[81] Instantiations referred to concrete economic facts. In our example the data included in the XBRL instance document.

XML Schema	OWL	Mapping motivation
element[@substitutionGroup= "xbrli:item"]	owl:Class	Facts, though elements, are mapped to classes
element | attribute	rdf:Property owl:DatatypeProperty owl:ObjectProperty	Named relation between nodes or nodes and values
element@substitutionGroup=" xbrli:item"	rdfs:subClassOf	The corresponding element is mapped to a owl:Class rdfs:subClassOf xbrli:item
element@substitutionGroup	rdfs:subPropertyOf	Relation can appear in place of a more general one
element@type	rdfs:range	The relation range kind
complexType|group |attributeGroup	owl:Class	Relations and contextual restrictions package
complexType//element	owl:Restriction	Contextualised restriction of a relation
extension@base | restriction@base	rdfs:subClassOf	Package concretises the base package
@maxOccurs @minOccurs	owl:maxCardinality owl:minCardinality	Restrict the number of occurrences of a relation
sequence choice	owl:intersectionOf owl:unionOf	Combination of relations in a context

Table 20: XBRL Schemas translations into OWL constructs. Source: (García, Gil 2010)

6.3.2. XBRL XML to RDF: XML2RDF

This step transforms the XML metadata structure (tree) into RDF using a structure-mapping approach. This way the resulting output in RDF expresses the data included in the XML file and its structure. As the RDF model is based on the graph, it is easy to model the XML tree structure using it. Furthermore, the semantics loose produced by the structure-mapping process is overcome by the fact that the underlying semantics were already formalised in the previous step into the corresponding ontologies. They will be appropriately attached to RDF metadata using the instantiation relation rdf:type added by the algorithm[82], explained below. In fact, when the XML document is processed, for the elements corresponding to properties, the range prompted is searched

[82] The algorithm is written in Java. More details http://www.java.com/en/java_in_action/

within the ontology (a class belonging to the corresponding complextype). Thus, it is added rdf:type to the resource that represents the object of the property with the value of the mentioned class.(García, Gil 2010)

Table 21 shows a XBRL XML instance fragment and the result of mapping it to RDF.

XBRL XML Fragment
<ipp-gen:ActivoNoCorrienteNiif decimals="0" contextRef="S22009_A-28015865_icc" unitRef="euro">84310549000</ipp-gen:ActivoNoCorrienteNiif>
XBRL RDF Fragment
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:xbrli="http://rhizomik.net/ontologies/2007/11/xbrl-instance-2003-12-31.owl#" xmlns:ipp-gen="http://www.cnmv.es/ipp/gen/1-2008/2008-01-01#" …> ... <xbrli:item> <ipp-gen:ActivoNoCorrienteNiif rdf:about="http://rhizomik.net/semanticxbrl/cnmv/2010027103-TEL/S22009_B/ActivoNoCorrienteNiif/"> <xbrli:unitRef rdf:resource="http://rhizomik.net/semanticxbrl/euro/"/> <xbrli:decimals>0</j.1:decimals> <xbrli:contextRef rdf:resource="http://rhizomik.net/semanticxbrl/cnmv/2010027103-TEL/S22009_B/"/> <rdf:value>84310549000</rdf:value> </ipp-gen:ActivoNoCorrienteNiif> </xbrli:item> … </rdf:RDF>

Table 21: Mapping for "ActivoNoCorrienteNiif" in the PGC position transformed into RDF

As shown in both parts of the table 21, the element and its currency and context are defined and the value and decimals are set. Nevertheless, meanwhile in the XML fragment these attributes are defined through the document syntax (tree structure), in the

OWL transformation these instantiations permit their reusability: the element identification is stated by the URI that includes the number of the report, the period and the entity (context), and the name of the corresponding fact. In order to better understand how the process of modelling the XBRL core concepts into RDF data works, figure 15 is included:

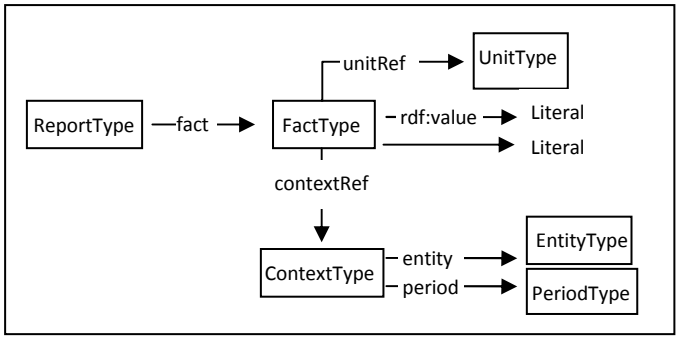

Figure 15: Modelling the XBRL core concepts into RDF data.Source: (García, Gil 2010)

As depicted in the figure 15 and pointed out by García, R. boxes correspond to OWL classes and arrows correspond to OWL properties. In our example, the report no. 2010027103-TEL/S22009_B is an instantiation of the class ReportType, i.e. our report is one of the individuals composing the OWL class ReportType.

This report includes a fact, i.e. ActivoNoCorrienteNiif, which is an instantiation of the class FactType. The fact is fully identified by the URI that relates not only to the accounting concept name, but also to the period, entity and the report number/reference. The FactType class is defined by two attributes (value and decimals) and by two properties: unitRef (euro in our example), that belongs to the UnitType class, and contextRef property (Telefonica and 2009) that belongs to the class ContextType that is defined by the properties and classes concerning the entity and the period.

Logically the perfect candidates to be transformed into OWL classes are the complex elements, but it should be noted, as indicated by García, R., that a fact is modelled as a class because it is more intuitive for programmers to have them as classes. Nevertheless, if we were applying a direct modelling of the XML tree, facts should be modelled as RDF properties because they correspond to XML elements. Therefore, the algorithm that implements the XML2RDF translation includes a modification to the basic

XML2RDF algorithm[83]: the method "transFact" that makes fact class instances instead of property instances. The algorithm is next included:

```
Model XBRL2RDF(Document doc, Mapping map)                                    (a)
{
        Model rdf;
        Resource r = rdf.createResource(doc.url);
        Element e = doc.getDocumentElement();
        Resource p = map(e.nsURI())+e.localName();
        if (p.subClassOf(XBRLI.FactType)
        {
                r = transFact(r, p, rdf);
        }
        Class range = map.getRange(null, Property(p));
        transResProps(r, e, range, rdf, map);
        }

Resource transFact(Resource r, Resource p,                                   (b)
        Model rdf)
{
        Resource f = rdf.createResource();
        f.addProperty(RDF.type, Class(p));
        r.addProperty(XBRLI.item, f);
        return f;
}

transResProps(Resource r, Element e,                                         (c)
        Class domain, Model rdf, Mapping map)
{
        foreach (a in e.attributes())
        {
                Property p = map(a.nsURI())+a.localName();
                r.addProperty(p, a.getValue());
        }
        foreach (c in e.childNodes())
        {
                if (c.isTextNode())
                {
                        Property p = map(c.nsURI())+c.localName());
                        r.addProperty(p, c.getValue());
                }
                else
                {
                        Resource rC = rdf.createResource();
                        Property p = map(c.nsURI())+c.localName());
                        r.addProperty(p, rC);
                        Class range = map.getRange(domain, p);
                        rC.addProperty(RDF.type, range);
                        transResProps(rC, c, range, rdf, map);
                }
        }
}
```

Figure 16: Algorithm. Source: (García, Gil 2010)

As indicated in the right side of the algorithm, there exist three different sections:

[83] Further details http://rhizomik.net/html/redefer/xml2rdf/

- Section (a): starting from the root element in the XML tree, it traverses and produces triples for all attributes and elements recursively using the "transResProps" method. The command "if" checks if the processed element is a FactType element, in which case the method transFact is called.
- Section (b): includes the additional method "transFact" responsible for making all the processed facts class instances instead of property instances, and for introducing the necessary connections to the rest of the generated triples that make the resulting data follow the core model shown in figure 15.
- Section (c): given that the algorithm is completed with an external document (configuration file) that includes the equivalences among the .xsd namespaces[84] and the OWL namespaces, this section maps the XML namespaces and the OWL namespaces linking the triples generated to the ontologies obtained in the first-step of this process, the XML Schema to OWL transformation.

6.3.3. Mappings between Spanish PGC and IFRS

The following table shows the mappings between the terms defined in the Spanish PGC and used in the previous position sent to the CNMV and those defined in IFRS and used in the position hypothetically sent to the U.S. SEC.

The approach is to define as equivalent, using the equivalentClass OWL construct, those terms that have the same value in both positions. When the relation is more complex than a simple equivalence, for instance the value for a term in one vocabulary is the sum of more than one value in other vocabularies, then the approach is to use a CONSTRUCT SPARQL query that computes the combined value, for instance the sum, and creates the computed fact. Terms with no equivalences or any other relation are stated as N/A (non available).

PGC	**IFRS**	
Assets		
ipp-gen:ActivoNoCorrienteNiif 84.311 €	ifrs:NoncurrentAssets 84.311 €	ipp-gen:ActivoNoCorrienteNiif owl:**equivalentClass**

[84]See section 4.2. Namespaces

		ifrs:NoncurrentAssets
ifrs-gp:IntangibleAssetsNet 35.412 €	N/A	
ifrs-gp:GoodwillNet 19.566 €	ifrs:Goodwill 19.566 €	ifrs-gp:GoodwillNet owl:**equivalentClass** ifrs:Goodwill
ifrs-gp:IdentifiableIntangibleAssetsNet 15.846 €	ifrs:IntangibleAssetsOtherThanGoodwill 15.846 €	ifrs-gp:IdentifiableIntangibleAssetsNet owl:**equivalentClass** ifrs-gp:IdentifiableIntangibleAssetsNet
ifrs-gp:PropertyPlantAndEquipmentNet 31.999 €	ifrs:PropertyPlantAndEquipment 31.999 €	ifrs-gp:PropertyPlantAndEquipmentNet owl:**equivalentClass** ifrs:PropertyPlantAndEquipment
ifrs-gp:InvestmentProperty 5 €	ifrs:InvestmentProperty 5 €	ifrs-gp:InvestmentProperty owl:**equivalentClass** ifrs:InvestmentProperty
ifrs-gp:EquityMethodAccountedInvestmentsTotal 4.936€	ifrs:InvestmentAccountedForUsingEquityMethod 4.936€	ifrs-gp:EquityMethodAccountedInvestmentsTotal owl:**equivalentClass** ifrs:InvestmentAccountedForUsingEquityMethod

ifrs-gp:OtherFinancialAssetsNonCurrent (5.499 €) + ifrs-gp:OtherAssetsNonCurrent (489 €)	ifrs:OtherNoncurrentFinancialAssets
	(5.988 €)
		CONSTRUCT
		{ [] a ifrs:OtherNoncurrentFinancialAssets;
		xbrli:contextRef ?context;
		xbrli:unitRef ?unit;
		xbrli:decimals ?decimals;
		rdf:value ?value.
		}
		WHERE
		{
		?ofanc a ifrs-gp:OtherFinancialAssetsNonCurrent;
		xbrli:contextRef ?context;
		xbrli:unitRef ?unit;
		xbrli:decimals ?decimals;
		rdf:value ?ofanc-value.
		
		?oanc a ifrs-gp:OtherAssetsNonCurrent;
		xbrli:contextRef ?context;
		xbrli:unitRef ?unit;
		xbrli:decimals ?decimals;
		rdf:value ?oanc-value.
		
		BIND(?ofanc-value+?oanc-value AS ?value)
		}

ifrs-gp:DeferredTaxAssets 5.971€	ifrs:DeferredTaxAssets 5.971€	ifrs-gp:DeferredTaxAssets owl:**equivalentClass** ifrs:DeferredTaxAssets
ipp-gen:ActivoCorrienteNiif 23.830€	ifrs:CurrentAssets 23.830€	ipp-gen:ActivoCorrienteNiif owl:**equivalentClass** ifrs:CurrentAssets
ifrs-gp:NonCurrentAssetsAndDisposalGroupsHeldForSale 9€	ifrs:NonCurrentAssetsOrDisposalGroupsClassifiedAsHeldForSale 9€	ifrs-gp:NonCurrentAssetsAndDisposalGroupsHeldForSale owl:**equivalentClass** ifrs:NonCurrentAssetsOrDisposalGroupsClassifiedAsHeldForSale
ifrs-gp:Inventories 934€	ifrs:Inventories 934	ifrs-gp:Inventories owl:**equivalentClass** ifrs:Inventories

ifrs-gp:TradeAndOtherReceivablesNetCurrent=ipp-gen:ClientesVentasPrestacionesServicios+ipp-gen:OtrosDeudores
8.288€ + 2.334€
	ifrs:TradeAndOtherCurrentReceivables
	10.622€
		ifrs-gp:TradeAndOtherReceivablesNetCurrent
		owl:**equivalentClass**
		ifrs:TradeAndOtherCurrentReceivables
		
		CONSTRUCT
		{ [] a ifrs-gp:TradeAndOtherReceivablesNetCurrent;
		xbrli:contextRef ?context;
		xbrli:unitRef ?unit;
		xbrli:decimals ?decimals;
		rdf:value ?value.
		}
		WHERE
		{
		?cvps a ipp-gen:ClientesVentasPrestacionesServicios;
		xbrli:contextRef ?context;
		xbrli:unitRef ?unit;
		xbrli:decimals ?decimals;
		rdf:value ?cvps-value.

		?od a ipp-gen:OtrosDeudores; xbrli:contextRef ?context; xbrli:unitRef ?unit; xbrli:decimals ?decimals; rdf:value ?od-value. BIND(?cvps-value+?od-value AS ?value) }
ifrs-gp:OtherFinancialAssetsCurrent	N/A	

ifrs-gp:CurrentTaxReceivables = ipp-gen:OtrosActivosCorrientes + ifrs-gp:CurrentTaxReceivables
2.150€ - 903€
	ifrs:CurrentTaxAssets
	1.246€
		CONSTRUCT
		{ [] a ifrs:CurrentTaxAssets;
		xbrli:contextRef ?context;
		xbrli:unitRef ?unit;
		xbrli:decimals ?decimals;
		rdf:value ?value.
		}
		WHERE
		{
		?oac a ipp-gen:OtrosActivosCorrientes;
		xbrli:contextRef ?context;
		xbrli:unitRef ?unit;
		xbrli:decimals ?decimals;
		rdf:value ?oac-value.
		
		?ctr a ifrs-gp:CurrentTaxReceivables;
		xbrli:contextRef ?context;
		xbrli:unitRef ?unit;
		xbrli:decimals ?decimals;
		rdf:value ?ctr-value.
		
		BIND(?oac-value-?ctr-value AS ?value)
		}

ifrs-gp:CashAndCashEquivalents 9.113€	ifrs:CashAndCashEquivalents 9.113€	
ipp-gen:TotalActivoNiif	N/A	
Liabilities		
ipp-gen:PatrimonioNetoNiif 24.274€	ifrs:Equity 24.274€	ipp-gen:PatrimonioNetoNiif owl:**equivalentClass** ifrs:Equity
ifrs-gp:EquityAttributableToEquityHoldersOfParent 21.734€	ifrs:EquityAttributableToOwnersOfParent 21.734€	ifrs-gp:EquityAttributableToEquityHoldersOfParent owl:**equivalentClass** ifrs:EquityAttributableToOwnersOfParent
ipp-gen:FondosPropiosNiif*	N/A	ipp-gen:FondosPropiosNiif = ifrs-gp:IssuedCapital + SharePremiumTotal + ifrs-gp:OtherReserves + ifrs-gp:TreasuryShares + es-be-fs:ResultadoAtribuidoGrupoBalance + es-be-fs:MenosDividendosRetribuciones + es-be-fs:OtrosInstrumentosCapitalFondosPropios
es-be-fs:CapitalFondoDotacion = ifrs-gp:IssuedCapital		
ipp-gen:AjustesValoracionNiif	N/A	ipp-gen:AjustesValoracionNiif = ifrs-gp:AvailableForSaleReserves + ipp-com:OperacionesCobertura + ipp-gen:DiferenciasConversion + ipp-com:OtrosAjustesValoracion
ifrs-gp:MinorityInterest 2.540€	ifrs:NoncontrollingInterests 2.540€	ifrs-gp:MinorityInterest owl:**equivalentClass** ifrs:NoncontrollingInterests
ipp-gen:PasivoNoCorrienteNiif 56.931€	ifrs:NoncurrentLiabilities 56.931€	ipp-gen:PasivoNoCorrienteNiif owl:**equivalentClass** ifrs:NoncurrentLiabilities
ifrs-gp:GovernmentGrantsNonCurrent	N/A	
ifrs-gp:ProvisionsNonCurrent	N/A	
ipp-gen:DeudasLargoPlazo = ipp-gen:DeudasEntidadesFinancierasLargoPlazo 47.607€	ifrs:OtherNoncurrentFinancialLiabilities 47.607€	ipp-gen:DeudasLargoPlazo owl:**equivalentClass** ipp-gen:DeudasEntidadesFinancierasLargoPlazo ipp-gen:DeudasEntidadesFinancierasLargoPlazo owl:**equivalentClass** ifrs:OtherNoncurrentFinancialLiabilities

ifrs-gp:DeferredTaxLiabilities 3.082€	ifrs:DeferredTaxLiabilities 3.082€	ifrs-gp:DeferredTaxLiabilities owl:**equivalentClass** ifrs:DeferredTaxLiabilities
ifrs-gp:ProvisionsNonCurrent 4.993€	ifrs:NoncurrentProvisions 4.993€	ifrs-gp:ProvisionsNonCurrent owl:**equivalentClass** ifrs:NoncurrentProvisions
ifrs-gp:OtherLiabilitiesNonCurrent	N/A	
ipp-gen:PasivoCorrienteNiif 26.936€	ifrs:CurrentLiabilities 26.936€	ipp-gen:PasivoCorrienteNiif owl:**equivalentClass** ifrs:CurrentLiabilities
ipp-gen:DeudasEntidadesFinancierasCortoPlazo = ipp-gen:DeudasCortoPlazo 9.184€	ifrs:OtherCurrentFinancialLiabilities 9.184€	ipp-gen:DeudasEntidadesFinancierasCortoPlazo owl:**equivalentClass** ipp-gen:DeudasCortoPlazo ipp-gen:DeudasCortoPlazo owl:**equivalentClass** ifrs:OtherCurrentFinancialLiabilities
ipp-gen:AcreedoresComercialesOtrasCuentasPagar	N/A	
ifrs-gp:TradeAndOtherPayablesCurrent	N/A	
ipp-gen:OtrosAcreedores	N/A	
ifrs-gp:CurrentTaxPayables	N/A	
ifrs-gp:OtherLiabilitiesCurrent	N/A	
ifrs-gp:ProvisionsCurrent 963€	ifrs:CurrentProvisions 963€	ifrs-gp:ProvisionsCurrent owl:**equivalentClass** ifrs:CurrentProvisions
ipp-gen:TotalPasivoPatrimonioNetoNiif 108.141€	ifrs:TotalEquityAndLiabilities 108.141€	ipp-gen:TotalPasivoPatrimonioNetoNiif owl:**equivalentClass** ifrs:TotalEquityAndLiabilities
ifrs-gp:IssuedCapi	N/A	
ipp-gen:AjustesValoracionNiif	N/A	
ifrs-gp:LiabilitiesIncludedInDisposalGroupsClassifiedAsHeldForSale	N/A	

Table 21: mappings between the terms defined in the Spanish PGC and those defined in IFRS (2011 IASB taxonomy).

6.4. Explaining the results.

Once the whole process of translation is finished, this section explains the results obtained. These results are available from http://rhizomik.net/semanticxbrl-demo/html/.

This website displays the benefits of a Semantic Web-approach to XBRL fillings for improved data integration and comparability. More concretely, the demo shows how it is possible to query a XBRL report based on the Spanish PGC taxonomy using terms from the IFRS taxonomy. The steps to set the demo are:

- Load the RDF version of part of a Telefónica S.A. XBRL report (for instance, the assets section of the consolidated balance sheet) submitted to the Spanish CNMV and based on its taxonomy.
- Load direct equivalences and equivalences based on operations (sums or substractions) between relevant PGC and IFRS terms.

These equivalences are those presented in the previous table and are based on:

- Expert knowledge.
- The comparison of the PGC version and the IFRS version generated from a report submitted to the US SEC by Telefónica S.A. (it is not yet allowed for foreign companies to submit their reports using XBRL).

Once the previous data has been loaded, it is possible to query the original PGC-based data using IFRS-terms.

The following figures show some of the results obtained:

Once the previous data has been loaded, it is possible to query the original PGC-based data using IFRS-terms:

PGC Fact and Value (thousands of €)	IFRS Equivalent Query
Assets	
ipp-gen:ActivoNoCorrienteNiif = 84.311 €	*Get* ifrs:NoncurrentAssets
ifrs-gp:IntangibleAssetsNet = 35.412 €	No equivalent
ifrs-gp:GoodwillNet = 19.566 €	*Get* ifrs:Goodwill
ifrs-gp:IdentifiableIntangibleAssetsNet = 15.846 €	*Get* ifrs:IntangibleAssetsOtherThanGoodwill
ifrs-gp:PropertyPlantAndEquipmentNet = 31.999 €	*Get* ifrs:PropertyPlantAndEquipment
ifrs-gp:InvestmentProperty = 5 €	*Get* ifrs:InvestmentProperty
ifrs-gp:EquityMethodAccountedInvestmentsTotal = 4.936€	*Get* ifrs:InvestmentAccountedForUsingEquityMethod
ifrs-gp:OtherFinancialAssetsNonCurrent (5.499 €) + ifrs-gp:OtherAssetsNonCurrent (489 €) = 5.988 €	*Get* ifrs:OtherNoncurrentFinancialAssets
ifrs-gp:DeferredTaxAssets = 5.971€	*Get* ifrs:DeferredTaxAssets
ipp-gen:ActivoCorrienteNiif = 23.830€	*Get* ifrs:CurrentAssets
ifrs-gp:NonCurrentAssetsAndDisposalGroupsHeldForSale = 9€	*Get* ifrs:NonCurrentAssetsOrDisposalGroupsClassifiedAsHeldForSale
ifrs-gp:Inventories = 934€	*Get* ifrs:Inventories
ipp-gen:ClientesVentasPrestacionesServicios (8.288€) + ipp-gen:OtrosDeudores (2.334€) = ifrs-gp:TradeAndOtherReceivablesNetCurrent (10.622€)	*Get* ifrs:TradeAndOtherCurrentReceivables
ifrs-gp:OtherFinancialAssetsCurrent	No equivalent
ipp-gen:OtrosActivosCorrientes (2.150€) - ifrs-gp:CurrentTaxReceivables (903€) = 1.246€	*Get* ifrs:CurrentTaxAssets
ifrs-gp:CashAndCashEquivalents = 9.113€	*Get* ifrs:CashAndCashEquivalents
ipp-gen:TotalActivoNiif	No equivalent

Figure 17: Demo screen capture.

Figure 18 shows in the left-upside corner (circled), the corresponding element in the CNMV taxonomy (ipp-gen:ActivoNoCorrienteNiif), when clicking on the IFRS element (ifrs:NoncurrentAssets):

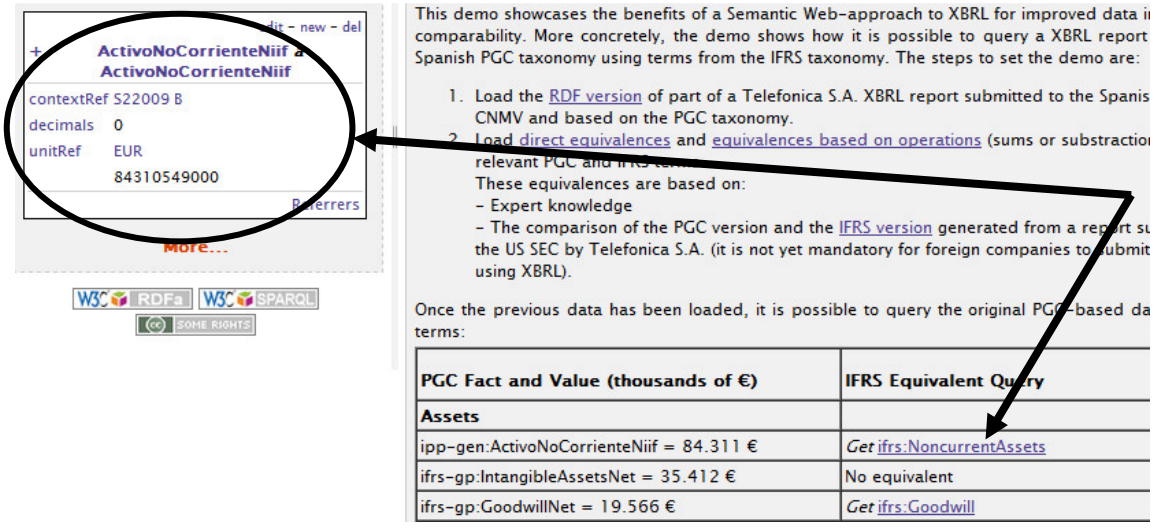

Figure 18: Obtaining the IFRS element (ifrs:NoncurrentAssets) from the corresponding element in the CNMV taxonomy (ipp-gen:ActivoNoCorrienteNiif).

Figure 19 shows the equivalence obtained when clicking in the Goodwill IFRS element. As before, in the upper left side of the screen it is shown the CNMV's corresponding element:

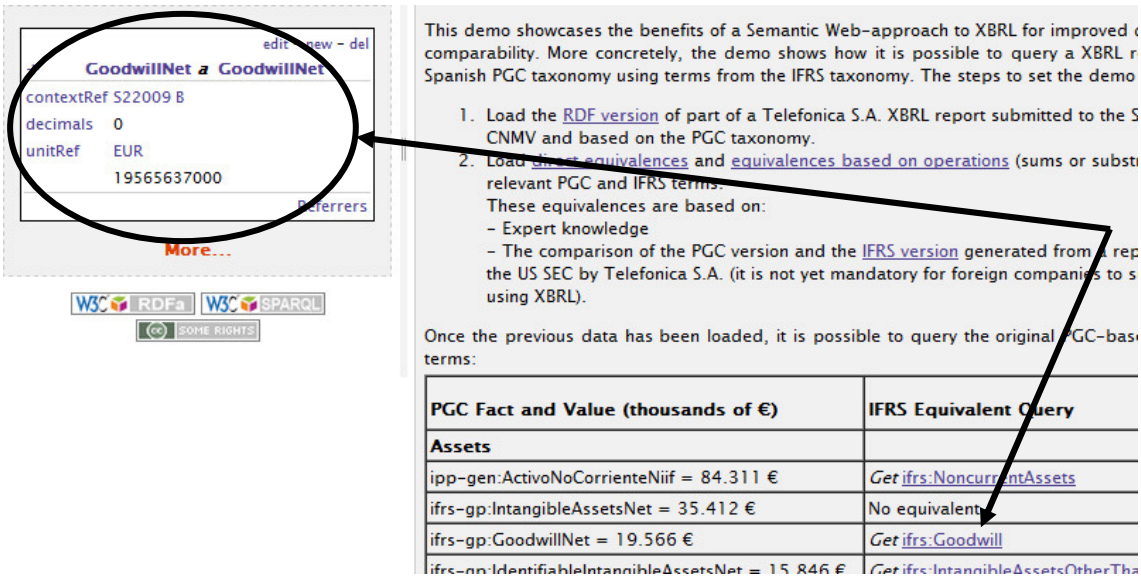

Figure 19: Obtaining the Goodwill IFRS element from the CNMV corresponding element.

In this demo the queries are launched when clicking on each IFRS element, obtaining the equivalent value of the CNMV's balance sheet corresponding to that IFRS element in the right part of the screen, i.e. we build the IFRS balance sheet from the CNMV's thanks to the definition of the equivalences in the ontology. Obviously, the whole process can be automated.

7. Conclusions

The new electronic exchange of financial information means a huge revolution for the accounting information systems and opens a new world of possibilities.

The advantages brought by the use of XBRL in the exchange of the financial information are off any discussion. For the first time in history, financial statements are written in the same machine-code, despite the human language used. The advantages to be taken from there are far to be foreseen. Moreover, this is the biggest achievement provided by this standard, despite its limitations.

The use of Semantic Web-based technologies upon the XBRL standard, adds new automated ways to manage and analyze that financial information overcoming old barriers previously insurmountable or, at least, very difficult to overcome. Defining the relation in OWL permits a better experience comparing financial statements: the comparability and reusability of the information is clearly enhanced, thus its value.

Concerning the international accounting regulatory context and more specifically, regarding the Process of Convergence jointly carried out by the IASB and FASB, the process itself seems to be currently developed in reverse order. In this sense, both accounting bodies focus their efforts on the issuance of a definitive and exhaustive regulation in regards of the acceptance of the global standards worldwide, trying to include all possible range of economic transactions. This seems to be a very difficult task, not to say impossible. Furthermore, it brings distrust to that process between the parties involved.

Nowadays, the way the accounting regulation emanates and is applied, involves an overexertion for the international and national accounting regulators, and for the issuers and users of the financial information. Thus, as can be stated from the Spanish accounting regulation example, it is first issued by the international accounting body. Then, it is the Spanish accounting regulator, who has to adapt, not only the accounting regulation, but sometimes modify other related laws, to homogenize them with different levels of success.

Given the new dimension acquired by the financial data on the Semantic Web, their structure (hierarchy) is no longer so important, though it is kept, especially when it comes to analyzing them. In the paper format the main source of data for analysis are the balance sheet, the income statement, etc, with their own format, which undoubtedly influences the analysis itself, meanwhile in the semantic format that hierarchy can be obviated, to focus on an item-by-item analysis more directly. In other words, the data in the semantic web allows the financial analyst to consult and use specific data, as required, without having to manage a complete financial statement set or report. Therefore, we propose an alternative approach to implement a more flexible model of accounting regulation that allows for a simpler adoption of the international standards through an *accounting principle of internationality*. This principle would oblige enterprises to apply the international standards as issued by the international accounting body, when they help to reflect the fair image of the financial and economic position of the enterprise. This way the efforts to adapt national regulations to the international ones would be avoided. Exceptionally, other standards would be allowed, wether they are particular cases, not enough covered by the international standards, or they are particular interpretations of the international ones. Their developers could be continental, national or even regional accounting standard setters, and only possible when these more specific *exceptional standards* and their application, would help to substantially improve the fair image of the business and they do not contravene, in any sense, the international ones.

These named *exceptional standards* or *annexes* could be digitally codified, creating equivalences that would allow for an easy identification with defined sections accross domestic and international regulations. E.g., an asset considered as current in Spain, as an exception to the international standard because of the fair image, which amount is benchmark treated as non-current asset by the international standards. This way the amount can be relocated easily by the information analyst/user thanks to its digital codification. Definitely, the comparability of the financial information will be improved, thus its value.

Besides, the desired and complex convergence process would get more relaxed, through the allowance of a controlled and identifiable flexibility, through the digital

codification. It would diminish the pressure on the issuers and users of the financial information, who will receive a minor quantity of changes from the accounting bodies, as information stakeholders would have the international primary principles as a core, and the additional appendixes, which develop possible differences in the way the principles shall be applied/defined. Countries, regions, industrial sectors or a combination of these criteria may organize these appendixes.

This new proposed accounting regulatory framework may imply new challenges that strictly escape accounting considerations, but they would never be more difficult to overcome to the ones already set by the current process of convergence.

Furthermore, this proposed accounting framework may provide the accounting regulatory system with better solutions: the same problem could be solved with different national/regional regulations (due the fair image requirement) allowing then choosing the most successful solution among the choices available, if considered appropriate.

The inexistence of the *principle of internationality* and its influence in the impairment of the comparability of the financial information can be clearly checked in the Spanish recent experience: the recently published Ministerial Order JUS/1698/2011, of June 13, approving the models for presentation on the Mercantile Registry of the consolidated financial statements. This new definition of the consolidated financial statements will result in the no comparability between financial statements elaborated prior to their entry into force in an easy way. Moreover, the adoption of the new consolidated financial statement templates in the Spanish GAAP is achieved late and may result in the impairment of the comparability of consolidated financial statements internationally; especially with those who directly adopt the consolidated models as issued by the IASB.

Accounting regulatory modifications will definitely affect comparability. Nevertheless, through the definition of semantic relations, either they are equalities, summations or other more sophisticated relations, the accountant will easily and quickly recover this comparability or at least reduce its impairment (and quicker and easier than designing them in XBRL).

8. Future research guidelines propposal

Despite the advantages described in the previous section concerning the use of the Web Semantic technologies, there are some important aspects to be considered:

These technologies are recently developed and irregularly implemented worldwide. Nowadays there are different developing technologies that blunt and it is not possible to say so far which will be the predominant future one.

In this sense, the OWL is a very useful technique, but needs further development. Despite the computational efficiency level limitations, the main problem that shall be pointed out is that the design and definition of the ontology means an added cost to publish the information as XBRL. That cost has been attempted to be reduced using an automatic transformation from XBRL to RDF and OWL, but still there exist the cost of implementing the approach and the cost to establish equivalences between different concepts schemas. These costs are far to be considered insignificant, because they require Semantic Web knowledge, which is less extended than the XML knowledge and more complex. It is expectable that as the technology knowledge spreads its associated costs will lessen.

In this sense, the ideal situation would be the one were the issuers already published their data in RDF format and that there was an international accounting institution in charge of defining the accounting equivalences across national regulations capturing the equivalence between different schemes in the definition of the corresponding ontologies. Alternatively, every national accounting scheme (PGC, US GAAP...) would be defined based on a scheme reference (IFRS) so that the comparability would be practically automatic.

It is not possible to deduce so far from our evaluation, whether the equivalences obtained will be applicable to other companies' filings. Our proposal for future research guidelines are the analysis of this aspect, through the study and analysis of more reports based on different taxonomies in order to identify their equivalences. Once the

equivalences have been obtained, the next step would be their generalization so they can be applied across different companies' filings and taxonomies.

Besides, we propose to study the way to automate the generation of the equivalences from the mathematical study of the financial statements based on different taxonomies (identify same figures and deduce that they correspond to direct equivalences, or values resulting from additions, subtractions, etc)

Annexes

Annexe 1

The report has been created from the "Información Pública Periódica" taxonomy (IPP taxonomy) published by the Spanish CNMV[85] including only the elements described for the consolidated balance sheet. The first part includes a declaration of the documents used from the Discovery Taxonomy Set[86] and lists all the namespaces used by the document: the corresponding to other schemas and XLink, the XBRL standard schemas and the namespace of the current document. The second part defines the elements: namespace prefix, name, id, type, period and balance.

Taxonomy Report (Schema) generated by Taxonomy Editor (98). All rights reserved, COPYRIGHT © Fujitsu Limited, 2004-2010 from Taxonomy IPP, "Circular 1/2008 de 30 de Enero de 2008" published by the CNMV. *(Only including the schema for the Consolidated Balance sheet)*	Sunday, May 14 2011 14H38' (GMT+1)

1	**Namespace Prefix**	ipp-gen
	Namespace URI	http://www.cnmv.es/ipp/gen/1-2008/2008-01-01
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\ipp-gen-2008-01-01.xsd
2	**Namespace Prefix**	Xbrli
	Namespace URI	http://www.xbrl.org/2003/instance
	Schema file	http://www.xbrl.org/2003/xbrl-instance-2003-12-31.xsd
3	**Namespace Prefix**	Link
	Namespace URI	http://www.xbrl.org/2003/linkbase
	Schema file	http://www.xbrl.org/2003/xbrl-linkbase-2003-12-31.xsd
4	**Namespace Prefix**	ipp-com
	Namespace URI	http://www.cnmv.es/ipp/com/1-2008/2008-01-01
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\ipp-com-2008-01-01.xsd
5	**Namespace Prefix**	dgi-lc-es
	Namespace URI	http://www.xbrl.org.es/es/2007/dgi/gp/lc-es/2007-05-30
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\dgi-lc-es-2007-05-30.xsd
6	**Namespace Prefix**	dgi-types
	Namespace URI	http://www.xbrl.org.es/es/2007/dgi/gp/types/2007-05-30

[85] http://www.cnmv.es/ipp/gen/1-2008/2008-01-01

[86] Usually, it is necessary to consider multiple related taxonomies together when interpreting (validating) an XBRL instance. The set of related taxonomy schemas and linkbases is called a *Discoverable Taxonomy Set* (DTS). The bounds of a DTS are determined by starting from some set of documents (instance, taxonomy, schema or linkbase) and following DTS discovery rules.

	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\dgi-types-2007-05-30.xsd
	Namespace Prefix	dgi-lc-int
7	Namespace URI	http://www.xbrl.org.es/es/2007/dgi/gp/lc-int/2007-05-30
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\dgi-lc-int-2007-05-30.xsd
	Namespace Prefix	dgi-est-gen
8	Namespace URI	http://www.xbrl.org.es/es/2007/dgi/gp/est-gen/2007-05-30
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\dgi-est-gen-2007-05-30.xsd
	Namespace Prefix	es-be-fs
9	Namespace URI	http://www.bde.es/es/fr/ifrs/basi/bde/4-2004/2006-01-01
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\es-be-fs-2006-01-01.xsd
	Namespace Prefix	es-be-fs-typ
10	Namespace URI	http://www.bde.es/es/fr/ifrs/basi/bde/4-2004/2006-01-01/types
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\es-be-fs-types-2006-01-01.xsd
	Namespace Prefix	es-be-fs-rol
11	Namespace URI	http://www.bde.es/es/fr/ifrs/basi/bde/4-2004/2006-01-01/roles
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\es-be-fs-roles-2006-01-01.xsd
	Namespace Prefix	ifrs-gp
12	Namespace URI	http://xbrl.iasb.org/int/fr/ifrs/gp/2005-05-15
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\ifrs-gp-2005-05-15.xsd
	Namespace Prefix	ifrs-gp-typ
13	Namespace URI	http://xbrl.iasb.org/int/fr/ifrs/gp/2005-05-15/types
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\ifrs-gp-types-2005-05-15.xsd
	Namespace Prefix	Ff
14	Namespace URI	http://www.xbrl.org/2005/role/restatedLabel
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\restatedLabel.xsd
	Namespace Prefix	Ref
15	Namespace URI	http://www.xbrl.org/2004/ref
	Schema file	http://www.xbrl.org/2004/ref-2004-08-10.xsd

NS_Prefix	Element Name	Element ID	Type	Period Type	Balance
Schema					
es-be-fs	ActivoPresentacion	es-be-fs_ActivoPresentacion	monetaryItemType	instant	debit
es-be-fs	DepositosEntidadesCreditoCarteraNegociacionActivoPresentacion	es-be-fs_DepositosEntidadesCreditoCarteraNegociacionActivoPresentacion	monetaryPositiveItemType	instant	debit
es-be-fs	PasivoPatrimonioNeto	es-be-fs_PasivoPatrimonioNeto	monetaryItemType	instant	
es-be-fs	ValoresPropiosBalance	es-be-fs_ValoresPropiosBalance	monetaryNegativeItemType	instant	credit
es-be-fs	OperacionesMercadoMonetarioEntidadesContrapartidaCartera	es-be-fs_OperacionesMercadoMonet	monetaryPositive	instant	debit

	NegociacionActivoPresentacion	arioEntidadesContrapartidaCarteraNegociacionActivoPresentacion	ItemType		
es-be-fs	ResultadoAtribuidoGrupoBalance	es-be-fs_ResultadoAtribuidoGrupoBalance	monetaryItemType	instant	credit
es-be-fs	CreditoClientelaCarteraNegociacionActivoPresentacion	es-be-fs_CreditoClientelaCarteraNegociacionActivoPresentacion	monetaryPositiveItemType	instant	debit
es-be-fs	ProMemoriaPrestadosGarantiaCarteraNegociacionActivoPresentacion	es-be-fs_ProMemoriaPrestadosGarantiaCarteraNegociacionActivoPresentacion	monetaryPositiveItemType	instant	debit
es-be-fs	OperacionesMercadoMonetarioEntidadesContrapartidaOtrosActivosFinancierosValorRazonableCambiosPerdidasGanancias	es-be-fs_OperacionesMercadoMonetarioEntidadesContrapartidaOtrosActivosFinancierosValorRazonableCambiosPerdidasGanancias	monetaryPositiveItemType	instant	debit
es-be-fs	CreditoClientelaOtrosActivosFinancierosValorRazonableCambiosPerdidasGananciasBalance	es-be-fs_CreditoClientelaOtrosActivosFinancierosValorRazonableCambiosPerdidasGananciasBalance	monetaryPositiveItemType	instant	debit
es-be-fs	ProMemoriaPrestadosGarantiaOtrosActivosFinancierosValorRazonableCambiosPerdidasGanancias	es-be-fs_ProMemoriaPrestadosGarantiaOtrosActivosFinancierosValorRazonableCambiosPerdidasGanancias	monetaryPositiveItemType	instant	debit
es-be-fs	ValoresRepresentativosDeudaActivosFinancierosDisponiblesVentaActivoPresentacion	es-be-fs_ValoresRepresentativosDeudaActivosFinancierosDisponiblesVentaActivoPresentacion	monetaryPositiveItemType	instant	debit
es-be-fs	OtrosInstrumentosCapitalActivosFinancierosDisponiblesVentaActivoPresentacion	es-be-fs_OtrosInstrumentosCapitalActivosFinancierosDisponiblesVentaActivoPresentacion	monetaryPositiveItemType	instant	debit
es-be-fs	ProMemoriaPrestadosGarantiaActivosFinancierosDisponiblesVentaActivoPresentacion	es-be-fs_ProMemoriaPrestadosGarantiaActivosFinancierosDisponiblesVentaActivoPresentacion	monetaryPositiveItemType	instant	debit
es-be-fs	DepositosEntidadesCreditoInversionesCrediticiasBalance	es-be-fs_DepositosEntidadesCreditoInversionesCrediticiasBalance	monetaryPositiveItemType	instant	debit
es-be-fs	OperacionesMercadoMonetarioEntidadesContrapartidaInversi	es-be-fs_OperacionesMercadoMonet	monetaryPositive	instant	debit

	onesCrediticias	arioEntidadesContrapartidaInversionesCrediticias	ItemType		
es-be-fs	CreditoClientelaInversionesCrediticias	es-be-fs_CreditoClientelaInversionesCrediticias	monetaryPositiveItemType	instant	debit
es-be-fs	ValoresRepresentativosDeudaInversionesCrediticiasBalance	es-be-fs_ValoresRepresentativosDeudaInversionesCrediticiasBalance	monetaryPositiveItemType	instant	debit
es-be-fs	OtrosActivosFinancieros	es-be-fs_OtrosActivosFinancieros	monetaryPositiveItemType	instant	debit
es-be-fs	ProMemoriaPrestadosGarantiaInversionesCrediticias	es-be-fs_ProMemoriaPrestadosGarantiaInversionesCrediticias	monetaryPositiveItemType	instant	debit
es-be-fs	ProMemoriaPrestadosGarantiaCarteraInversionVencimiento	es-be-fs_ProMemoriaPrestadosGarantiaCarteraInversionVencimiento	monetaryPositiveItemType	instant	debit
es-be-fs	DerivadosCoberturaActivoPresentacion	es-be-fs_DerivadosCoberturaActivoPresentacion	monetaryPositiveItemType	instant	debit
es-be-fs	DepositosEntidadesCreditoActivosNoCorrientesVentaActivoPresentacion	es-be-fs_DepositosEntidadesCreditoActivosNoCorrientesVentaActivoPresentacion	monetaryPositiveItemType	instant	debit
es-be-fs	CreditoClientelaActivosNoCorrientesVentaActivoPresentacion	es-be-fs_CreditoClientelaActivosNoCorrientesVentaActivoPresentacion	monetaryPositiveItemType	instant	debit
es-be-fs	ValoresRepresentativosDeudaActivosNoCorrientesVentaActivoPresentacion	es-be-fs_ValoresRepresentativosDeudaActivosNoCorrientesVentaActivoPresentacion	monetaryPositiveItemType	instant	debit
es-be-fs	InstrumentosCapital	es-be-fs_InstrumentosCapital	monetaryPositiveItemType	instant	debit
es-be-fs	ActivoMaterialActivosNoCorrientesVentaActivoPresentacion	es-be-fs_ActivoMaterialActivosNoCorrientesVentaActivoPresentacion	monetaryPositiveItemType	instant	debit
es-be-fs	RestoActivos	es-be-fs_RestoActivos	monetaryPositiveItemType	instant	debit
es-be-fs	ContratosSegurosVinculadosPensiones	es-be-fs_ContratosSegurosVinculadosPensiones	monetaryPositiveItemType	instant	debit
es-be-fs	ActivoMaterialActivoPresentacion	es-be-fs_ActivoMaterialActivoPre	monetaryPositive	instant	debit

		sentacion	ItemType		
es-be-fs	DeUsoPropio	es-be-fs_DeUsoPropio	monetaryPositiveItemType	instant	debit
es-be-fs	OtrosActivosCedidosArrendamientoOperativo	es-be-fs_OtrosActivosCedidosArrendamientoOperativo	monetaryPositiveItemType	instant	debit
es-be-fs	AfectoObraSocial	es-be-fs_AfectoObraSocial	monetaryPositiveItemType	instant	debit
es-be-fs	ProMemoriaAdquiridoArrendamientoFinanciero	es-be-fs_ProMemoriaAdquiridoArrendamientoFinanciero	monetaryPositiveItemType	instant	debit
es-be-fs	PeriodificacionesActivoPresentacion	es-be-fs_PeriodificacionesActivoPresentacion	monetaryPositiveItemType	instant	debit
es-be-fs	PasivoPresentacion	es-be-fs_PasivoPresentacion	monetaryItemType	instant	credit
es-be-fs	DepositosEntidadesCreditoCarteraNegociacionPasivoPresentacion	es-be-fs_DepositosEntidadesCreditoCarteraNegociacionPasivoPresentacion	monetaryPositiveItemType	instant	credit
es-be-fs	OperacionesMercadoMonetarioEntidadesContrapartidaCarteraNegociacionPasivoPresentacion	es-be-fs_OperacionesMercadoMonetarioEntidadesContrapartidaCarteraNegociacionPasivoPresentacion	monetaryPositiveItemType	instant	credit
es-be-fs	DepositosClientelaCarteraNegociacionPasivoPresentacion	es-be-fs_DepositosClientelaCarteraNegociacionPasivoPresentacion	monetaryPositiveItemType	instant	credit
es-be-fs	PosicionesCortasValores	es-be-fs_PosicionesCortasValores	monetaryPositiveItemType	instant	credit
es-be-fs	DepositosEntidadesCreditoOtrosPasivosFinancierosValorRazonableCambiosPerdidasGananciasBalance	es-be-fs_DepositosEntidadesCreditoOtrosPasivosFinancierosValorRazonableCambiosPerdidasGananciasBalance	monetaryPositiveItemType	instant	credit
es-be-fs	DepositosClientelaOtrosPasivosFinancierosValorRazonableCambiosPerdidasGananciasBalance	es-be-fs_DepositosClientelaOtrosPasivosFinancierosValorRazonableCambiosPerdidasGananciasBalance	monetaryPositiveItemType	instant	credit
es-be-fs	PasivosFinancierosValorRazonableCambiosPatrimonioNetoBalance	es-be-fs_PasivosFinancierosValorRazonableCambiosPatrimonioNetoBalance	monetaryPositiveItemType	instant	credit
es-be-fs	DepositosEntidadesCreditoPasivosFinancierosValorRazonabl	es-be-fs_DepositosEntidadesCredi	monetaryPositive	instant	credit

	eCambiosPatrimonioNetoBalance	toPasivosFinancierosValorRazonableCambiosPatrimonioNetoBalance	ItemType		
es-be-fs	DepositosClientelaPasivosFinancierosValorRazonableCambiosPatrimonioNetoBalance	es-be-fs_DepositosClientelaPasivosFinancierosValorRazonableCambiosPatrimonioNetoBalance	monetary Positive ItemType	instant	credit
es-be-fs	DebitosRepresentadosValoresNegociablesPasivosFinancierosValorRazonableCambiosPatrimonioNetoBalance	es-be-fs_DebitosRepresentadosValoresNegociablesPasivosFinancierosValorRazonableCambiosPatrimonioNetoBalance	monetary Positive ItemType	instant	credit
es-be-fs	PasivosFinancierosCosteAmortizadoBalance	es-be-fs_PasivosFinancierosCosteAmortizadoBalance	monetary Positive ItemType	instant	credit
es-be-fs	DepositosEntidadesCreditoPasivosFinancierosCosteAmortizadoBalance	es-be-fs_DepositosEntidadesCreditoPasivosFinancierosCosteAmortizadoBalance	monetary Positive ItemType	instant	credit
es-be-fs	DepositosClientelaPasivosFinancierosCosteAmortizadoPasivoPresentacion	es-be-fs_DepositosClientelaPasivosFinancierosCosteAmortizadoPasivoPresentacion	monetary Positive ItemType	instant	credit
es-be-fs	DerivadosCoberturaPasivoPresentacion	es-be-fs_DerivadosCoberturaPasivoPresentacion	monetary Positive ItemType	instant	credit
es-be-fs	DepositosClientelaPasivosAsociadosActivosNoCorrientesVenta	es-be-fs_DepositosClientelaPasivosAsociadosActivosNoCorrientesVenta	monetary Positive ItemType	instant	credit
es-be-fs	Provisiones	es-be-fs_Provisiones	monetary Positive ItemType	instant	credit
es-be-fs	ProvisionesImpuestos	es-be-fs_ProvisionesImpuestos	monetary Positive ItemType	instant	credit
es-be-fs	ProvisionesRiesgosCompromisosContingentes	es-be-fs_ProvisionesRiesgosCompromisosContingentes	monetary Positive ItemType	instant	credit
es-be-fs	OtrasProvisiones	es-be-fs_OtrasProvisiones	monetary Positive ItemType	instant	credit
es-be-fs	OtrosPasivos	es-be-fs_OtrosPasivos	monetary ItemType	instant	credit
es-be-fs	FondoObraSocial	es-be-fs_FondoObraSocial	monetary Positive ItemType	instant	credit
es-be-fs	RestoOtrosPasivos	es-be-fs_RestoOtrosPasivos	monetary	instant	credit

			ItemType		
es-be-fs	CapitalNaturalezaPasivoFinanciero	es-be-fs_CapitalNaturalezaPasivoFinanciero	monetaryPositiveItemType	instant	credit
es-be-fs	PatrimonioNetoPresentacion	es-be-fs_PatrimonioNetoPresentacion	monetaryItemType	instant	credit
es-be-fs	AjustesValoracion	es-be-fs_AjustesValoracion	monetaryItemType	instant	credit
es-be-fs	PasivosFinancierosValorRazonableCambiosPatrimonioNetoBalancePatrimonioNeto	es-be-fs_PasivosFinancierosValorRazonableCambiosPatrimonioNetoBalancePatrimonioNeto	monetaryItemType	instant	credit
es-be-fs	CoberturasFlujosEfectivoBalance	es-be-fs_CoberturasFlujosEfectivoBalance	monetaryItemType	instant	credit
es-be-fs	CoberturasInversionesNetasNegociosExtranjeroBalance	es-be-fs_CoberturasInversionesNetasNegociosExtranjeroBalance	monetaryItemType	instant	credit
es-be-fs	CapitalFondoDotacion	es-be-fs_CapitalFondoDotacion	monetaryPositiveItemType	instant	credit
es-be-fs	PendienteDesembolsoNoExigido	es-be-fs_PendienteDesembolsoNoExigido	monetaryNegativeItemType	instant	credit
es-be-fs	PrimaEmision	es-be-fs_PrimaEmision	monetaryPositiveItemType	instant	credit
es-be-fs	ReservasPerdidasAcumuladas	es-be-fs_ReservasPerdidasAcumuladas	monetaryItemType	instant	credit
es-be-fs	OtrosInstrumentosCapitalFondosPropios	es-be-fs_OtrosInstrumentosCapitalFondosPropios	monetaryItemType	instant	credit
es-be-fs	DeInstrumentosFinancierosCompuestos	es-be-fs_DeInstrumentosFinancierosCompuestos	monetaryItemType	instant	credit
es-be-fs	RestoOtrosInstrumentosCapitalFondosPropios	es-be-fs_RestoOtrosInstrumentosCapitalFondosPropios	monetaryItemType	instant	credit
es-be-fs	CuotasParticipativasFondosAsociadosCajasAhorro	es-be-fs_CuotasParticipativasFondosAsociadosCajasAhorro	monetaryItemType	instant	credit
es-be-fs	CuotasParticipativas	es-be-fs_CuotasParticipativas	monetaryPositiveItemType	instant	credit
es-be-fs	FondoReservasCuotaparticipes	es-be-fs_FondoReservasCuotaparti	monetaryItemType	instant	credit

		cipes			
es-be-fs	FondoEstabilizacion	es-be-fs_FondoEstabilizacion	monetaryItemType	instant	credit
es-be-fs	MenosDividendosRetribuciones	es-be-fs_MenosDividendosRetribuciones	monetaryNegativeItemType	instant	credit
es-be-fs	TotalPatrimonioNeto	es-be-fs_TotalPatrimonioNeto	monetaryItemType	instant	credit
es-be-fs	ProMemoriaBalancePublico	es-be-fs_ProMemoriaBalancePublico	monetaryItemType	instant	credit
es-be-fs	RiesgosContingentes	es-be-fs_RiesgosContingentes	monetaryPositiveItemType	instant	credit
es-be-fs	GarantiasFinancieras	es-be-fs_GarantiasFinancieras	monetaryPositiveItemType	instant	credit
es-be-fs	ActivosAfectosObligacionesTerceros	es-be-fs_ActivosAfectosObligacionesTerceros	monetaryPositiveItemType	instant	credit
es-be-fs	OtrosRiesgosContingentes	es-be-fs_OtrosRiesgosContingentes	monetaryPositiveItemType	instant	credit
es-be-fs	CompromisosContingentes	es-be-fs_CompromisosContingentes	monetaryPositiveItemType	instant	credit
es-be-fs	DisponiblesTerceros	es-be-fs_DisponiblesTerceros	monetaryPositiveItemType	instant	credit
es-be-fs	OtrosCompromisos	es-be-fs_OtrosCompromisos	monetaryPositiveItemType	instant	credit
es-be-fs	BalanceConsolidadoPublico	es-be-fs_BalanceConsolidadoPublico	monetaryItemType	instant	credit
es-be-fs	ActivosReaseguros	es-be-fs_ActivosReaseguros	monetaryPositiveItemType	instant	debit
es-be-fs	Existencias	es-be-fs_Existencias	monetaryPositiveItemType	instant	debit
es-be-fs	RestoOtrosActivos	es-be-fs_RestoOtrosActivos	monetaryPositiveItemType	instant	debit
es-be-fs	DepositosBancosCentralesPasivosAsociadosActivosNoCorrientesVenta	es-be-fs_DepositosBancosCentralesPasivosAsociadosActivosNoCorrientesVenta	monetaryItemType	instant	credit

es-be-fs	DepositosEntidadesCreditoPasivosAsociadosActivosNoCorrientesVenta	es-be-fs_DepositosEntidadesCreditoPasivosAsociadosActivosNoCorrientesVenta	monetaryItemType	instant	credit
es-be-fs	DebitosRepresentadosValoresNegociablesPasivosAsociadosActivosNoCorrientesVenta	es-be-fs_DebitosRepresentadosValoresNegociablesPasivosAsociadosActivosNoCorrientesVenta	monetaryItemType	instant	credit
es-be-fs	RestoPasivosConsolidado	es-be-fs_RestoPasivosConsolidado	monetaryPositiveItemType	instant	credit
es-be-fs	PasivosContratosSeguros	es-be-fs_PasivosContratosSeguros	monetaryItemType	instant	credit
es-be-fs	FondosPropios	es-be-fs_FondosPropios	monetaryItemType	instant	credit
es-be-fs	ReservasPerdidasEntidadesValoradasMetodoParticipacion	es-be-fs_ReservasPerdidasEntidadesValoradasMetodoParticipacion	monetaryItemType	instant	credit
es-be-fs	EntidadesAsociadasReservasPerdidasEntidadesValoradasMetodoParticipacion	es-be-fs_EntidadesAsociadasReservasPerdidasEntidadesValoradasMetodoParticipacion	monetaryItemType	instant	credit
es-be-fs	EntidadesMultigrupoReservasPerdidasEntidadesValoradasMetodoParticipacion	es-be-fs_EntidadesMultigrupoReservasPerdidasEntidadesValoradasMetodoParticipacion	monetaryItemType	instant	credit
es-be-fs	PasivoPeriodificaciones	es-be-fs_PasivoPeriodificaciones	monetaryPositiveItemType	instant	
es-be-fs	ReservasTotal	es-be-fs_ReservasTotal	monetaryItemType	instant	
ifrs-gp	AdvancesFromCentralBanks	ifrs-gp_AdvancesFromCentralBanks	monetaryItemType	instant	credit
ifrs-gp	AssetRecognisedForFairValueChangesOfHedgedItemInPortfolioHedgeOfInterestRateRisk	ifrs-gp_AssetRecognisedForFairValueChangesOfHedgedItemInPortfolioHedgeOfInterestRateRisk	monetaryItemType	instant	debit
ifrs-gp	AssetsTotal	ifrs-gp_AssetsTotal	monetaryItemType	instant	debit
ifrs-gp	AvailableForSaleFinancialAssetsTotal	ifrs-gp_AvailableForSaleFinancialAssetsTotal	monetaryItemType	instant	debit
ifrs-gp	AvailableForSaleReserves	ifrs-gp_AvailableForSaleReserves	monetaryItemType	instant	credit

ifrs-gp	CashAndBalancesWithCentralBanks	ifrs-gp_CashAndBalancesWithCentralBanks	monetaryItemType	instant	debit
ifrs-gp	CumulativeIncomeExpenseRelatingToNonCurrentAssetsAndDisposalGroupsHeldForSale	ifrs-gp_CumulativeIncomeExpenseRelatingToNonCurrentAssetsAndDisposalGroupsHeldForSale	monetaryItemType	instant	credit
ifrs-gp	CurrentTaxPayables	ifrs-gp_CurrentTaxPayables	monetaryItemType	instant	credit
ifrs-gp	CurrentTaxReceivables	ifrs-gp_CurrentTaxReceivables	monetaryItemType	instant	debit
ifrs-gp	DebenturesAndDebtCertificates	ifrs-gp_DebenturesAndDebtCertificates	monetaryItemType	instant	credit
ifrs-gp	DeferredTaxAssets	ifrs-gp_DeferredTaxAssets	monetaryItemType	instant	debit
ifrs-gp	DeferredTaxLiabilities	ifrs-gp_DeferredTaxLiabilities	monetaryItemType	instant	credit
ifrs-gp	EquityAndLiabilitiesTotal	ifrs-gp_EquityAndLiabilitiesTotal	monetaryItemType	instant	credit
ifrs-gp	EquityMethodAccountedInvestmentsInAssociates	ifrs-gp_EquityMethodAccountedInvestmentsInAssociates	monetaryItemType	instant	debit
ifrs-gp	EquityMethodAccountedInvestmentsTotal	ifrs-gp_EquityMethodAccountedInvestmentsTotal	monetaryItemType	instant	debit
ifrs-gp	FinancialAssetsDesignatedAsFairValueThroughProfitOrLossEquityInstruments	ifrs-gp_FinancialAssetsDesignatedAsFairValueThroughProfitOrLossEquityInstruments	monetaryItemType	instant	debit
ifrs-gp	FinancialAssetsDesignatedAsFairValueThroughProfitOrLossLoansAndAdvancesToBanks	ifrs-gp_FinancialAssetsDesignatedAsFairValueThroughProfitOrLossLoansAndAdvancesToBanks	monetaryItemType	instant	debit
ifrs-gp	FinancialAssetsDesignatedAsFairValueThroughProfitOrLossOtherDebtInstruments	ifrs-gp_FinancialAssetsDesignatedAsFairValueThroughProfitOrLossOtherDebtInstruments	monetaryItemType	instant	debit
ifrs-gp	FinancialAssetsDesignatedAsFairValueThroughProfitOrLossTotal	ifrs-gp_FinancialAssetsDesignatedAsFairValueThroughProfitOrLossTotal	monetaryItemType	instant	debit
ifrs-gp	FinancialAssetsHeldForTradingEquityInstruments	ifrs-gp_FinancialAssetsHeldForTradingEquityInstruments	monetaryItemType	instant	debit
ifrs-gp	FinancialAssetsHeldForTradin	ifrs-	monetary	instant	debit

	gOtherDebtInstruments	gp_FinancialAssetsHeldForTradingOtherDebtInstruments	ItemType		
ifrs-gp	FinancialAssetsHeldForTradingTotal	ifrs-gp_FinancialAssetsHeldForTradingTotal	monetaryItemType	instant	debit
ifrs-gp	FinancialAssetsHeldForTradingTradingDerivatives	ifrs-gp_FinancialAssetsHeldForTradingTradingDerivatives	monetaryItemType	instant	debit
ifrs-gp	FinancialLiabilitiesDesignatedAsFairValueThroughProfitOrLossDebenturesAndDebtCertificates	ifrs-gp_FinancialLiabilitiesDesignatedAsFairValueThroughProfitOrLossDebenturesAndDebtCertificates	monetaryItemType	instant	credit
ifrs-gp	FinancialLiabilitiesDesignatedAsFairValueThroughProfitOrLossTotal	ifrs-gp_FinancialLiabilitiesDesignatedAsFairValueThroughProfitOrLossTotal	monetaryItemType	instant	credit
ifrs-gp	FinancialLiabilitiesHeldForTradingDebtInstruments	ifrs-gp_FinancialLiabilitiesHeldForTradingDebtInstruments	monetaryItemType	instant	credit
ifrs-gp	FinancialLiabilitiesHeldForTradingTotal	ifrs-gp_FinancialLiabilitiesHeldForTradingTotal	monetaryItemType	instant	credit
ifrs-gp	FinancialLiabilitiesHeldForTradingTradingDerivatives	ifrs-gp_FinancialLiabilitiesHeldForTradingTradingDerivatives	monetaryItemType	instant	credit
ifrs-gp	GoodwillNet	ifrs-gp_GoodwillNet	monetaryItemType	instant	debit
ifrs-gp	HeldToMaturityInvestmentsTotal	ifrs-gp_HeldToMaturityInvestmentsTotal	monetaryItemType	instant	debit
ifrs-gp	IdentifiableIntangibleAssetsNet	ifrs-gp_IdentifiableIntangibleAssetsNet	monetaryItemType	instant	debit
ifrs-gp	IntangibleAssetsNet	ifrs-gp_IntangibleAssetsNet	monetaryItemType	instant	debit
ifrs-gp	InvestmentProperty	ifrs-gp_InvestmentProperty	monetaryItemType	instant	debit
ifrs-gp	IssuedCapital	ifrs-gp_IssuedCapital	monetaryItemType	instant	credit
ifrs-gp	LiabilitiesIncludedInDisposalGroupsClassifiedAsHeldForSale	ifrs-gp_LiabilitiesIncludedInDisposalGroupsClassifiedAsHeldForSale	monetaryItemType	instant	credit
ifrs-gp	LiabilitiesTotal	ifrs-gp_LiabilitiesTotal	monetaryItemType	instant	credit
ifrs-gp	LiabilityRecognisedForFairValueChangesOfHedgedItemInPort	ifrs-gp_LiabilityRecognisedForF	monetaryItemType	instant	credit

	folioHedgeOfInterestRateRisk	airValueChangesOfHedgedItemInPortfolioHedgeOfInterestRateRisk			
ifrs-gp	LoansAndReceivablesTotal	ifrs-gp_LoansAndReceivablesTotal	monetaryItemType	instant	debit
ifrs-gp	MinorityInterest	ifrs-gp_MinorityInterest	monetaryItemType	instant	credit
ifrs-gp	NonCurrentAssetsAndDisposalGroupsHeldForSale	ifrs-gp_NonCurrentAssetsAndDisposalGroupsHeldForSale	monetaryItemType	instant	debit
ifrs-gp	OtherAssetsTotal	ifrs-gp_OtherAssetsTotal	monetaryItemType	instant	debit
ifrs-gp	OtherBorrowedFunds	ifrs-gp_OtherBorrowedFunds	monetaryItemType	instant	credit
ifrs-gp	OtherEquityMethodAccountedInvestments	ifrs-gp_OtherEquityMethodAccountedInvestments	monetaryItemType	instant	debit
ifrs-gp	OtherMoneyMarketDeposits	ifrs-gp_OtherMoneyMarketDeposits	monetaryItemType	instant	credit
ifrs-gp	PostEmploymentBenefitObligationTotal	ifrs-gp_PostEmploymentBenefitObligationTotal	monetaryItemType	instant	credit
ifrs-gp	RetainedEarningsAccumulatedLosses	ifrs-gp_RetainedEarningsAccumulatedLosses	monetaryItemType	instant	credit
ifrs-gp	SubordinatedLiabilities	ifrs-gp_SubordinatedLiabilities	monetaryItemType	instant	credit
ifrs-gp	TaxAssetsTotal	ifrs-gp_TaxAssetsTotal	monetaryItemType	instant	debit
ifrs-gp	TaxLiabilitiesTotal	ifrs-gp_TaxLiabilitiesTotal	monetaryItemType	instant	credit
ifrs-gp	TranslationReserves	ifrs-gp_TranslationReserves	monetaryItemType	instant	credit

Annexe 2

The report has been created from the "Información Pública Periódica" taxonomy (IPP taxonomy) published by the Spanish CNMV[87] including only the elements described for the consolidated balance sheet. The first part of the schema lists all the namespaces used by the document: the corresponding to other schemas and XLink, the XBRL standard schemas and the namespace of the current document. The second part defines the elements: namespace prefix, label and order.

Taxonomy Report (Schema) generated by Taxonomy Editor (98). All rights reserved, COPYRIGHT © Fujitsu Limited, 2004-2010 from Taxonomy IPP, "Circular 1/2008 de 30 de Enero de 2008" published by the CNMV. *(Only including the presentation for the Consolidated Balance sheet)*	Sunday, April 10 2011 15H16' (GMT+1)

1	**Namespace Prefix**	ipp-gen
	Namespace URI	http://www.cnmv.es/ipp/gen/1-2008/2008-01-01
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\ipp-gen-2008-01-01.xsd
	Linkbase file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\ipp-gen-2008-01-01-presentation.xml
2	**Namespace Prefix**	xbrli
	Namespace URI	http://www.xbrl.org/2003/instance
	Schema file	http://www.xbrl.org/2003/xbrl-instance-2003-12-31.xsd
3	**Namespace Prefix**	link
	Namespace URI	http://www.xbrl.org/2003/linkbase
	Schema file	http://www.xbrl.org/2003/xbrl-linkbase-2003-12-31.xsd
4	**Namespace Prefix**	ipp-com
	Namespace URI	http://www.cnmv.es/ipp/com/1-2008/2008-01-01
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\ipp-com-2008-01-01.xsd
	Linkbase file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\ipp-com-2008-01-01-presentation.xml
5	**Namespace Prefix**	dgi-lc-es
	Namespace URI	http://www.xbrl.org.es/es/2007/dgi/gp/lc-es/2007-05-30
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\dgi-lc-es-2007-05-30.xsd

[87] http://www.cnmv.es/ipp/gen/1-2008/2008-01-01

6	Namespace Prefix	dgi-types
	Namespace URI	http://www.xbrl.org.es/es/2007/dgi/gp/types/2007-05-30
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\dgi-types-2007-05-30.xsd
7	Namespace Prefix	dgi-lc-int
	Namespace URI	http://www.xbrl.org.es/es/2007/dgi/gp/lc-int/2007-05-30
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\dgi-lc-int-2007-05-30.xsd
8	Namespace Prefix	dgi-est-gen
	Namespace URI	http://www.xbrl.org.es/es/2007/dgi/gp/est-gen/2007-05-30
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\dgi-est-gen-2007-05-30.xsd
	Linkbase file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\dgi-est-gen-2007-05-30-presentation.xml
9	Namespace Prefix	es-be-fs
	Namespace URI	http://www.bde.es/es/fr/ifrs/basi/bde/4-2004/2006-01-01
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\es-be-fs-2006-01-01.xsd
	Linkbase file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\es-be-fs-2006-01-01-presentation.xml
10	Namespace Prefix	es-be-fs-typ
	Namespace URI	http://www.bde.es/es/fr/ifrs/basi/bde/4-2004/2006-01-01/types
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\es-be-fs-types-2006-01-01.xsd
11	Namespace Prefix	es-be-fs-rol
	Namespace URI	http://www.bde.es/es/fr/ifrs/basi/bde/4-2004/2006-01-01/roles
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\es-be-fs-roles-2006-01-01.xsd
12	Namespace Prefix	ifrs-gp
	Namespace URI	http://xbrl.iasb.org/int/fr/ifrs/gp/2005-05-15
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\ifrs-gp-2005-05-15.xsd
13	Namespace Prefix	ifrs-gp-typ
	Namespace URI	http://xbrl.iasb.org/int/fr/ifrs/gp/2005-05-15/types
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\ifrs-gp-types-2005-05-15.xsd
14	Namespace Prefix	ff
	Namespace URI	http://www.xbrl.org/2005/role/restatedLabel
	Schema file	D:\Documentos\Profesor\Tesis\Experimento\Taxonomía ipp\restatedLabel.xsd
15	Namespace Prefix	ref
	Namespace URI	http://www.xbrl.org/2004/ref
	Schema file	http://www.xbrl.org/2004/ref-2004-08-10.xsd

NS_Prefix	Label	Order
http://www.bde.es/es/fr/ifrs/basi/bde/4-2004/6320/t/2006-01-01/role/BalancePublicoConsolidado/		
es-be-fs	BALANCE CONSOLIDADO PÚBLICO	
es-be-fs	ACTIVO	1.0
ifrs-gp	CAJA Y DEPÓSITOS EN BANCOS CENTRALES	1.0
ifrs-gp	CARTERA DE NEGOCIACIÓN	2.0
es-be-fs	Depósitos en entidades de crédito	1.0
es-be-fs	Operaciones del mercado monetario a través de entidades de contrapartida	2.0
es-be-fs	Crédito a la clientela	3.0
ifrs-gp	Valores representativos de deuda	4.0
ifrs-gp	Otros instrumentos de capital	5.0
ifrs-gp	Derivados de negociación	6.0
es-be-fs	Pro-memoria: Prestados o en garantía	7.0
ifrs-gp	OTROS ACTIVOS FINANCIEROS A VALOR RAZONABLE CON CAMBIOS EN PÉRDIDAS Y GANANCIAS	3.0
ifrs-gp	Depósitos en entidades de crédito	1.0
es-be-fs	Operaciones del mercado monetario a través de entidades de contrapartida	2.0
es-be-fs	Crédito a la clientela	3.0
ifrs-gp	Valores representativos de deuda	4.0
ifrs-gp	Otros instrumentos de capital	5.0
es-be-fs	Pro-memoria: Prestados o en garantía	6.0
ifrs-gp	ACTIVOS FINANCIEROS DISPONIBLES PARA LA VENTA	4.0
es-be-fs	Valores representativos de deuda	1.0
es-be-fs	Otros instrumentos de capital	2.0
es-be-fs	Pro-memoria: Prestados o en garantía	3.0
ifrs-gp	INVERSIONES CREDITICIAS	5.0

es-be-fs	Depósitos en entidades de crédito	1.0
es-be-fs	Operaciones del mercado monetario a través de entidades de contrapartida	2.0
es-be-fs	Crédito a la clientela	3.0
es-be-fs	Valores representativos de deuda	4.0
es-be-fs	Otros activos financieros	5.0
es-be-fs	Pro-memoria: Prestados o en garantía	6.0
ifrs-gp	⊟CARTERA DE INVERSIÓN A VENCIMIENTO	6.0
es-be-fs	Pro-memoria: Prestados o en garantía	1.0
ifrs-gp	AJUSTES A ACTIVOS FINANCIEROS POR MACRO-COBERTURAS	7.0
es-be-fs	DERIVADOS DE COBERTURA	8.0
ifrs-gp	⊟ACTIVOS NO CORRIENTES EN VENTA	9.0
es-be-fs	Depósitos en entidades de crédito	1.0
es-be-fs	Crédito a la clientela	2.0
es-be-fs	Valores representativos de deuda	3.0
es-be-fs	Instrumentos de capital	4.0
es-be-fs	Activo material	5.0
es-be-fs	Resto de activos	6.0
ifrs-gp	⊟PARTICIPACIONES	10.0
ifrs-gp	Entidades asociadas	1.0
ifrs-gp	Entidades multigrupo	2.0
es-be-fs	CONTRATOS DE SEGUROS VINCULADOS A PENSIONES	11.0
es-be-fs	ACTIVOS POR REASEGUROS	12.0
es-be-fs	⊟ACTIVO MATERIAL	13.0
es-be-fs	De uso propio	1.0
ifrs-gp	Inversiones inmobiliarias	2.0
es-be-fs	Otros activos cedidos en arrendamiento operativo	3.0
es-be-fs	Afecto a la Obra social	4.0
es-be-fs	Pro-memoria: Adquirido en arrendamiento financiero	5.0
ifrs-gp	⊟ACTIVO INTANGIBLE	14.0

ifrs-gp	Fondo de comercio	1.0
ifrs-gp	Otro activo intangible	2.0
ifrs-gp	⊟ACTIVOS FISCALES	15.0
ifrs-gp	Corrientes	1.0
ifrs-gp	Diferidos	2.0
es-be-fs	PERIODIFICACIONES	16.0
ifrs-gp	⊟OTROS ACTIVOS	17.0
es-be-fs	Existencias	1.0
es-be-fs	Resto	2.0
ifrs-gp	TOTAL ACTIVO	18.0
es-be-fs	⊟PASIVO Y PATRIMONIO NETO	2.0
es-be-fs	⊟PASIVO	1.0
ifrs-gp	⊟CARTERA DE NEGOCIACIÓN	1.0
es-be-fs	Depósitos de entidades de crédito	1.0
es-be-fs	Operaciones del mercado monetario a través de entidades de contrapartida	2.0
es-be-fs	Depósitos de la clientela	3.0
ifrs-gp	Débitos representados por valores negociables	4.0
ifrs-gp	Derivados de negociación	5.0
es-be-fs	Posiciones cortas de valores	6.0
ifrs-gp	⊟OTROS PASIVOS FINANCIEROS A VALOR RAZONABLE CON CAMBIOS EN PÉRDIDAS Y GANANCIAS	2.0
es-be-fs	Depósitos de entidades de crédito	1.0
es-be-fs	Depósitos de la clientela	2.0
ifrs-gp	Débitos representados por valores negociables	3.0
es-be-fs	⊟PASIVOS FINANCIEROS A VALOR RAZONABLE CON CAMBIOS EN PATRIMONIO NETO	3.0
es-be-fs	Depósitos de entidades de crédito	1.0
es-be-fs	Depósitos de la clientela	2.0
es-be-fs	Débitos representados por valores negociables	3.0
es-be-fs	⊟PASIVOS FINANCIEROS A COSTE AMORTIZADO	4.0

ifrs-gp	Depósitos de bancos centrales	1.0
es-be-fs	Depósitos de entidades de crédito	2.0
ifrs-gp	Operaciones del mercado monetario a través de entidades de contrapartida	3.0
es-be-fs	Depósitos de la clientela	4.0
ifrs-gp	Débitos representados por valores negociables	5.0
ifrs-gp	Pasivos subordinados	6.0
ifrs-gp	Otros pasivos financieros	7.0
ifrs-gp	AJUSTES A PASIVOS FINANCIEROS POR MACRO-COBERTURAS	5.0
es-be-fs	DERIVADOS DE COBERTURA	6.0
ifrs-gp	⊟PASIVOS ASOCIADOS CON ACTIVOS NO CORRIENTES EN VENTA	7.0
es-be-fs	Depósitos de bancos centrales	1.0
es-be-fs	Depósitos de entidades de crédito	2.0
es-be-fs	Depósitos de la clientela	3.0
es-be-fs	Débitos representados por valores negociables	4.0
es-be-fs	Resto de pasivos	5.0
es-be-fs	PASIVOS POR CONTRATOS DE SEGUROS	8.0
es-be-fs	⊟PROVISIONES	9.0
ifrs-gp	Fondos para pensiones y obligaciones similares	1.0
es-be-fs	Provisiones para impuestos	2.0
es-be-fs	Provisiones para riesgos y compromisos contingentes	3.0
es-be-fs	Otras provisiones	4.0
ifrs-gp	⊟PASIVOS FISCALES	10.0
ifrs-gp	Corrientes	2.0
ifrs-gp	Diferidos	3.0
es-be-fs	PERIODIFICACIONES	11.0
es-be-fs	⊟OTROS PASIVOS	12.0
es-be-fs	Fondo Obra social	1.0
es-be-fs	Resto	2.0
es-be-fs	CAPITAL CON NATURALEZA DE PASIVO FINANCIERO	13.0

ifrs-gp	TOTAL PASIVO	14.0
es-be-fs	⊟PATRIMONIO NETO	2.0
ifrs-gp	INTERESES MINORITARIOS	1.0
es-be-fs	⊟AJUSTES POR VALORACIÓN	2.0
ifrs-gp	Activos financieros disponibles para la venta	1.0
es-be-fs	Pasivos financieros a valor razonable con cambios en el patrimonio neto	2.0
es-be-fs	Coberturas de los flujos de efectivo	3.0
es-be-fs	Coberturas de inversiones netas en negocios en el extranjero	4.0
ifrs-gp	Diferencias de cambio	5.0
ifrs-gp	Activos no corrientes en venta	6.0
es-be-fs	⊟FONDOS PROPIOS	3.0
es-be-fs	⊟Capital o fondo de dotación	1.0
ifrs-gp	Emitido	1.0
es-be-fs	Pendiente de desembolso no exigido (-)	2.0
es-be-fs	Prima de emisión	2.0
es-be-fs	⊟Reservas	3.0
es-be-fs	Reservas (pérdidas) acumuladas	1.0
ifrs-gp	Remanente	2.0
es-be-fs	⊟Reservas (pérdidas) de entidades valoradas por el método de la participación	3.0
es-be-fs	Entidades asociadas	1.0
es-be-fs	Entidades multigrupo	2.0
es-be-fs	⊟Otros instrumentos de capital	4.0
es-be-fs	De instrumentos financieros compuestos	1.0
es-be-fs	Resto	2.0
es-be-fs	Menos: Valores propios	5.0
es-be-fs	⊟Cuotas participativas y fondos asociados (Cajas de Ahorros)	6.0
es-be-fs	Cuotas participativas	1.0
es-be-fs	Fondo de reservas de cuotapartícipes	2.0

es-be-fs	Fondo de estabilización	3.0
es-be-fs	Resultado atribuido al grupo	7.0
es-be-fs	Menos: Dividendos y retribuciones	8.0
es-be-fs	TOTAL PATRIMONIO NETO	4.0
ifrs-gp	TOTAL PATRIMONIO NETO Y PASIVO	5.0
es-be-fs	⊟PRO-MEMORIA	3.0
es-be-fs	⊟RIESGOS CONTINGENTES	1.0
es-be-fs	Garantías financieras	1.0
es-be-fs	Activos afectos a obligaciones de terceros	2.0
es-be-fs	Otros riesgos contingentes	3.0
es-be-fs	⊟COMPROMISOS CONTINGENTES	2.0
es-be-fs	Disponibles por terceros	1.0
es-be-fs	Otros compromisos	2.0

Annexe 3

Here is included an example of a calculation link base. To read more about calculation linkbase please go to section 2.2.2.2.2.2. Calculation linkbase

```
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xmlns:iXBRL_Sample="http://www.iasb.org/xbrl/example1"
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30.xsd#ifrs_NoncurrentAssets" xlink:type="locator"
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use="optional"/><link:loc
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```

```
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use="optional"/><link:loc
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30.xsd#ifrs_IntangibleAssetsOtherThanGoodwill"     xlink:type="locator"
xlink:label="loc_4"/><link:calculationArc              xlink:type="arc"
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use="optional"/><link:loc
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30.xsd#ifrs_InvestmentAccountedForUsingEquityMethod"
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use="optional"/><link:loc
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use="optional"/><link:loc
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30.xsd#ifrs_CurrentAssets"                          xlink:type="locator"
xlink:label="loc_10"/><link:calculationArc             xlink:type="arc"
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use="optional"/><link:loc
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xlink:label="loc_7"/><link:calculationArc              xlink:type="arc"
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xlink:arcrole="http://www.xbrl.org/2003/arcrole/summation-item"
use="optional"/><link:loc
xlink:href="http://xbrl.iasb.org/taxonomy/2010-04-30/ifrs-cor_2010-04-
30.xsd#ifrs_TradeAndOtherCurrentReceivables"       xlink:type="locator"
xlink:label="loc_8"/><link:calculationArc              xlink:type="arc"
```

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30.xsd#ifrs_Inventories" xlink:type="locator"
xlink:label="loc_9"/><link:calculationArc xlink:type="arc"
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use="optional"/><link:loc
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30.xsd#ifrs_EquityAndLiabilities" xlink:type="locator"
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xlink:label="loc_14"/><link:calculationArc xlink:type="arc" weight="1"
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use="optional"/><link:loc
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30.xsd#ifrs_RetainedEarnings" xlink:type="locator"
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use="optional"/><link:loc
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use="optional"/><link:loc
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use="optional"/><link:loc
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30.xsd#ifrs_CashFlowsFromUsedInInvestingActivities"
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use="optional"/><link:loc
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1" order="20.0" xlink:to="loc_14" xlink:from="loc_15"
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use="optional"/><link:loc
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use="optional"/><link:loc
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use="optional"/><link:loc
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xlink:from="loc_19"
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use="optional"/></link:calculationLink></link:linkbase>

Annexe 4

Here is included an example of an extract of an instance document file. It includes the section of the Consolidated Balance Sheet from Telefónica own produced using the IASB 2011 taxonomy. To read more about instance documents, please go to section 4.2.3. Instance document

```
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28015865_icc" unitRef="EUR">84310549000</ifrs:NoncurrentAssets>
            <ifrs:NoncurrentAssets decimals="0" contextRef=" S22008_A-
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            <ifrs: IntangibleAssetsOtherThanGoodwill decimals="0"
contextRef="S22009_A-28015865_icc" unitRef="euro">158461330000</ifrs:
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            <ifrs: IntangibleAssetsOtherThanGoodwill decimals="0"
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IntangibleAssetsOtherThanGoodwill>
            <ifrs:Goodwill decimals="0" contextRef="S22009_A-
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            <ifrs:Goodwill decimals="0" contextRef="S22008_A-
28015865_ipac" unitRef="euro">18322974000</ifrs:Goodwill>
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Annexe 5

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