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The Role of XBRL on EMAS Reporting: An Analysis of Organisational Values Compatibility

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Abstract

This paper proposes a measurement method for assessing the extent to which the XBRL digital standard eXtensible Business Reporting Language can assist firms in implementing their reporting when applying EMAS The EU Eco-Management and Audit Scheme. A specific survey based on the work of (Bunker *et al.*, 2007), which uses Value Compatibility, was carried out at the most important firms in Southern Spain. Different sectors were involved in the study: public hospital, copper manufacturing facilities, petrochemical plant and pulp and renewable energy production. The results reveal some concordances between EMAS using XBRL as a reporting technology, and the cultural, organisational and technical working environment of the analysed firms, specifically those related to the Structural Dimension. By contrast, some discordance is highlighted related to the Practical Dimension. The paper proposes for the first time the application of the global financial standard XBRL for a non financial purpose like the widely accepted EMAS, to actual potential uses in real scenarios. The empirical research combined heavy industry with services, privately owned firms with public entities, private and public sector, in the analysis of this technology. The paper represents a necessary landmark for a subsequent longitudinal study.

Keywords: EMAS; XBRL; environmental reporting; digital reporting; value compatibility; industrial firms.

JEL classification: D8; M14; M15; M41; M48.

1. INTRODUCTION

Over the last two decades, there has been concern in organisations about voluntarily environmental and social issues integration in business models and daily operations, through the adoption of corporate policies (Eccles *et al.*, 2012). The details of this information are increasingly publicly shared in corporate sustainability or equivalent reports, used as the

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mechanism through which corporations share information on their economic, social, environmental and governance performance with their stakeholders to demonstrate the link between strategy and commitment to a sustainable global economy (Cuadrado-Ballesteros *et al.*, 2014; Unerman, 2000). The drivers for these reporting trends are many and varied, including reputation enhancement, meeting investor demand for performance information, and fulfilling a commitment to demonstrate the concern of the firms about the impact of their business on society, environment and economy to stakeholders (Freeman, 1984; Salzmann *et al.*, 2005; Searcy and Elkhawas, 2012).

Over time, several initiatives, such as the Global Reporting Initiative GRI, ISO 26000 and Dow Jones Sustainability Index DJSI have appeared as way to provide recommendations to managers regarding how to measure, prepare and disclose social, environmental and economic performances. These initiatives provide guidelines and frameworks to standardise the disclosure process of sustainability performance, they fall short of prescribing specific internal processes to collect, manage, and act on a sustainability metric (Tomsky and Manco, 2011). Other frameworks are devoted solely to environmental concerns, like EMAS, the EU Eco-Management and Audit Scheme and Carbon Disclosure Project CDP. EMAS, since its inception in 1993, has registered more than 13,700 organisations and sites in Europe, situated in Italy, Spain and Germany, as the leader in the environmental reporting with EMAS. EMAS is being recognised as a relevant framework in the sustainability arena, able to have a significant effect on firm performance both from an environmental and a competitive point of view (Iraldo *et al.*, 2009). On the other hand, CDP represents an internationally acknowledged organisation for the standardisation of environmental reporting, working to create more robust and comparable environmental reports in collaboration with firms, investors, cities and policy makers. It is a voluntary initiative designed to improve the transparency between firms and investors, and promote a new economic model to solve some of the world's most pressing problems by establishing the appropriate information flows for businesses. Since its foundation in 2002, CDP has captured considerable attention from investors and reporting firms, with more than 700 engaged investors and 5,000 reporting companies worldwide.

The importance of these initiatives is being taking into account worldwide with the fast development of environmental regulation. Proof of that is the directive 78/660/EEC and 83/349/EEC approved by both the European Parliament and the Council amending Council Directives in April 2014, regarding the disclosure of non-financial information. As a result, large listed companies in the EU will be asked to disclose their environmental and social impacts as part of their mainstream reporting to investors. It is expected that 6,000 companies will be affected in Europe, from which around 700 are Spanish. This directive recognised EMAS, ISO 26000 and other standard initiatives for the disclosure of environmental information:

In providing this information, companies may rely on national frameworks, EU-based frameworks such as the Eco-Management and Audit Scheme EMAS, and international frameworks such as the United Nations UN Global Compact, the Guiding Principles on Business and Human Rights implementing the UN Protect, Respect and Remedy Framework, the Organisation for Economic Co-operation and Development OECD Guidelines for Multinational Enterprises, the International Organisation for Standardisation ISO 26000, the International Labour Organization ILO Tripartite Declaration of principles concerning multinational enterprises and social policy, and the Global Reporting Initiative.

Looking at the present, environmental reporting is still a matter of voluntary disclosure practices in many national and industry contexts. In fact, the impact of environmental regulation in certain industries and countries is still open (Stanić, 2015). Public and large firms tend to have more active environmental strategy with impact on three strategy aspects: monitor compliance, motivate continuous improvements and decision making (Henri and Journeault, 2008).

Now is the moment to make much more and much better use of that information, because even though there is a greater transparency, it is not enough to build trust in the organisation. The lack of effectiveness and confidence in the reporting process leads to the absence of credibility. The criticism regarding the quality assurance and relevance of the data and the lack of information technology systems for engaging the stakeholders with this information, puts a reporting practice in place which does not cover the demands of stakeholders. Several studies have focused on the relative weaknesses and strengths of the information systems to support sustainability reporting. Ahmed and Sundaram (2012) found that the current information system in the organisations are not designed to capture social and environmental data, nor are they designed to support the management of data of all sustainability dimensions. An increasing amount of reports is an issue, more than an efficient tool to monitor the environmental behaviour of firms.

On the other hand, in the financial arena, XBRL is already required, around the world, by regulators and supervisory agencies. Since 2008, the U.S. Securities and Exchange Commission SEC adopted rules requiring public companies and foreign private issuers to provide financial statements in XBRL, and publish their financial statements on their corporate website using XBRL SEC, 2008. Since then, other regulatory agencies around the world have enacted similar mandates. In Europe, XBRL is now required for external financial reporting by banking regulators and for all publicly traded companies. There is also a relevant gap in the literature on how XBRL can be used for other purposes beyond financial reporting schemes.

The aim of this paper is to explore the potential use of XBRL to support EMAS-related reporting and performance-improvement activities, as well as to assess the extent to which this combination of EMAS-XBRL reporting can match the previous managerial, technological and cultural structures of industrial firms. XBRL can help in the integration of EMAS information into the main control systems i.e. financial information is commonly supported by XBRL in Europe and other areas. This aspect is particularly relevant for a coherent business strategy, as argued by Jansson *et al.* (2000).

The paper is organised into four sections. First, a brief literature review of EMAS and XBRL is provided, identifying the socio-economic context in which both practices take place, and the role that both play in the corporate reporting and organisational values. Second, a description of the methodology adopted to conduct the research is shown. Third, results and discussion are presented, and the paper closes with conclusions, limitations and recommendations for further research.

2. THEORETICAL BACKGROUND

According to the European Commission (2014), EMAS is a management instrument that aims to guide companies and other entities to evaluate, report, and improve their environmental performance. Along with other related standards, like ISO14001, it is

perceived as a source of benefits but also costs. A detailed list of drivers that have been considered relevant to explain why firms adopt sustainability strategies in general and these concrete standards in particular can be found by in the study by Kolln and Prakash (2002). The author's highlight the fact that some domestic factors negatively influence the popularity of sustainability standards, something that would explain country differences, for instance, in EMAS popularity. Other authors detected that industry-specific reporting patterns are also apparent to explain differences in environmental reporting (Cormier and Magnan, 2003; Fujii and Managi, 2013). What seems clear is that the one vehicle by which firms benefit from improving their results is reporting. Undoubtedly, environmental improvements can help corporations to save resources, and to increase sales by means of product enhancements and quality. However, due to their reporting practices and its positive impact on reputation, the companies that more rigorously adopt a responsible strategy can benefit from significantly better stock market behaviour (Gupta and Goldar, 2005; Wahba, 2008). When comparing EMAS to ISO14001, the EU Commission highlights that EMAS signifies, among other differences, an incremental reporting effort, through the publication of the EMAS environmental statement, with certain quantitative indicators.

EMAS requires that the policy, program, environmental management system and details of the organisation's performance are made publicly available as part of the environmental statement. Meanwhile, ISO requires that only the policy be publicly available. Both require the certification of this management system by a third-party auditor, which is a key factor to reduce the credibility gap in firms, increasing the robustness and reliability of this information (Dando and Swift, 2003).

The research on corporate transparency remains relatively scarce. However, academic studies do show that there is an interest in using the information in sustainability reports, at least in part, to guide investment decisions (Searcy and Elkhawas, 2012). Cohen and Santhakumar (2007) recognize that reporting obligations could have several types of impact, even beyond the economic ones. In the other hand, when considering the voluntary adoption of reporting practices, it is not evident how to measure the impact, as suggested by Matisoff (2015). With respect to the instruments and format by means of which this reporting is disclosed, there is a growing flow of literature. The paradigmatic book `One Report´ by Eccles and Krzus (2010) introduces the idea of using Websites for reporting not just as a mere container of PDFs but by enabling users to interact with the reports in a much more sophisticated way:

When the Web is used to provide information, much higher degrees of integration are made feasible. Not being limited to the linear nature of the paper format […]. Every piece of business information […], tons of carbon emissions […] can have an electronic tag called metadata that enables access to this information. (Eccles and Krzus, 2010, p. 191)

Accordingly, one of these new forms of reporting is based on the use of meta-data languages that add electronic tags to every relevant piece of published data, allowing for digital and automated treatment. XBRL eXtensible Business Reporting Language is mentioned by these authors as one of the most extensively acknowledged standards for that purpose, widely used at the international level to support the reporting of financial regulated information, but just recently considered for non-financial data transmission (XBRL, 2014). Despite its advantages, there are several authors that draw attention to the advantages of new forms of communication technologies, in particular for reporting standards like XBRL (Vasarhelyi *et al*., 2012).

2.1 Environmental reporting as part of the sustainability reporting. Sharing origins, drivers and importance

Since 1991, there have been several projects aiming to respond to the growing demand of structured sustainability reporting. In that year, the American Institute of Certified Public Accountants (AICPA, 1991) amid growing demand for an improved corporate reporting model, established the Special Committee on Financial Reporting, also known as the Jenkins Committee. This discussion forum was set up to analyse users' increasing demand for business information focusing on investors and lenders and to develop the content of company business reporting to accommodate users' needs. One of the most interesting attempts to improve accounting information comes from the document entitled Improving Business Reporting – A Customer Focus, commonly referred to as the Jenkins Report, issued in December 1994. The motivation of the Jenkins Report was to address the general dissatisfaction with the model of financial information. Additionally, in January 2003, the American Institute of Certified Public Accountants AICPA established the Special Committee on Enhanced Business Reporting to take action over initiatives that had fallen into oblivion, such as the Jenkins Report. The Committee concluded its work in 2005, having brought together a consortium of investors, creditors, regulators, managers and other stakeholders to improve the quality and transparency of the information used for business decision-making. Thus, the Enhanced Business Reporting Consortium EBRC, was born. The Enhanced Business Reporting Framework was published in October 2005 and was intended to promote greater transparency regarding the strategy and performance of businesses. It was based on the materials used to elaborate the value-reporting model of PricewaterhouseCoopers, which researched the types of information used in 16 industries in 14 countries both to manage an organisation information from the point of view of the manager and to assess an organisation for purposes of investment. This framework organises the disclosure of additional information not currently covered by the Generally Accepted Accounting Principles GAAPs. The EBR Framework (2005) recommends that companies disclose information on corporate responsibility from both its main perspectives: respect and protection of the natural environment and commitment to social, ethical and charitable principles. Three non-binding standards have also had great influence, from an institutional point of view, on non-financial reporting: the United Nations Global Compact, the Conventions of the International Labor Organization ILO and the Organisation for Economic Co-operation and Development guidelines (OECD, 2004). The European Union has also issued several statements and recommendations on Corporate Social Responsibility CSR and sustainable development, strongly connected to the Rio de Janeiro declaration (1992) or the Brundtland Report (1987). In the environmental management and reporting arena, and lastly updated, the EMAS III scheme offers an even deeper commitment to reporting and transparency, materialised in the development of `environmental core indicators´, which aim to improve the way in which environmental performance improvements are documented and to allow multiannual comparisons within and between organisations. Indicators include, among others: 'energy efficiency', concerning the total direct energy use and the renewable energy use; 'water', concerning the total annual water consumption; 'emissions', concerning the total annual emission of greenhouse gases and the total annual air emission. EMAS implementation implies certain costs for the registered companies, like validation and verification fees, registration fees, and also other costs

related to internal audits, preparation of EMAS statements and modifications of IT systems. Cost of reporting is a key variable in determining how reporting is going to be organized, in particular when dealing with voluntary disclosures (Bonson and Flores-Muñoz, 2014). Websites are highly relevant for EMAS registered organisations, as they publicly show the official EMAS stamp and publish the EMAS Environmental statement in that open site. Different authors explored the advantages of an online environmental reporting strategy. Isenmann *et al.* (2007) argue that, compared with orthodox methods, online reporting used for sustainability communication including, of course, environmental topics overcomes the limitations of paper-based disclosure, such as 'one size fits all' reports, print medium fixation and one-way communication. Mora Gonzálbez and Mora Rodríguez (2012) highlighted several issues in traditional reporting, such as:

- the massive amount of organisational information, both audited and unaudited,
- the lack of connection between firm publications, and
- the inefficiencies of a PDF-based format for reports delivery.

In fact, Isenmann (2009) argued that there is a strong requirement for a more sophisticated environmental system that is much more personalised depending on user needs, and has the advantages of information technology. New management schemas are evolving, combining technologies with social aspects driven by stakeholders' involvements (Giordano *et al.*, 2007). For the particular case of EMAS-based reports, Makela (2017) reiterates that, even taking into account a particular industry, reports are so diverse that it makes comparisons difficult. A key feature of our time is this `data revolution´ (Stuart, 2015). Among several standards technologies available, XBRL has been identified as a trustworthy and high-quality digital standard to represent business data in a digital environment and includes important global regulators involved in its implementation, such as the SEC Securities and Exchange Commission (2014), and the International Accounting Standard Board (2014).

2.2 The place of XBRL in organisations: Looking at corporate reporting processes insight

The main idea behind XBRL is standardisation. For a specific rule or guideline i.e., IFRS, US-GAAP, GRI, EMAS, CDP, etc. and its corresponding statements and reports, a single XBRL taxonomy is created. The taxonomy is where the rules and data definition materialise, it is comprised by a set of elements i.e., KPIs and all the presentation, calculation and logic rules that operate, according to that rule or standard. Once created, the XBRL taxonomy is made public as an open remote resource on the Internet. Then, for a specific firm, the proprietary software can create an XBRL instance the report itself, containing the concrete facts and figures for a certain period. The XBRL instance can be checked against the taxonomy by all parties reporting entity, a regulator, or even the public in order to guarantee its validation. The creation of an XBRL taxonomy implies the agreement of all interested parties. When applied to financial information, the XBRL working groups involve regulators, IT experts, the academia and the industry; this was also the case for non-financial guidelines like GRI and CDP.

Once the taxonomy is public, the reporting entity must for compulsory adoption or can for voluntary reporting initiatives adapt their pre-existing systems, to be able to prepare and publish such an XBRL report. The final destination of the report can be multiple: the corporate

website, an official reporting platform or repository, etc. Once in XBRL, business facts are much more accessible to any kind of application for data analysis, and allow all users to make easy and fast calculations, rankings, evolutions and comparisons. The reporting entity itself can also benefit from this digital format for consolidation or internal auditing purposes. Arndt *et al.* (2006) explored the use of XBRL for environmental reporting in the context of the Global Reporting Initiative GRI (2014), G3. The author's defined XBRL as the language which specifies the syntax of a report and can be defined as a number of report concepts as well as its respective contents. According to the framework approach, reports consist of two levels: XBRL instances and taxonomies. The environmental report can be understood as an XBRL instance, and the XBRL taxonomy is the set of minimum content and business relationships that the data contained in the environmental report instance must respect. Hrebicek *et al.* (2011) find the use of XBRL to be essential for GRI reporting in particular, as long as the use of tags is linked to the definition, reporting and transmission of Key Performance Indicators KPIs in the Economic, Social, Environmental and Corporate Governance arenas. Even in the context of the Integrated Reporting, XBRL is considered as a technology able to improve corporate disclosure and open un new opportunities for resurging the Intellectual capital reporting (La Torre *et al.*, 2018).

The aim of XBRL is to improve the communication of financial and business information, allowing a seamless flow of data across computers and thus facilitating the sharing of data by the users (Valentinetti and Rea, 2011). XBRL is preferred as a standard format by regulators, but also by companies that use it on a voluntary basis (Bonson *et al.*, 2009; Bonson-Ponte *et al.*, 2009). In addition, it is perceived to be a consolidated digital language with a growing impact in the academic and professional press since 1998 (Roohani *et al.*, 2010). Nowadays, XBRL is being applied more and more frequently for nonfinancial data, i.e., Global Reporting Initiative G3 guidelines (Isenmann and Gomez, 2009) and CDP. The role of XBRL, according to Bonson *et al.* (2008), improving reporting is double: on the one hand, it represents a step forward with respect to paper-based or PDF-static-based documents. On the other hand, the XBRL Consortium and its several Working Groups are the organisational structure whose mission is to create each specific XBRL taxonomy; this interdisciplinary group, where experts in the domain and in the technology, work around a consensus on which specific concepts should appear in the corresponding standardised report, and which business rules apply, help clarification and interpret abstract rules. That was the case for the International Financial Reporting Standards IFRS and the United States Generally Accepted Accounting Principles US-GAAPs, for financial reports, Basel III for solvency reports, GRI G4 and so on. Despite these developments, the application of XBRL is experiencing some obstacles in different regulatory and industry contexts. As highlighted by Troshani and Rao (2007), it is possible to identify environmental, organisational and innovation-related factors that apply to XBRL adoption and diffusion. Janvrin and No (2012) also studied some issues regarding XBRL implementation, in particular the extent to which companies are prepared to implement XBRL, and whether software tools and guidance exists to lead preparers through the process of creating XBRL-related documents. Through this process, four factors were revealed as worth monitoring: management support and involvement, implementation approach, organizational readiness or expertise, and control over the XBRL reporting process. Thus, not only technical, but also organisational and managerial topics must be taken into account when implementing XBRL for certain reporting. The extent to which a certain pre-existing working environment is appropriate or

not for the completion of XBRL reporting procedures is still a key issue. XBRL as others information technologies are becoming necessary for the sustainable management of natural resources (Nagabhatla *et al.*, 2015; Bonson *et al.*, 2011). It is also required to investigate, in line with the work of Sumbal *et al.* (2017), the interrelationships between big data technologies and pre-existing knowledge management systems.

2.3 From IT innovations to organisational values: structure, practice and culture

The adoption of new IT solutions implies certain consequences on the pre-existing norms and values of the potential adopters. In this study we refer to the framework of organisational values proposed by Bunker *et al.* (2007), which consists of three dimensions: structural, practice and culture.

Organisational structure refers to "the total of the ways in which its labour is divided into distinct tasks and then its coordination achieved among those tasks" (Mintzberg, 1989). According to Robbins *et al.* (2013), the key elements related to the organisational structure are: 1) work specialisation, as the degree with which tasks are subdivided into separate jobs. This implies to break a job into a number of steps to be completed by an individual; 2) departmentalisation, as the basis on which jobs are grouped together; 3) chain of command, as the unbroken line of authority that extends from the top of the organisation to the lowest echelon and clarifies who reports to whom. This element includes the concepts of authority, as the rights inherent in a managerial position to give orders, and the unity of command, for which a person should have only one superior to whom is directly responsible; 4) span of control, as the number of employees which a manager can effectively and efficiently direct. In other words, it determines the numbers of levels and managers an organisation has; 5) centralisation, as the degree to which decision making is concentrated at a single point in the organisation. Such a concept includes only formal authority, that is, the rights inherent in a position; and 6) formalisation, as the degree to which jobs within the organisation are standardised.

Practices are also considered in the literature on organisational values. In this regard, the following key elements can be identified (Hofstede, 1994; Croucher, 2017): 1) process-orientated vs. result-orientated: the difference between a concern with means (i.e., technical bureaucratic routines) and a concern with goals; 2) employee-orientated vs. job-orientated: the central focus of attention is on employee or job performance; 3) parochial vs. professional: the level to which the employee's identity is derived from the organisation as opposed to deriving their identity from the type of job they hold. This element is also identified as "local vs. cosmopolitan"; 4) open systems vs. closed systems: the 'communication climate' of the company and the ease with which outsiders and newcomers are admitted; 5) loose control vs. tight control: the degree of formality and punctuality within the organisation. Specifically, the restraint or checks with regards to budgets, meeting times and level of formalness; and 6) normative vs. pragmatic organisations: high importance in following internal organisational procedures or the market and the customers' needs.

Organisational cultural is considered as a shared pattern of basic assumption learned by a group as it solved its problems of external adaptation and internal integration (Schein, 1985). The key elements that capture the essence of an organisation's cultural include (Robbins and Langton, 2001; Robbins *et al.*, 2009): 1) predisposition to innovation and risk-taking, as the degree to which employees are encouraged to be innovative and take risks; 2)

level of attention to detail, as the degree to which employees are expected to exhibit precision, analysis and attention to detail; 3) outcome driven orientation, as the degree to which management focuses on results and outcomes; 4) people management orientation, as the degree to which management decisions take the consideration the effects of outcomes on people within the organisation; 5) team work orientation, as the degree to which work activities are organised around teams rather than individuals; 6) aggressiveness, as the degree to which people are aggressive and competitive rather than easy-going; 7) stability, as the degree to which organisational activities emphasise maintaining the status quo in contrast to growth.

The combination of structural, practical and cultural dimensions are considered to apply the value compatibility test, as explained in the next section.

3. RESEARCH METHOD

Value compatibility testing

Compatibility has been recognized as an important element in the adoption of IT innovations in the market. For instance, in mobile technologies paradigm, some software applications apps can run in different terminals thanks to the compatibility carried out by the operative systems Android, iOS. That is, the apps written for one mobile platform can run on another from a different manufacturer. Going beyond this idea of IT compatibility, there is also a need for appropriateness between business and technology, such as that developed by Bunker *et al.* (2007). The authors point out the need to test the compatibility of technological standards, not only with the technological pre-existing environment, but also with the cultural-organisational, in order to go further with value compatibility testing.

Value compatibility (see Table no. 1) refers to 'the suitability of the innovation with the norms or values of the potential adopters', while practical compatibility refers to 'the suitability of the innovation with the current practices of the adopters' (Bunker *et al.*, 2007). Also, organisational culture and its associated values should be considered, in order to perform a comprehensive analysis on value compatibility. In this study, we refer to XBRL standard for EMAS-related reporting as the technology that it is intended to be implemented, and an heterogeneous industrial firm environment as the normative-organisational environment in which it is intended to be applied. Hence, we followed the application of Bunker *et al.* (2007), as conducted by Bonson *et al.* (2011), in order to build the framework of analysis on the three dimensions discussed in the previous section: structural, practical and cultural dimensions. A limitation of this framework is the proper study of ethical aspects, which represents a challenge for further research regarding ethical compatibility.

A procedure of consultation has been carried out through the definition of a questionnaire to be addressed for a set of heterogeneous entities, including a public hospital, a copper manufacturing facility, a petrochemical plant and pulp factory, all located in southwest Spain (see Table no. 2). The study was conducted in 2013. The reasons for these geo-temporal coordinates are as follows:

- this specific region is heavily occupied by massive industries like those selected, with a high environmental impact and under social pressure due to collateral potential damage to public health; in this particular scenario, we are interested in both polluting firms and the main public health centre in the area;

- 2013 was a key year for the development of XBRL in order to link its developments to the recent Big Data movement. In particular, the XBRL consortium was developing Streaming Extensions 1.0 Requirements published in March 2013 and Abstract Model 2.0 Public Working Draft published since June 2012, so, for the first time, XBRL and Big Data were publicly linked.

Table no. 1 – Value compatibility dimensions and indicators

Value Compatibility	
-Structural dimension	
Work specialisation	*High. medium or low*
Departmentalization	*High. medium or low*
Chain of command	Clear Or confusing
Span of control	0 to 10
Centralization/decentralization	0 to 10
Formalization	*High. medium or low*
-Practice dimension	-Practice dimension
Process vs. results orientation	0 to 10
Employee vs. job orientation	"
Parochial vs. professional	"
Open systems vs. closed systems	"
Loose control vs. tight control	"
Normative vs. pragmatic practices	"
-Cultural dimension	-Cultural dimension
Innovation and risk-taking	*High. medium or low*
Attention to detail	"
Outcome orientation	"
People orientation	"
Team orientation	"
Aggressiveness	"
Stability	"

Table no. 2 – Details on the entities surveyed

Registration no.	**Entity name**	**EMAS registration date**	**Industry – NACE code**	**Nature**	**No. of employees**
ES-AN-000019	Hospital Juan Ramón Jiménez	30-12-02	86.10 - Hospital activities	Public sector	2309
ES-AN-000004	Atlantic Copper	23-03-99	24.44 - Copper production	Firm	591
ES-AN-000001	Cepsa Química	26-02-97	20.13 - Manufacture of other inorganic basic chemicals 20.14 - Manufacture of other organic basic chemicals	Firm	1184
ES-AN-000002	ENCE	12-01-99	17.11 - Manufacture of pulp	Firm	282

In all cases, the interviewees held a management role with direct responsibility for environmental monitoring, data aggregation and preparation in relation to the EMAS reporting procedures. All interviews were carried out in-person during the fall 2013.

The means of data collection used is a combination of semi-structured interviews accompanied by the application of a specialised questionnaire, following the value compatibility scale. Thus, the visits to conduct interviews were planned beforehand, with a written request for the approval and cooperation of the entity's senior management. The organisation chart of the entity was made available to the researchers so that they could select the most appropriate jobholder to consult with for each interview. The interviews and the completion of the specialist questionnaires took place in the head office of the entity analysed. Consequently, four managers took part in four sessions spread almost uniformly over a fieldwork period of two months. As the meetings with managers were taking place, notes were taken on possible changes in the style of the set of questionnaires for the next interview, which provided useful feedback. This process of improvement did not, however, detract from the quality of the first interviews, since the questionnaire was not the only means employed to capture information.

This procedure is in line with previous work regarding application of complex information systems in corporations (Flores *et al.*, 2006). The subsequent analysis is based on the application of simple descriptive statistical techniques on the information obtained from the questionnaires, together with the analysis and discussion of the transcriptions of the interviews and of the results of the questionnaires by the researchers; all this was done to avoid the frequent data overload and possible bias that could be a problem in qualitative research (Miles and Huberman, 1994).

4. RESULTS AND DISCUSSION

Data gathering and analysis comprised three steps: 1) a familiarisation with the working environment of each firm, detailing similarities and differences between these environments; 2) data collection for each company, and finally 3) the analysis and comparisons across dimensions and entities.

The chart reported in Table no. 3 is structured as follows. The horizontal axis shows the variables analyzed, grouped into the structural, practice and cultural dimensions. The vertical axis provides 3 different measurement scales, as follows:

- low, medium or high (left side of the chart), to measure the following variables: *Work specialisations*, *Departmentalization*, *Formalization*, and *Innovation and risk-taking*;
- confusing or clear (left side of the chart), to measure the variable *Chain of command*;
- 0 to 10 (right side of the chart), to measure the remaining variables.

Two distinct scores marked in round brackets are assigned for each variable: the black score is related to the workplace style, while the red score is related to technology perceptions. The higher is the distance between the pairs of scores, the higher are the differences between the business environment (marked in arabic numbers for each entity analysed) and the perceived features of the technology (i.e., XBRL). The lower is the distance, the higher is the degree of compatibility between the organisational values and the IT innovation values.

Table no. 3 – Results of the Value Compatibility test

	Clear						**Confusing**			
	High			***Medium***					***Low***	
Structural dinemsion										
Work specialisation	(1) (3) (4) ***(4)***			(2)					***(1) (2) (3)***	
Departmentalization	(1)			***(1)*** (2) ***(2)*** (3) ***(3)*** (4) ***(4)***						
Chain of command			(1) ***(1)*** (2) ***(2)*** (3) ***(3)*** (4) ***(4)***							
Span of control				(3) ***(3)***	***(2)***	***(1)***	(2)	(1)		(4) ***(4)***
Centralisation/ decentralisation	(1) (2) (3) ***(3)*** (4)				***(1) (2) (4)***					
Formalisation	(1) ***(1)*** (2) (3) ***(3)*** (4)				***(2) (4)***					
Practice dimension										
Process vs results orientation	(4) ***(4)***	(1)	***(1)*** (3)	(3)			(2)	***(2)***		
Employee vs job orientation				***(2)***	(2)	***(1)*** ***(4)***	(3) (4)	(1) ***(2)***		
Parochial vs professional	(1)		***(1)*** (3)	***(4)***	***(3)***	(4)	(2)	(2)		
Open systems vs closed systems		(1)	***(1)*** (2) ***(4)***	***(2)***		(4)	(3)		***(3)***	
Loose control vs tight control		(1) (3) ***(3)*** ***(4)***	***(1)*** (4)		***(2)***	(2)				
Nommative vs pragmatic practices							(3) ***(3)***	***(1)*** (2) ***(2)***	(1)	(4) ***(4)***
Cultural dimension										
Innovation and risk-taking		(2) ***(2)*** ***(4)***			(1) ***(1)*** (3) ***(3)*** (4)					
Attention to detail		***(1)*** (3) ***(3)*** (4) ***(4)***			(1) (2) ***(2)***					
Outcome orientation		(1) (2) ***(2)*** (3) ***(3)*** (4) ***(4)***			***(1)***					
People orientation		(3) ***(3)***			(1) ***(1)*** (2) ***(2)*** (4) ***(4)***					
Team orientation		(1) ***(1)*** (2) ***(2)*** (3) ***(3)*** (4)			***(4)***					
Aggressiveness		(4) ***(4)***			(2) ***(2)*** (3) ***(3)***				(1) ***(1)***	
Stability		(1) ***(1)*** (2) ***(2)*** (3) ***(3)***			***(4)***				(4)	

Note: Workplace style: (1) HJRJ; (2) AC; (3) CQ; (4) E; ***Technology perceptions: (1) HJRJ; (2) AC; (3) CQ; (4) E.***

The initial inspection of Table no. 3 leads us to appreciate a considerable level of coherence between the proposed tool and the pre-existing environments. In particular, in each dimension it was possible to identify a coincidence or great similarity of scoring for both the organisation and the tool. In respect to the Structural Dimension, the main coincidence can be located in the scorings that refers to *Departmentalisation* for which both

the organisation and the technology were scored as *Medium*, and *Chain of Command*, where they were scored as *Clear*. Accordingly, this coincidence reveals a work environment in which the division in functional units is not so strict; this is logical when taking into account that EMAS preparation and reporting imply efficient flows of information and people among departments. The chain of command is clear, and the managers feel that the implementation of XBRL will not risk the command structure in their organisations. With regard to the Practice Dimension, the variable with higher concordance was *loose control versus tight control*, with scorings around 8 and 9 for both workplace and the technology. A high level of control is needed to ensure the reliability of the environmental information collected and published. According to the interviewed directors, XBRL will help maintain such controls over the processes involved. When analysing answers for cultural aspects, the tool is perceived as especially compatible with pre-existing environments for the items labelled as *Outcome orientation* and *Team orientation*, again with values in 9 for almost all cases. Results that are coherent to the previous scoring include both the EMAS preparation and publication working environment imply collaboration between different members of the organisation, but in a highly standardised way, for which the application of a formal digital standard is perceived as pertinent.

The results also show that there are some variables in which there is considerable difference between the business environment and the features of the technology. In particular, for the Practice Dimension, a major divergence is located in the *process versus results orientation* item. In this case, the organisation receives higher scores than the technology. Thus, the organisations are highly committed to obtaining a result, the EMAS report, while the implementation of XBRL enables managers to have a tool to monitor the processes from which that report comes. This is a typical feature of XBRL, that makes easier the accessibility and integration of the information to any application or management process, as it is an open standard, particularly in the context of environmental reporting (Mora Rodriguez and Preist, 2016). In respect to cultural aspects, the technology is perceived as of equal Aggressiveness than the organisation, but the results were quite different across organisations. This can be interpreted as neutrality: for a given level of aggressiveness in the culture of a specific organisation, the implementation of the standard will not have a significant impact. The previous background of interviewed managers played an important role to ensure this level of compatibility. This result is coherent with similar studies that analyzed the implementation of XBRL for financial purposes (Boritz *et al.*, 2017).

For the rest of the variables considered, there appears to be a sufficient degree of value compatibility between the work environment and the proposed technology, with minor differences between the two scorings. Managers were generally optimistic regarding a potential implementation in the short run. They understood that the use of XBRL taxonomies to clarify and concretely establish the definition of indicators would allow for a major level of comparability and that this new system would simplify auditing processes. On the other hand, the use of XBRL reports based on these instances will relatively reduce the importance of creating and editing a `nice´ PDF document, that distracts them from the real task of benefiting from reporting practices to improve operations and managements. Managers were all curious about how well XBRL could allow them to compare their firms with competitors, and asked the researchers in detail how XBRL could help them simplify compulsory reporting tasks too. The overall insight after the interviews was that, currently, the actual system of preparation and publication of environmental statements is not satisfying

managers' needs or the demands from the public. The interviewed managers all agreed that a more transparent and efficient reporting system would help to properly appreciate the strong effort and commitment their firms have regarding environmental improvements.

In light of these results, it can be summarised that, as it was presented to the managers, the application of XBRL for EMAS-related reporting is likely to be implemented without major challenges, as long as both Structural Dimension and Cultural Dimensions show a sufficient degree of compatibility. These results are to some extent in line with those obtained by Sumbal *et al.* (2017), who found that combination of tacit knowledge of relevant staff with explicit knowledge obtained from big data could be relevant and complementary. For the Practical Dimension, some divergences have arisen, and it is in them where managers should pay more attention in the XBRL implementation process. For instance, there is special care they have to take for aspects like the role of professionals in a more automated work environment where less skilled workers could play a more important role, or the role of an open standard like XBRL where other proprietary and/or non-open systems will coexist.

In summary, these results are relevant in order to provide insights to managers and regulators, regarding the potential applicability of XBRL for environmental reporting in the EU and worldwide. The results reveal some concordances between EMAS using XBRL as a reporting technology, and the cultural, organisational and technical working environment of the analysed firms, specifically those related to the Structural Dimension. By contrast, some discordance is highlighted related to the Practical Dimension. From the Big Data perspective, EMAS should benefit from a greater level of standardization using XBRL, reducing some of the critical problems under Big Data scenario as the heterogeneity of formats and the volatility of data.

5. CONCLUSIONS AND FURTHER RESEARCH

The aim of this work was to explore how compatible XBRL could be for EMAS-related reporting and to assess the extent to which managers perceive the possible match between this proposal and their respective working environment. The degree of compatibility between XBRL and the EMAS reporting firms is quite interesting, and this study made it possible to focus on several concrete aspects that will have to be considered in more detail during implementation. Due to its nature as preliminary research exploration, this work presents some limitations, such as a possible bias towards the geographical location where the interviews took place, which could inspire a deep development in further steps of research. With these factors, the following aspects remain for future research:

to increase the sample and to apply a longitudinal approach to complete this cross-sectional vision; in this respect, other industries should be present, to fully capture industry specific patterns, in line with Fujii and Managi (2013); despite the interest of the specific year of the study, it will be required to replicate it and check if potential advantages were achieved;

- to consider alternative methods to capture the opinion and perceptions of managers, going beyond the structured scheme of the selected methodology of this first study;
- to explore which short run and long run effects could be derived from the application of certain transparency policies, in a more general contextualisation of social or environmental policies, and in line with the efforts like those of Karp *et al.* (2003);

- to involve the surveyed managers in a pilot of EMAS-XBRL taxonomy in order to measure real effects and compare with previous perceptions analysed in this paper.

These research contributions will hopefully allow industrial managers to increase the visibility and perceived reliability of their companies, in order to enhance their market valuation and to raise more funds from investors, as the natural complement to their current disclosure policy, as it´s suggested by some authors (Rodriguez-Fernandez, 2016). In fact, the paper proposed for the first time the application of the global financial standard XBRL for a non financial purpose like the widely accepted EMAS, to actual potential uses in real scenarios. The empirical research combined heavy industry with services, privately owned firms with public entities, private and public sector, in the analysis of this technology. This first attempt represented a necessary landmark for a subsequent longitudinal study.

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