Use of XBRL extensions in digital financial reporting (ESEF) – evidence from Poland

Abstract

The article investigates the use of extended tags (extensions) in eXtensible Business Reporting Language (XBRL) based on primary financial statements of Polish listed companies. It is motivated by concerns that erroneous company-specific extensions to the ESEF taxonomy reduce the transparency of financial reporting, thereby eliminating main benefits of XBRL. Using a sample of 1,356 extended tags (extensions) over the period 2020 to 2022, results show that most extensions were incorrect. The most common errors in terms of extensions included creating unauthorized extended tags and selecting anchors too wide in accounting meaning. The most errors were found in the statements of cash flows, next to the statements of financial position. The number of all extensions as well as the number of extensions errors decreased from year to year. The statistical analysis indicated a significant difference in the number of substantive errors across the three evaluated years. The decreasing trend suggests a consistent improvement in errors reduction over time. This proves that the accuracy of creating and anchoring extensions improves over time, and it is crucial due to the obligation to tag notes included in financial statements for 2022 and later years, as well as sustainability reports for 2025 and beyond.

This study contributes to the literature by detailed examining extended tags that cannot be automatically detected using a dedicated application (so-called validator). Additionally, the study addresses the issue of anchoring extensions, which is a key difference between tagging requirements in the US and the EU.

Keywords: extensions, XBRL, ESEF, errors, tagging, Polish listed companies.

I. Introduction

There is an ongoing academic debate about improving the transparency in business and financial information and achieving efficiency gains in collecting, analyzing, and disseminating such information (Al-Okaily et al., 2024). Improved transparency and comparability promotes capital accumulation and allows companies to raise capital at a lower cost. This opens up greater opportunities for investment, which in turn leads to economic growth and development (IFRS, 2024). eXtensible Business Reporting Language (XBRL), a complex technological change in financial reporting of an unprecedented scope, has the potential to improve the transparency of financial information (Bartley et al., 2010). This solution makes information transparent and data more informative and readily accessible, which is expected by regulators, investors, and other stakeholders. Its importance is also demonstrated by the fact that XBRL is often described as 'the business reporting equivalent of bar coding' (Lester, 2007).

However, complexity of XBRL creates the risk of introducing errors that threaten the transparency of financial statements (Bartley et al., 2010). In particular, according to the ESEF regulation, which is obligatory in the European Union, if financial statement concept does not correspond to existing taxonomy elements, companies create unique elements called extended tags (extensions) to reflect firm-specific information. Errors in extended tags (extensions), i.e. unauthorized self-created tags, inhibit information search and thus reduce the usefulness of XBRL data.

The aim of this article is to examine the scope of extensions created by entities in their primary financial statements for 2020-2022, as well as to verify correctness of extensions in relation to the tagging requirements contained in ESEF regulations. The thesis stated is that the accuracy of creating and anchoring extensions will improve over time which is crucial for more transparent XBRL reporting.

This paper is structured as follows. After the introduction, Section II contains the theoretical background and research questions. Section III describes the sample and the research method used to gather our data. Section IV presents result of the study. We conclude in Sections V and VI with the closing remarks containing limitations and directions for future research.

This article adds to the literature that the main source of errors in extensions is insufficient knowledge and understanding of the ESEF taxonomy, however, over time, the number of errors gradually decreases. The study may be useful both for issuers preparing financial statements using XBRL tags and for statutory auditors who are required to verify the correctness of the tags used as part of their audit obligation.

II. Theoretical background and research questions

Overview of XBRL

The literature agrees on the importance of transparency in financial reporting, however, emphasizes different aspects. Information is considered transparent when it reflects the entity's underlying economics in a way that is readily understandable by users and it is easily extracted and effectively used (Enachi, 2023). One of the sources of improving the efficiency and transparency of financial reporting is XBRL (Pinsker, Li, 2008; Beerbaum et al., 2021; Hoitash et al., 2021), which was invented in 1998 and in just over a decade it moved from an idea to a voluntary filing program (VFP) sponsored by the U.S. Securities and Exchange Commission (SEC), and finally to the SEC mandate for XBRL (Henderson et al. 2011). In 2009, the SEC passed Final Rule: Interactive Data to Improve Financial Reporting, which required publicly traded companies in the U.S. and foreign private issuers to tag their financial statements using XBRL, furnish their statements with the SEC in XBRL format, and publish the XBRL-tagged statements on their corporate websites (SEC, 2009). Nowadays XBRL is already widely used internationally, outside the US and Europe also in countries such as: China, India, Japan, Chile, South Africa, Australia and Israel (Markelevich et al, 2015, Durović et al, 2021). Reasons for the worldwide use of XBRL include:

- reducing information asymmetry on the capital market (Rezaee, Hoffman, 2001; Ramin, Prather, 2003; Jones, Willis, 2003; Yoon et al., 2011; Müller-Wickop et al., 2013),
- positive impact on the firm's stock liquidity (Sassi et al., 2021),
- limiting the financial statements' window dressing because XBRL data sources have to conform to certain standard requirements or taxonomies (Matherne, Coffin, 2001; Abdullah et al., 2009; Alles, Piechocki, 2012).

XBRL, an open standard reporting language, has the potential of improving the disclosure of financial information, thanks to XML (Extensible Markup Language), which gives data structure and context that can be understood by wide range of software applications (Abdullah et al., 2009). Through the tagging process, during which the financial data is marked up with XBRL codes ('tags'), it is possible to make the document machine-readable. Once entered into a financial information database, investors, analysts, and other users can download it quickly in a format that allows for immediate analysis and easier comparisons than financial reports in traditional formats (Markelevich at al., 2015).

The foundation of XBRL consists of taxonomies – complex hierarchical classification systems of terms related to a specific reporting area (e.g., financial reporting, banking, insurance, taxes), which can be briefly described as dictionaries of concepts. These taxonomies are expected to provide similar meanings across all users (Abdullah et al., 2009). For example, with regard to financial reporting, the IFRS Accounting Taxonomy reflects the presentation and disclosure requirements of International Financial Reporting Standards and includes elements from the accompanying materials to the IFRSs such as implementation guidance and illustrative examples. In addition, IFRS Taxonomy contains elements for disclosures not specifically required by IFRSs but commonly reported in practice (IFRS, 2023).

As Markelevich at al. (2015) pointed out, XBRL is a tool to bridge potential language barriers and unify financial reporting. This particularly applies to foreign investors who, among others, can rely on information presented in financial reports tagged with XBRL and make investment decisions without having to translate financial statements from local language. This aspect seems to be especially important in the EU, where each Member State uses its own national language in financial reporting. The labels of the taxonomy are translated into all EU national languages, but the tag for a given item remains the same in each language version.

The fundamental principle of XBRL, evident even in the name of this standard, is its extensibility. Organizations preparing their reports in XBRL cannot modify the taxonomy they use (so-called 'core taxonomy'); however, they can add their own self-defined items to it. These are called extensions. Properly created taxonomy extensions allow the companies to make disclosures not envisaged in the core taxonomy, thereby adding value for information users (Debreceny et al., 2011). Proponents of extensibility concept argue that XBRL extensions provide more useful information about atypical items specific to a particular enterprise. According to opponents, creating extensions reduces the comparability of financial statements, complicate and impede financial analysis (Li, Nwaeze, 2015).

ESEF Regulation in Europe

In 2013, the European Commission amended the Transparency Directive to include a requirement for issuers to prepare their annual financial reports in a new electronic reporting format. The European Securities and Markets Authority (ESMA) was assigned the responsibility to develop regulatory technical standards (RTS) to specify this format, officially named as the European Single Electronic Format (ESEF). In the following years ESMA conducted open public consultations and performed a cost-benefit analysis which supported the

use of Inline XBRL for embedding XBRL markups in XHTML documents (EC, 2019). The complete timeline of ESEF development in the EU is presented in Table 1.

Table 1. Timeline of ESEF development in the European Union

October 2013	Directive 2004/109/EC (Transparency Directive) requires ESEF Reporting Format with an effective date on or after 1 January 2020
September 2015	ESMA issues Consultation Paper on the Regulatory Technical Standards on the European Single Electronic Format (ESEF)
September 2016	ESMA publishes Feedback Statement on the Consultation Paper on the Regulatory Technical Standard on the European Single Electronic Format (ESEF)
June-September 2017	ESMA conducts a series of field tests on ESEF with 25 European volunteer issuers
December 2017	ESMA publishes Final Report on the RTS on ESEF
December 2018	EC adopts ESMA RTS on ESEF as a Commission Delegated Regulation
May 2019	Commission Delegated Regulation (EU) 2019/815 supplementing Directive 2004/109/EC of the European Parliament and of the Council with regard to regulatory technical standards on the specification of a single electronic reporting format published in the Official Journal of the European Union
January 2020	Effective date for ESEF Financial Statement Filings for periods starting on or after 1 January 2020
December 2020	EC and EU Parliament agree to postpone the ESEF obligation for one year due to COVID-19 pandemic
January 2020	Effective date for ESEF Financial Statement Filings for periods starting on or after 1 January 2021
January 2022	Effective date for footnote block tagging requirement
January 2025	Effective date for tagging of sustainability reports

Source: own study.

The RTS on ESEF (and the Commission Delegated Regulation based on RTS) specifies that all issuers subject to the Transparency Directive's requirements prepare their annual financial reports in Extensible Hypertext Markup Language (XHTML) format. If an issuer prepares consolidated financial statements based on IFRS, it marks up them using the XBRL markup language. The markups are embedded in the XHTML version of the annual financial report using the Inline XBRL format (ESMA, 2023). In the future corporate sustainability reports will also have a mandatory electronic format and will be marked according to sustainability reporting standards (CSRD, 2022).

The main rules for digital reporting in the European Union are shown in Table 2 compared to the SEC's requirements, which are essentially similar, but there are some differences.

Table 2. The main rules for digital reporting in the European Union and the United States

Specification	European Union (ESMA requirements)	United States (SEC requirements)
Types of tagged reports	Annual Reports (consolidated financial statements only)	Quarterly reports (Forms 10-Q), Annual Reports (Forms 10-K)
Tagging data in primary financial statements	Detailed: all numbers in a declared currency marked with a separate tag, tagging other numbers (e.g. number of shares) is not required	Detailed: all numbers in a declared currency marked with a separate tag as well as other numbers presented (e.g. number of shares)
Tagging the descriptive content (text) of financial statements (accounting policies and notes)	Multi-layer block tagging (many block tags matching a given text fragment)	Single-layer block tagging (one block tag matching a given text fragment)
Tagging data in the tables included notes	Multi-layer block tagging, not detailed: applies to entire tables (only if a given tag corresponds to the data presented in the table), there is no obligation to specifically tag the numbers included in the tables	Single-layer block tagging, detailed: each number marked with a separate label, additionally each table must be marked with a separate block tag
Anchoring extensions	Extensions for amounts in primary financial statements must be anchored (except for subtotals, which do not require anchoring), extensions for block tags in notes do not need to be anchored	No extensions need to be anchored
Audit of the tagging correctness	Mandatory	Voluntary

Source: Kobiela-Pionnier (2023).

As shown in the table above, one of the key differences between tagging requirements in the US and the EU is the issue of anchoring extensions, presented in the following section.

Taxonomy extensions

XBRL is used with the goal of decreasing information processing costs and improving investor information by standardizing financial statement items. Standardization is achieved by applying standard tags to financial statement items that should be interpreted in a similar manner[1]. However, to allow firms to disclose line items that do not have an official standard tag, it is permitted to extend the standard XBRL taxonomy (Johnston, 2020). It is in accordance with the

[1] For example, one firm may refer to 'operating income' as 'operating profits' while another may refer to it as 'income from operations'. Using XBRL, both firms could tag this item with the official tag ('OperatingIncomeLoss'), thereby avoiding any confusion of semantics. The use of labels in XBRL facilitates the different account descriptions while still preserving the underlying meaning of the line items (Johnston, 2020).

transparency of financial reporting, which states that information is considered transparent when it allows entities a certain degree of freedom to reflect their specifics (Enachi, 2023). In general, extended tags allow preparers to markup firm-specific disclosures, thus presenting their financial information more accurately (Troshani, Rowbottom, 2021).

Janvrin and No (2012) interviewed 9 accountants from various industries, who reported creating extensions when financial items did not match the core taxonomy's standard description. All respondents attempted to minimize the number of extended tags due to either the desire to match with the existing standard taxonomy or their perceptions regarding difficulty creating taxonomy extensions (Janvrin, No, 2021). Observations of the US filings in the first year of mandatory tagging disclosed an excessive number of extensions created by some filers (Aguilar, 2009). Many studies indicate a significant number of created unnecessary, unauthorized extensions when an equivalent tag is already provided in the taxonomy (Boritz, No 2009; Debreceny et al., 2011, Du et al., 2013). Examining justified and unjustified extensions Scherr and Ditter (2017) find that the use of necessary extended tags is associated with the complexity of financial reporting and costs of voluntary disclosure. Unnecessary extension use is most common in firms with less experience in XBRL reporting or less involvement in the XBRL tagging process.

Undoubtedly, XBRL extensions play a significant role when financial data in XBRL is analysed automatically. Conducted studies indicate that extensions are associated with lower information asymmetry as measured by bid-ask spread. However, after a certain level of disclosure of XBRL extensions, the impact on stock pricing is negative (creates noise on stock markets). Results indicate also that XBRL extensions are positively (negatively) related to stock market value for firms that exhibit positive (negative) earnings. This suggests a complementary effect between earnings and XBRL extensions on their relation with stock price. It would imply that XBRL extensions allow to better assess the relevance of earnings (positive or negative) on the stock market valuation. (Cormier et al. 2021). Abnormal extensions have a positive and significant impact on both the analyst following and forecast accuracy, and a negative and significant impact on analyst forecast dispersion. The results are weaker during the first year and stronger during later years of the XBRL-based reporting (Li, Nwaeze, 2018).

The ESEF regulation provides general, although rather straightforward and understandable rules for creating extensions. Generally, when marking up disclosures, issuers use the element

of the core taxonomy[2] with the closest accounting meaning to the disclosure being marked up. Where there appears to be a choice of the core taxonomy elements, issuers select the element with the narrowest accounting meaning and/or scope (EC 2019, Annex IV, point 3). But if the closest core taxonomy element would misrepresent the accounting meaning of the disclosure being marked up, issuers create an extension taxonomy element and use that to mark up the disclosure concerned (EC 2019, Annex IV, point 4). Created extension element shall not duplicate the meaning and scope of any core taxonomy element.

While the extended tags could reflect important firm-specific information disclosed by the firm, which is one of the main benefits of XBRL, extended tags could be detrimental to the processing of financial statement information. The research on this topic provided mixed results with some studies finding that extended tags may be used erroneously (Debreceny et al., 2011; Johnston, 2020), either due to misunderstanding of the taxonomy, or to intentionally obfuscate financial reports (Huang et al., 2019; Hoitash et al., 2021). Errors made in tagging negate the main purpose of XBRL which is to enable investors to make company comparisons more easily (McCann, 2010). Thus, as Bartley and al. (2010) emphasize, such extensions cannot be readily interpreted by analytical software and should be minimized. Furthermore, unnecessary extensions violate the XBRL protocol and may attract regulatory attention.

To limit some disadvantages of extensions, ESEF regulation, unlike in the US, requires that created extensions are anchored to one or more core taxonomy elements. In particular:

- the issuer anchors its extended taxonomy element to the core taxonomy element that has the closest wider accounting meaning and/or scope to that extended taxonomy element of the issuer,
- the issuer may anchor the extended taxonomy element to the core taxonomy element or elements having the closest narrower accounting meaning and/or scope to that extended taxonomy element concerned,
- where the extension taxonomy element combines a number of core taxonomy elements, the issuer anchors that extended taxonomy element to each of those core taxonomy elements except any such core taxonomy element or elements, which are reasonably deemed to be insignificant.

[2] A core taxonomy refers to the taxonomy prepared and provided by the regulator or an organization acting on its behalf. In the case of the EU, this means the combined set of the taxonomy elements set out in Annex VI of the ESEF Regulation and collection of links prepared by ESMA.

It is worth emphasizing that cited research from the US market concentrates on unnecessary extensions and does not take into consideration anchoring issues, which are specific to ESEF requirements (Cormier et al, 2021). Therefore, the authors decided to investigate this issue and answer to following research questions:

RQ1: What was the frequency of creating extensions in primary financial statements of Polish issuers in 2020-2022? Did the frequency of creating extensions change between 2020 and 2022? Was the change statistically significant?

RQ2: What was the frequency of substantive errors made by entities in terms of ESEF requirements? What was the proportion of incorrect extensions in relation to the total extensions created? Did the frequency of substantive errors made by entities change between 2020 and 2022? Was the change statistically significant?

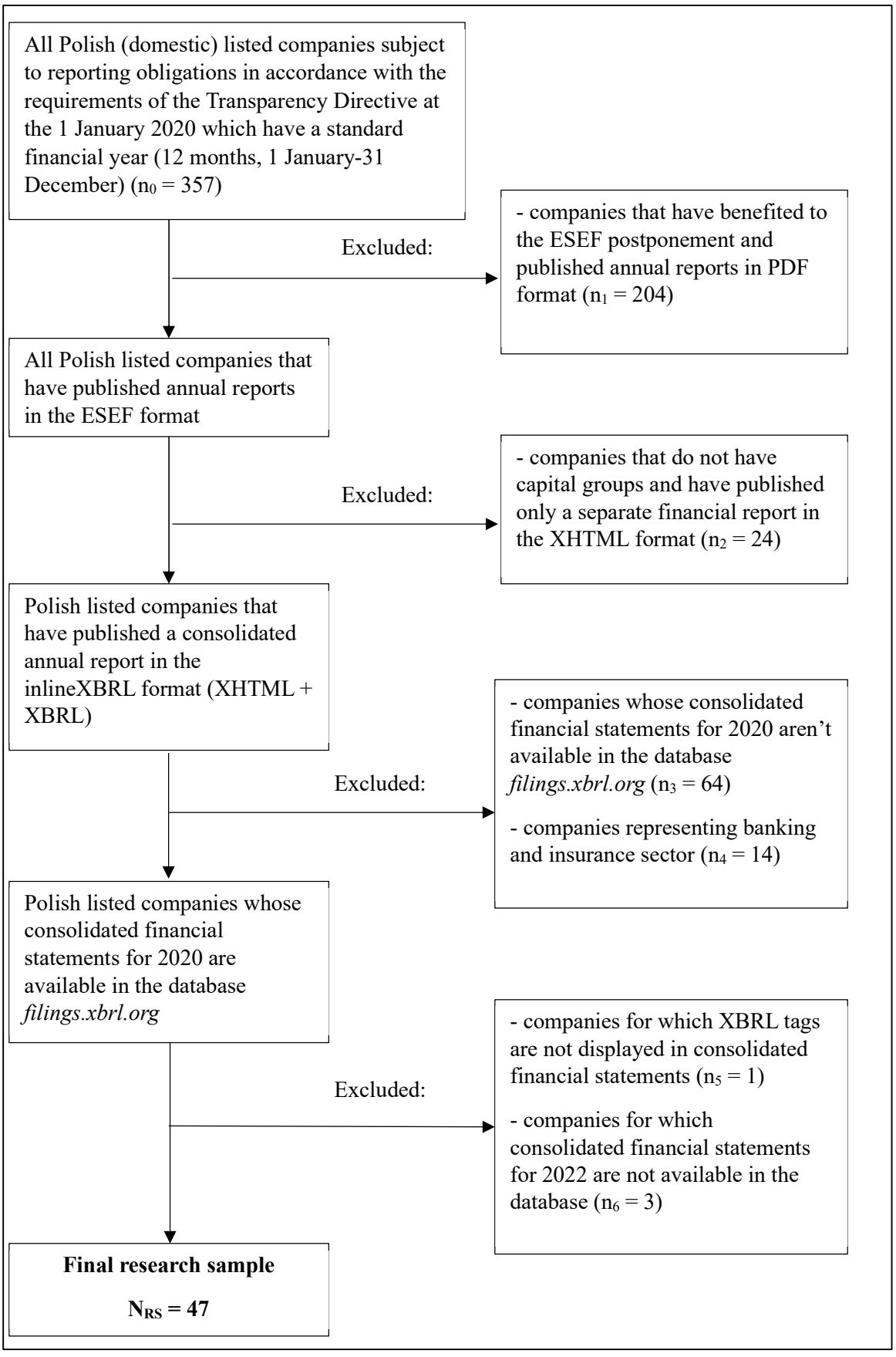
RQ3: What were the types of substantive errors in extensions made by entities in terms of ESEF requirements?

III. Research method and sample companies

The study was based on statistical analyses of XBRL tags used by 47 companies listed on the Warsaw Stock Exchange in their consolidated financial statements for 2020[3], 2021 and 2022. This sample covers all Polish listed companies whose consolidated financial statements for all 3 years are available in the database *filings.xbrl.org* provided by the XBRL International, which is the only large database of inlineXBRL reports that could be found online. Banks and insurers were excluded due to the different content of their financial statements. The process of selecting the research sample is presented in Figure 1 below and the final research sample is shown in Table 3.

[3] Poland, like most EU Member States, decided to use the national option to delay the ESEF obligation for one year because of the Covid-19 pandemic. Despite the postponement, approximately 40% of the Polish companies decided to proceed with ESEF electronic filings (Gierczak, Kobiela-Pionnier, 2021).

Figure 1. Research sample selecting process



Source: own study.

Table 3. A final sample of Polish listed companies reporting in the ESEF format on a voluntary basis for the year ended December 31, 2020 and consistently for 2021 and 2022

Company	Macrosector	Main sector	Subsector
Agora	Trade & Services	Media	Publishing
APS Energia	Industrials	Machinery	Electro machinery
Arctic Paper	Chemicals & Materials	Wood&Paper	Paper & packaging
Asseco Poland	Technology	IT	IT systems
Asseco South	Technology	IT	Software
Auto Partner	Consumer Goods	Automobiles	Auto parts
Benefit Systems	Trade & Services	Leisure facilities	Other - leisure facilities
Best	Financials	Mortgage	Mortgage
Bioton	Healthcare	Pharmaceuticals	Pharmaceuticals
Ciech	Chemicals & Materials	Chemicals	Basic chemicals
Comarch	Technology	IT	IT systems
Cyfrowy Polsat	Technology	Telecom	Telecom
Develia	Financials	Real estate	Real estate sales
Dino Polska	Trade & Services	General Retailers	Consumer discretionary
Dom Development	Financials	Real estate	Real estate sales
Echo Investment	Financials	Real estate	Real estate sales
EMC Instytut Medyczny	Healthcare	Healthcare Services	Healthcare Services
Enea	Oil & Energy	Energy	Power
Energa	Oil & Energy	Energy	Power
Grupa Azoty (Police)	Chemicals & Materials	Chemicals	Basic chemicals
Grupa Azoty (Puławy)	Chemicals & Materials	Chemicals	Basic chemicals
Grupa Azoty (Tarnów)	Chemicals & Materials	Chemicals	Basic chemicals
Grupa Kęty	Chemicals & Materials	Metallurgy	Non-ferrous metallurgy
Inpro	Financials	Real estate	Real estate sales
Instal Kraków	Industrials	Construction	Industry construction
Ipopema	Financials	Capital Market	Exchanges and brokers
JSW	Chemicals & Materials	Mining	Coal mining
Kino Polska TV	Trade & Services	Media	Radio & tv
Kogeneracja	Oil & Energy	Energy	Power
Kruk	Financials	Mortgage	Mortgage
Lentex	Industrials	Industrial Supplies	Construction materials
Marvipol Development	Financials	Real estate	Real estate sales
Neuca	Healthcare	Pharmaceuticals Wholesales	Pharmaceuticals Wholesales
Orange Polska	Technology	Telecom	Telecom
Orlen	Oil & Energy	Oil & Gas	Oil & gas exploration and production
P.A. Nova	Industrials	Construction	General construction
PGE	Oil & Energy	Energy	Power
PKP Cargo	Industrials	Transportation	Transportation
Sanok Rubber Company	Consumer Goods	Automobiles	Auto parts
Sonel	Industrials	Machinery	Electro machinery
Tauron Polska Energia	Oil & Energy	Energy	Power
Triton Development	Financials	Real estate	Real estate sales
Ulma	Industrials	Construction	Construction materials
Unibep	Industrials	Construction	General construction

Unimot	Oil & Energy	Oil & Gas	Oil & Gas distribution
Wielton	Industrials	Machinery	Farm & heavy trucks
ZUE	Industrials	Construction	Building products

Source: own study based on https://www.gpw.pl/list-of-companies (access: 13.10.2023).

In particular, the authors conducted comparisons of all created extensions (1,356) from consolidated financial statements of surveyed entities with the concepts included in the ESEF Taxonomy. Detailed verification of the economic significance of a given item in accordance with the additional information and its comparison with the description of the concept in the ESEF taxonomy allowed for the detection of unnecessary extensions. For each extended tag, its compliance with the requirements for creating extensions from RTS and ESEF Reporting Manual was checked. As a result, it was possible to assess the correctness of the anchoring of the extensions.

To test the correctness of extensions, the classification proposed by Kobiela-Pionnier (2023) was adopted[4], according to which substantive errors regarding extensions consist of:

- Too wide anchoring: a tag selected from the core taxonomy as an anchoring basis is too broad in accounting meaning,
- Too narrow anchoring: a tag selected from the core taxonomy as an anchoring basis is too narrow in accounting meaning,
- No required narrower anchoring: for a given extension that combines many elements of the core taxonomy, these elements are not indicated,
- Incorrect disaggregation of items: a tag selected from the core taxonomy is used twice – directly for one item and as an anchoring basis for another item. In this situation there should be two extensions created and anchored to one selected tag from the core taxonomy,
- Anchoring of subtotals,
- Unnecessary extension: an extension created for a reporting item for which there is an appropriate tag in the core taxonomy.

It is worth noting that none of the irregularities indicated above can be detected using automatic verification.

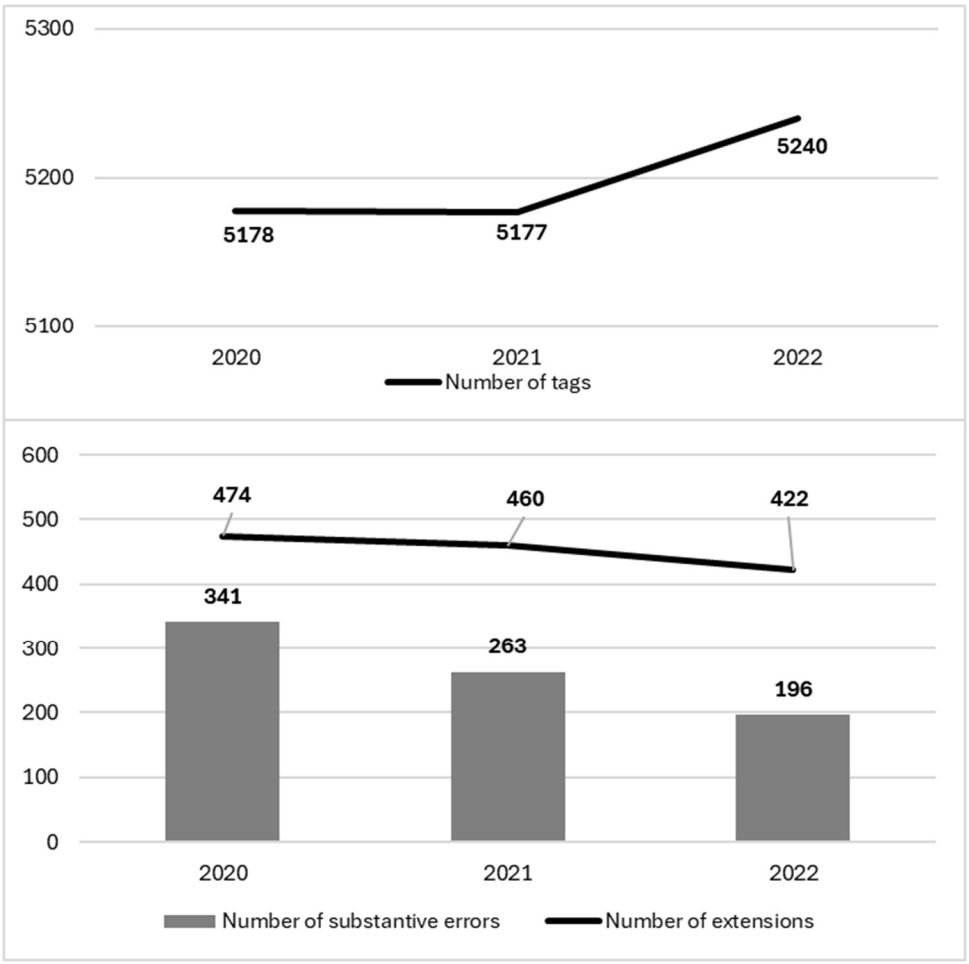
[4] Kobiela-Pionnier (2023) observed that issuers preparing financial statements made various substantive errors in selection of XBRL elements, in particular, by using an inappropriate tag or creating an unnecessary extension. Based on the results it was proposed a classification of substantive errors that may occur in financial statements tagged with ESMA ESEF taxonomy.

In the final step, statistical analyses were conducted using SPSS software. This meticulous approach was aimed at gaining a better understanding of XBRL tag usage and application, ensuring comprehensive evaluation of the tagging process. Key focus areas included the number of tags, the number of extensions, and the occurrence of substantive errors within these tags, providing a critical measure of the quality and accuracy of the financial reporting, thus capturing overarching trends as well as intricate details of financial data communication through XBRL tags.

IV. Results

Figure 2 illustrates the total number of tags, extensions and substantive errors in extensions that were found in the examined financial statements, divided on years.

Figure 2. Number of tags, extensions and substantive errors



Source: own study.

It was found that the total number of extensions was 474 in 2020 and accounted for 9.2% of all tags. However, most extensions were incorrect (71.9% in 2020). The number of extensions decreased from year to year – to 460 (8.9%) in 2021 and to 422 (8.1%) in 2022. The number of

substantive errors also decreased from year to year – to 263 (decrease by 22.9% from year to year) in 2021 and to 196 (decrease by 25.5% from year to year) in 2022. The share of substantive errors in the total number of extensions decreased to 57.2% in 2021 and 46.4% in 2022. Table 4 illustrates the total number of substantive errors in extensions, divided by their types and years examined.

Table 4. Number of substantive errors divided by their types

Year	Type of substantive errors					
	Too wide anchoring	Too narrow anchoring	No required lower anchoring	Incorrect disaggregation of items	Anchoring of subtotal	Unauthorized extension
2020	154	18	35	25	12	97
2021	126	11	27	20	6	75
2022	93	8	18	17	6	54

Source: own study.

The most common errors were: too wide anchoring (45.2%, 47.5%, 47.4% of all errors in 2020-2022, respectively) and unauthorized extension (28.4%, 28.3%, 27.6% of all errors in 2020-2022, respectively). The most errors were found in statements of cash flows (47.8%, 47.2%, 48.0% of all errors in 2020-2022) and statements of financial position (38.1%, 41.5%, 39.3% of all errors in 2020-2022). Table 5 illustrates the total number of tags, extensions and substantive errors in extensions that were found in the examined statements of cash flows, divided on years and type of substantive errors.

Table 5. Number of tags, extensions and substantive errors in the statement of cash flows

Year	Number of tags	Number of extensions	%	Number of substantive errors	%
2020	1,551	236	15.2%	163	69.1%
2021	1,527	214	14.0%	125	58.4%
2022	1,568	209	13.3%	94	45.0%

Year	Type of substantive errors					
	Too wide anchoring	Too narrow anchoring	No required lower anchoring	Incorrect disaggregation of items	Anchoring of subtotal	Unauthorized extension
2020	84	8	15	12	6	38
2021	69	2	11	8	5	30
2022	47	3	7	8	3	26

Source: own study.

The total number of substantive errors in the statement of cash flows decreased from 163 in the financial statements for 2020 to 125 in 2021 (decrease by 23.3% year to year) and to 94 in 2022 (decrease by 24.8% year to year). The most common type of errors was too wide anchoring. Detailed substantive errors included anchoring:

- gross profit from continuing and discontinuing operations to cash flows,
- net interest, exchange differences and dividends to adjustments to reconcile profit (loss) in operating activity, instead of finance income (cost),
- interest inflows and outflows from operating activities to interest received,
- impairment losses of tangible fixed assets and intangible assets to adjustments other than changes in working capital, instead of adjustments resulting from an impairment loss (reversal of impairment loss) recognised in profit or loss,
- changes in assets or liabilities (e.g. prepaid expenses, unearned revenue, accruals) to adjustments, instead of more specific tags,
- acquisition of tangible fixed assets and intangible assets to cash flows from investing activity,
- inflows and outflows of interest and dividends to cash flows from investing activities.

There were also unnecessary extensions for items for which appropriate tags exist e.g.: change in cash and cash equivalents, interest in financing activities, inflows and outflows from investing activities.

6 illustrates the total number of tags, extensions and substantive errors in extensions that were found in the examined statements of financial position, divided on years and type of substantive errors.

Table 6. Number of tags, extensions and substantive errors in the statement of financial position

Year	Number of tags	Number of extensions	%	Number of substantive errors	%
2020	1,917	152	7.9%	130	85.5%
2021	1,937	159	8.2%	110	69.2%
2022	1,935	143	7.4%	77	53.8%
Year	Type of substantive errors				

	Too wide anchoring	Too narrow anchoring	No required lower anchoring	Incorrect disaggregation of items	Anchoring of subtotal	Unauthorized extension
2020	54	7	17	10	0	42
2021	46	7	14	7	0	36
2022	39	3	10	5	0	20

Source: own study.

The total number of substantive errors in the statement of financial position decreased from 130 in the financial statements for 2020 to 110 in 2021 (decrease by 15.4% year to year) and to 77 in 2022 (decrease by 30.0% year to year). The most common types of errors were too wide anchoring and unauthorized extension. Detailed substantive errors included anchoring:

- tangible fixed assets and right-of-use assets to assets, instead of fixed assets,
- investments in bonds and loans to other long-term investments, instead of investments measured at amortised cost,
- investments in shares to other long-term investments, instead of investments measured at fair value,
- long- and short-term CO_2 emission rights to fixed or current assets,
- current assets from contracts and short-term receivables from contracts with customers to current assets, instead of current assets, excluding assets held for sale,
- long-term and short-term loans and leasing to total liabilities, instead of long-term and short-term financial liabilities,
- long-term and short-term provisions for employee benefits to total liabilities, instead of more specific tags,
- unearned revenues and donations to total liabilities, instead of more specific tags,
- equity components to total equity, instead of more specific tags.

There were also unnecessary extensions for items for which appropriate tags exist e.g.: intangible assets and goodwill, land, tangible fixed assets together with right-of-use assets, agio, long-term and short-term lease liabilities, long-term and short-term accruals.

It was found that there were significantly fewer errors in the statement of profit or loss and other comprehensive income and in the statement of changes in equity. Table 7 illustrates the total number of tags, extensions and substantive errors in extensions that were found in the examined

statements of profit or loss and other comprehensive income, divided on years and type of substantive errors.

Table 7. Number of tags, extensions and substantive errors in the statement of profit or loss and other comprehensive income

Year	Number of tags	Number of extensions	%	Number of substantive errors	%
2020	1,308	67	5.1%	39	58.2%
2021	1,324	62	4.7%	26	41.9%
2022	1,342	59	4.4%	23	39.0%

Year	Type of substantive errors					
	Too wide anchoring	Too narrow anchoring	No required lower anchoring	Incorrect disaggregation of items	Anchoring of subtotal	Unauthorized extension
2020	13	3	2	3	5	13
2021	8	2	1	5	1	9
2022	7	2	1	4	1	8

Source: own study.

The total number of substantive errors in the statement of profit or loss and other comprehensive income decreased from 39 in the financial statements for 2020 to 26 in 2021 (decrease by 33.3% year to year) and to 23 in 2022 (decrease by 11.5% year to year). The most common types of errors were too wide anchoring and unauthorized extension. Detailed substantive errors included anchoring:

- revenues from sales of finished goods and revenues from sales of merchandise and materials to sales revenue, instead of revenues from sales of goods,
- subsidies to sales prices to operating profit or loss, instead of revenues,
- other operating expenses to expenses by nature,
- profit or loss on sales of tangible fixed assets to other profit or loss, instead of profit or loss on sale of fixed assets,
- profit before income tax and share in profit or loss of associates and joint ventures to net profit or loss, instead of gross profit or loss.

There were also unnecessary extensions for items for which appropriate tags exist e.g.: other operating expenses, net loss attributable to owners of parent, net loss attributable to non-

controlling interest, comprehensive income attributable to owners of parent, comprehensive income attributable to non-controlling interest.

Table 8 illustrates the total number of tags, extensions and substantive errors in extensions that were found in the examined statements of changes in equity, divided on years and type of substantive errors.

Table 8. Number of tags, extensions and substantive errors in the statement of changes in equity

Year	Number of tags	Number of extensions	%	Number of substantive errors	%
2020	402	19	4.7%	9	47.4%
2021	389	25	6.4%	4	16.0%
2022	395	11	2.8%	2	18.2%

Year	Type of substantive errors					
	Too wide anchoring	Too narrow anchoring	No required lower anchoring	Incorrect disaggregation of items	Anchoring of subtotal	Unauthorized extension
2020	3	0	1	0	1	4
2021	3	0	1	0	0	0
2022	0	0	0	0	2	0

Source: own study.

The total number of substantive errors in the statement of changes in equity decreased from 9 in the financial statements for 2020 to 4 in 2021 (decrease by 55.6% year to year) and to 2 in 2022 (decrease by 50.0% year to year). Detailed substantive errors included anchoring individual components of equity to total equity, instead of at least to changes in equity and the division of profit to net profit. Detailed examination of statement of changes in equity also allowed for the detection of a specific error consisting in the lack of tagging of columns for the extensions created.

The statistical analyses for the years 2020-2022 were conducted on aggregated data. The first analysis focused on examining the normality of distributions of individual variables. The normality of distributions was assessed using the Kolmogorov-Smirnov test. Table 9 provides the test statistics – K-S, the number of analyzed cases – N, and significance – p.

Table 9. Tests of normality of distributions of analyzed variables in Total for 2020-2022

Indicators	Kolmogorov-Smirnov		
	2020	2021	2022

	K-S	N	p	K-S	N	p	K-S	N	p
Number of tags	0,150	47	0,010*	0,137	47	0,028*	0,102	47	0,200
Number of extensions	0,100	47	0,200	0,096	47	0,200	0,111	47	0,193
Number of substantive errors	0,139	47	0,023*	0,131	47	0,044*	0,177	47	<0,001*

Source: Own elaboration in SPSS, based on the examined financial statements.

The Kolmogorov-Smirnov tests indicated non-normal distributions for the number of tags in 2020 and 2021, with p-values of 0.010 and 0.028 respectively, justifying the use of the Friedman's rank test for three dependent variables and the Wilcoxon signed-rank test for two dependent variables[5]. Conversely, the number of extensions maintained a stable normal distribution across all years, with p-values consistently above 0.190, allowing the use of parametric tests like ANOVA for three dependent variables and the Student's t-test for dependent groups for analysis. The number of substantive errors also demonstrated significant non-normality across all years, with p-values of 0.023, 0.044, and less than 0.001 for 2020, 2021, and 2022 respectively, necessitating non-parametric analyses to accurately reflect the data's distribution characteristics[6]. Subsequently, individual indicators were compared before and after the correction to determine whether statistically significant changes in Total occurred (Tables 10-15).

Table 10. Comparison of number of tags in Total for 2020-2022

Indicator	Moment	N	Min	Max	M	Me	SD	Avgr
Number of tags	2020	47	85,00	144,00	110,17	108,00	14,25	1,95
	2021	47	84,00	146,00	110,15	109,00	14,72	1,88
	2022	47	87,00	146,00	111,49	111,0	14,63	2,17
Friedman's test: $\chi 2$=2,284, p=0,319								

Source: Own elaboration in SPSS, based on the examined financial statements.

The Friedman test yields a chi-squared value of 2.284 with a p-value of 0.319, indicating that there are no statistically significant differences in the number of tags across the years 2020, 2021, and 2022. The relatively high p-value suggests that any observed differences in the median values and distributions of the number of tags among these years could likely be attributed to random variation rather than a systematic change over time. Given the Friedman test results indicating no statistically significant differences across 2020, 2021, and 2022 in the

[5] Although the 2022 distribution for number of tags returned p-value of 0.200, indicating normality, non-parametric testing was consistently applied across all years for coherence.

[6] This adherence to consistent testing methods ensures the integrity and comparability of results across different years and variables, facilitating reliable conclusions about financial reporting practices.

number of tags, attention should be directed towards the comparison of 2020 and 2022, which is essential for understanding long-term trends or broader changes over the period, given the subtle increase in average ranks from 1.95 to 2.17, suggesting potential underlying shifts.

Table 11. Comparison of number of tags in Total for 2020 and 2022

Indicator	Moment	N	Min	Max	M	Me	SD	Avgr
Number of tags	2020	47	85,00	144,00	110,17	108,00	14,25	1,95
	2022	47	87,00	146,00	111,49	111,0	14,63	2,17
Wilcoxon signed-rank test: Z=-1,391, p<0,001* Increase:25, No change:3, Decrease:19								

Source: Own elaboration in SPSS, based on the examined financial statements.

The Wilcoxon signed-rank test result indicated a statistically significant change in the number of tags between the years 2020 and 2022, with a p-value of less than 0.001. Although the Z-value of -1.391 suggests that the median of the differences between paired data is negative, this result points towards a generally increasing trend in the number of tags from 2020 to 2022. This increase is further supported by the observation that the median and mean values rose slightly over this period.

Table 12. Comparison of number of extensions in Total for 2020-2022

Indicator	ANOVA test								
	Moment	N	Min	Max	M	Me	SD	F	p
Number of extensions	2020	47	0,00	34,00	10,09	9,00	7,40	2,300	0,046*
	2021	47	0,00	34,00	9,79	9,00	7,36	1,991	0,081
	2022	47	0,00	31,00	8,98	8,00	7,35	2,874	0,016*

Source: Own elaboration in SPSS, based on the examined financial statements.

The ANOVA test indicates statistically significant differences in the number of extensions for the years 2020 and 2022, as evidenced by p-values of 0.046 and 0.016, respectively. Both years showed significant variability in this metric, suggesting changes in operational processes or data handling strategies. However, the year 2021 did not demonstrate statistically significant differences (p-value of 0.081), suggesting more stability or fewer changes in that year compared to the others. Given the ANOVA results, a detailed pairwise comparison using the Student's t-test would be valuable between the years that showed significant differences. Specifically, comparing 2020 and 2022 would be pertinent. These years not only demonstrated significant changes individually but also show a clear trend in the reduction of the mean number of

extensions from 10.09 in 2020 to 8.98 in 2022. Conducting a Student's t-test between these years should provide insights into the nature and significance of the reduction observed.

Table 13. Comparison of number of extensions in Total for 2020 and 2022

Indicator	Moment	N	Min	Max	M	Me	SD
Number of extensions	2020	47	0,00	34,00	10,09	9,00	7,40
	2022	47	0,00	31,00	8,98	8,00	7,35
Student's t-test for dependent groups: t=2,030, p<0,001* Increase:14, No change:10, Decrease:23							

Source: Own elaboration in SPSS, based on the examined financial statements.

The paired Student's t-test confirms a significant decrease in the number of extensions from 2020 to 2022, as evidenced by a t-value of 2.030 and a highly significant p-value of less than 0.001. This suggests that the changes observed between these two years are not due to random variation but reflect a true decline in the number of extensions during this period.

Table 14. Comparison of number of substantive errors in Total for 2020-2022

Indicator	Moment	N	Min	Max	M	Me	SD	Avgr
Number of substantive errors	2020	47	0,00	21,00	7,26	6,00	5,19	2,65
	2021	47	0,00	16,00	5,64	5,00	4,52	1,96
	2022	47	0,00	16,00	4,17	3,00	3,89	1,39
Friedman's test: $\chi 2$=52,134, p<0,001*								

Source: Own elaboration in SPSS, based on the examined financial statements.

The Friedman's test indicates a statistically significant difference in the number of substantive errors across the three evaluated years. The decreasing trend in the mean values and the average ranks (from 2.65 in 2020 to 1.39 in 2022) suggests a consistent improvement in reducing errors over time. The reduction in both the mean and the maximum values from 2020 through 2022 supports the notion of enhanced data management practices or improvements in operational accuracy. Given the Friedman's test results, particular attention will be directed towards the years 2021 and 2022. This decision is based on the observation that while there was an improvement from 2020 to 2021, as evidenced by the decrease in average ranks, the most substantial reduction occurs between 2021 and 2022, suggesting further enhancements or successful implementations of error-reduction strategies during this period. To further investigate these improvements, a Wilcoxon signed-rank test will be conducted for these two years.

Table 15. Comparison of number of substantive errors in Total for 2021 and 2022

Indicator	Moment	N	Min	Max	M	Me	SD	Avgr
Number of substantive errors	2021	47	0,00	16,00	5,64	5,00	4,52	1,96
	2022	47	0,00	16,00	4,17	3,00	3,89	1,39
Wilcoxon signed-rank test: Z=-3,795, p<0,001* Increase:2, No change:22, Decrease:23								

Source: Own elaboration in SPSS, based on the examined financial statements.

The Z-value of -3.795 with a p-value of less than 0.001 indicates a statistically significant reduction in the number of substantive errors from 2021 to 2022. The negative Z-value suggests that the median of the differences between the paired years is less than zero, confirming that the number of errors in 2022 was consistently lower than in 2021 across the sample.

V. Discussion

In general, results from this study confirm that the accuracy of creating and anchoring extensions improves over time. This is consisted with research conducted by Debreceny et al. (2011) and Du et al. (2013). However, specific to this research is a detailed verification of the methods of anchoring extensions and their correctness, which has not been conducted in other mentioned studies. It was found less errors that involved unauthorized extension (about 30% to 40% according to Debreceny et al., 2011). The possible source of such a significant difference in results may be the mandatory audit of XBRL reports in the EU, which is not present in the US.

In the following years, the examined companies reduced the number of substantive errors of all types. In case of too wide anchoring, firms e.g.:

- indicated the long-term and short-term periods regarding items in the statement of financial position such as loans, bonds issued, prepaid expenses and unearned revenue,
- anchored extensions in the statement of financial position to items having the closest (or at least closer) wider accounting meaning (e.g. to tangible fixed assets, instead of assets or fixed assets),
- anchored extensions in the statement of cash flows to items having closer wider accounting meaning, instead of using concepts that are rather general in meaning and often are subtotal concepts, for example adjustments to reconcile profit (loss) in operating activity.

In case of an unauthorized extension the examined companies started to use appropriate tags that exist in the core taxonomy, e.g. intangible assets and goodwill, revenue and operating

income, interests in financing activities, lease liability, net loss attributable to owners of parent, net loss attributable to non-controlling interest, comprehensive income attributable to owners of parent, comprehensive income attributable to non-controlling interest.

The errors in the statement of cash flows were often caused by the lack of core tags, which resulted in low information value of investing and financing activities, or resulted from the flat taxonomy structure of this financial statement.

It was found that there were significantly fewer errors in the statement of profit or loss and other comprehensive income and in the statement of changes in equity. The possible reason of this fact is the widespread use of a standard template for these financial statements, such as a statement of profit or loss by function, with relatively few unusual items.

Observed detailed changes in the XBRL extensions of Polish companies in the reports for the years 2020-2022 were confirmed by statistical analysis. The increase in the number of tags from 2020 to 2022 was not statistically significant and is more likely attributable to random factors rather than a systematic upward trend. In contrast, extensions exhibit significant differences in their numbers and a clear trend in their reduction according to statistical tests, suggesting changes in financial reporting processes compliant with the XBRL standard.

The statistically significant difference in the number of substantive errors across the three evaluated years implies a consistent improvement in error reduction over time. The significant decrease in errors in the 2022 reports may be associated with the introduction of the obligation to tag notes to financial statements. This new reporting requirement likely prompted companies to re-evaluate the accuracy of tagging in primary financial statements and to improve existing errors. This interpretation aligns with the changes observed between 2020 and 2022, which are not due to random variation but reflect a genuine decline in the number of extensions during this period, potentially indicating the occurrence of an organizational learning effect. Such change was not as noticeable in the 2021 reports, where companies mostly replicated extensions created in the previous year.

VI. Conclusion

According to Troshani and Rowbottom (2021), digital corporate reporting describes the process by which paper-based corporate reports are converted and represented in a machine-readable digital format. XBRL is the exact technology that enables software to ‘read’ and ‘understand’ of what is being reported. Errors made in tagging reduce ESMA’s ability to achieve its goal of harmonised and consistent approach for the preparation of annual financial reports in the format

specified in the RTS on ESEF. This is particularly important in relation to the issue of extended tags. The use of individual or poorly structured standard extensions could seriously diminish the expected benefits of a move to XBRL reporting (CFA, 2009), especially the potential for automated analysis of financial data. It is worth to underline that regulators responsible for delivering taxonomies examine tagged financial statements, especially extensions created by issuers. This aims to consistently develop their taxonomies, enhancing transparency and comparability of financial statements, thereby improving the quality of reporting information.

This study examined the scope of extensions created by Polish entities in their primary financial statements for the three evaluated years and verified the correctness of these extensions in relation to the tagging requirements contained in the ESEF regulations. Both the overall statistical analysis and the detailed verification of extension accuracy in the examined sample confirmed a consistent improvement in reducing errors over time. The study concentrated on primary financial statements. However, XBRL reporting in the EU is still in its early stages of development. One source of improving the efficiency and transparency of financial reporting is XBRL implications the results of our study.

Results of this study provide evidence about use of extensions in accordance with ESEF requirements, with particular emphasis on types and frequency of existing errors occurring. But several factors limit the conclusions drawn from our research. The sample size is quite limited and does not include this part of companies whose consolidated financial statements for 2020 are not available in the filings.xbrl.org database. As a result, the study covers only 42% of Polish companies that prepared reports in the ESEF format for the years 2020 - 2022. Moreover, only reports from one EU country were examined. For this reason, similar studies should therefore be conducted on a larger number of companies from different EU countries.

More detailed studies on the specific conditions under which mapping errors occur and how they are corrected certainly warrant future research. In particular, this concerns examining the impact of annual taxonomy changes and amendments, as well as the education of accounting teams and the occurrence of the learning effect. A particular issue requiring further in-depth research is the impact of mandatory verification of XBRL tags by statutory auditors. The next interesting research direction is the impact of the cooperation with other participants of the XBRL reporting process, e.g. external advisors and software providers. Another issue for further research is the occurrence of relationships between the location of the XBRL reporting preparation process (whether it is within the company or outsourced). It appears that all the mentioned aspects can significantly influence both the number and the accuracy of extensions

created by issuers in their XBRL financial reports and consequently affect the information asymmetry.

VII. References

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