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The UK-China economic and political cooperation: The Brexit implications

Luiza Kostecka-Tomaszewska, Monika Krukowska

ABSTRACT

Objective: The research aimed to examine the strength and nature of the UK's relations with China under new circumstances caused by Brexit. Specifically, this article attempts to answer what was the impact of Brexit on economic and political relations between the UK and its significant economic partner, China. In pursuance of the goal, the authors discuss the economic and political implications of a new status quo in bilateral cooperation in the field of trade and investment and the political aspects of Brexit for both partners.

Research Design & Methods: We explored the UK-China relationship in the context of Brexit implications using a literature analysis and examined the strength and nature of economic relations between countries mentioned above using the trade orientation and intensity indicators.

Findings: Brexit created a new landscape for bilateral cooperation between the UK and its partners worldwide. The long-term consequences of Brexit will continue to unfold in years to come, but we may already recognize some early trends in bilateral relations. The analysis of the UK's trade orientation based on the historical data for the period 2013-2022 revealed the decreasing significance of Germany and the increasing position of China and the United States as the UK's trading partners. Moreover, the analysis of trade intensity revealed the lowest trade intensity between the UK and China post-2012 compared with Germany and the US. Nevertheless, the values of the trade intensity index with China indicate that there is still potential to increase exports to China.

Implications & Recommendations: The proposed set of indicators can serve to question the major tendencies of bilateral trade. Together, the indicators portray a comprehensive picture of interdependence and the strength of existing connections between two countries and help examine whether cooperation is strengthening or weakening. The orientation index identifies the strength and importance of the relationship with the trading partner relative to other trade relations' significance and monitors the progress of the cooperation, while the trade intensity index can be used to determine whether the value of trade between two countries is greater or smaller than expected based on their importance in world trade. The analysis results will allow scholars to determine possible actions that should be undertaken by the UK and – possibly – the EU to develop trade and investment cooperation with China in a more balanced way.

Contribution & Value Added: The article extends the knowledge of Brexit's economic and political implications for UK-China bilateral cooperation. Furthermore, the article presents a comprehensive analysis and evaluation of the current UK-China relations in the context of Brexit. We examined economic relations between the countries mentioned by means of trade orientation and intensity indicators.

Article type: research article

Keywords: Brexit; UK-China relations; trade; trade orientation indicator; trade intensity indicator

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INTRODUCTION

The United Kingdom (UK) withdrew from the European Union (EU) on 31 January 2020. Significant challenges to the existing relationships of the UK with its economic partners worldwide emerged not only during the process of leaving the community itself but also in the following years. The new reality

requires legal agreements that provide the basis for future satisfactory bilateral cooperation. The disengagement from the EU is a complex process that has already changed the trade and investment patterns in Europe and may have many implications for the global economy, including the trade diversion effect and reshaping of global value chains. The miscellaneous consequences of the process need evaluation and discussion, even though the time span is short.

The article aims to examine the strength and nature of the UK's relations with China, one of the UK's most significant economic partners, under new circumstances created by Brexit. We compared China with Germany and the US, the remaining British top economic partners, to provide the context to distinctive bilateral relations with China. Vice versa, the UK, Germany, and the US are China's top economic partners.

Specifically, this article attempts to answer two research questions:

RQ1: What are the short-term implications of Brexit on economic cooperation between the UK and China?

RQ2: Has Brexit worsened UK-China political relationship?

In pursuance of the goal, we will discuss the institutional and economic implications of a new status quo in bilateral cooperation in the field of trade and investment and the political aspects of Brexit for both partners. Despite a short time span and unexpected phenomena such as the Covid-19 pandemic and war in Ukraine, the first shifts in trade patterns should be visible, thus allowing early recognition and enriching the scope of the analysis. The article is divided into three parts. The first section discusses Brexit in the context of international relations. The second section presents the indicators used to examine the strength and nature of trade relations between the UK and its major economic partners. The final section explores the UK's political and economic relations with China under the new circumstances caused by Brexit.

LITERATURE REVIEW

Brexit Through the Lens of International Relations

As a relatively new phenomenon, Brexit needs intense research. Until 2016, studies concentrated on theories of integration, leaving the possibility of withdrawal from the EU unchecked. Moreover, until scholars have not researched the mechanisms that had to be adopted to manage a new reality after the British voted to leave. Thus, academic literature on Brexit is growing fast.

There are different reasons for Brexit. Back in 1956, Myrdal saw the process of disintegration as a result of economic hardships. Colantone and Stanig (2018) backed his arguments and noticed the support for Brexit in the British regions suffering from the globalization process. Interestingly, the authors blame China for the hardships of the British economy. Other authors stress the role of cultural resentment and identity (Norris & Inglehart, 2019).

There are few studies about the economics of disengaging from different communities. According to Rosamond (2016), Brexit can be regarded as an open-ended process and a definable outcome. Head *et al.* (2010) conducted an in-depth analysis of the effects of independence on post-colonial trade. Djankov and Freund (2002) and Mazhikeyev and Edwards (2021) undertook the issue of cooperation between post-Soviet countries after the collapse of the Soviet Union. Meanwhile, Brexit is an example of partial disintegration that has not been studied before.

Many studies explore the following subjects: the costs and benefits of Brexit (Dhingra *et al.*, 2017), the changes in value chains (Vandenbussche *et al.,* 2017), foreign direct investment (FDI) flows (McGrattan & Waddle, 2019) or the general consequences to the British economy (Plakandaras *et al.*, 2017; Begg, 2017; Graziano *et al.*, 2018). Hallet (2019) argues that Brexit will entail high economic costs and economic performance losses from trade and investment reductions. Gao *et al.* (2022) confirmed it by finding that political events have essential effects on mutual fund reallocation as asset management practices appear to have changed since the Brexit referendum. One of the most important consequences of Brexit is uncertainty shared by all partners involved in trade and investment. Osnago *et al.* (2015) found that uncertainty about future trade policy has an average effect on trade compared to tariffs of up to 8.7%. To reduce policy uncertainty, new trade agreements need to be

signed (Limão & Maggi, 2015), and the negative impact of Brexit should be compensated by free trade agreements (Jackson & Shepotylo, 2018). According to Freund and McLaren (1999), trade flows change in anticipation of preferential trade agreements (PTAs). Baier and Bergstrand (2009) proved that the effects of PTAs are usually more intense than presumed.

While the consequences of Brexit remain unknown, theoretical approaches emphasise different factors. Neoclassical realism appreciates the role of decision-makers and the material capabilities or military power the UK has at its disposal. Thus, according to Oliver (2017), the most important challenge of Brexit might be asymmetry in economic relations with the EU which may be mitigated by a new quality of cooperation with other partners. Much will depend on the British reconstruction of the UK's international image and role in the global system, as well as on ideas and perceptions of leading politicians engaged in the process.

The UK-China cooperation appears as an example of a realistic approach in international relations theory where countries cooperate due to rationality, despite asymmetric gains (Mearsheimer, 1990). A separate issue is a possible EU disintegration process that Brexit might unleash (Jones, 2018).

RESEARCH METHODOLOGY

The research methodologies applied to explore the UK-China economic and political relations in the context of Brexit implications vary. The political aspects of bilateral relations are based on content analysis, whereas the strength and nature of economic cooperation between the countries were examined using the trade orientation and intensity indicators. The data used was retracted from International Trade Centre Database (ITC) and HM Department for International Trade Database.

We may examine the short-term economic consequences of Brexit through the lens of the UK's economic connections with its main partners. Moreover, we can measure the trade orientation and the intensity of cooperation between two countries by the level of cross-border flows of goods and services (trade) as well as capital (FDI and other types of financial assets) between these partners compared to their bilateral or multilateral economic relations with the rest of the world. There is extensive scientific literature on the measurement and analysis of bilateral economic relations, especially trade relations. We may identify several basic approaches to studying the strength and nature of bilateral trade relations, including the gravity model of bilateral trade (Tinbergen, 1962), indicators of trade intensity (Kojima, 1964; Srivastava & Green, 1986), and geoeconomic vulnerability indicators (Kostecka-Tomaszewska & Krukowska, 2020).

The overall picture of the scope and nature of international bilateral relations ties between economic partners can be characterised by indicators presented below. The proposed indicators provide a proper set that can be used to investigate the economic linkages between countries from the angle of trade orientation and intensity of bilateral cooperation. As trade is one of the main dimensions of economic interactions between countries, consequently, we will use this variable to analyse the strength of bilateral relations and the degree of interdependence between the UK and its significant economic partners, *i.e.* Germany, the US, and China.

We employed the indicators presented below to analyse the trade relations that the UK has with China and compare them to the ones it has with Germany and the US. We conducted the analysis over the 2013-2022 period based on data from the International Trade Centre (ITC). The indicators allow for exploring the performance of the UK's exports and imports in various dimensions, providing a comprehensive picture of the strength and nature of the UK's bilateral relationships with its selected partners.

Furthermore, applying trade integration and intensity indicators can be helpful to quest the major tendencies of bilateral trade. Together, the indicators portray a comprehensive picture of interdependence and the strength of existing connections between two countries and help examine whether cooperation is strengthening or weakening. We may use the orientation index (2) to identify the strength and importance of the relationship with the trading partner relative to other trade relations' significance and monitors the progress of the cooperation and the trade intensity index (3) by Srivastava and Green (1986) – to determine whether the value of trade between two countries is greater or smaller than expected based on their importance in world trade.

$$\text{Trade share}_{ij} = \frac{\text{Export}_{ij} + \text{Import}_{ji}}{\text{Export}_{iw} + \text{Import}_{wi}} \quad (1)$$

$$\text{Trade orientation index}_{ij} = \frac{\text{Export}_{ij} + \text{Import}_{ji}}{\text{Export}_{iw} + \text{Import}_{wi}} \div \frac{\text{Export}_{iw} + \text{Import}_{wi}}{\text{Export}_{ww} + \text{Import}_{ww}} \quad (2)$$

$$\text{Export orientation index}_{ij} = \frac{\text{Export}_{ij}}{\text{Export}_{iw}} \div \frac{\text{Export}_{iw}}{\text{Export}_{ww}} \quad (2.1)$$

$$\text{Import orientation index}_{ij} = \frac{\text{Import}_{ji}}{\text{Import}_{wi}} \div \frac{\text{Import}_{wi}}{\text{Import}_{ww}} \quad (2.2)$$

$$\text{Trade intensity index}_{ij} = \frac{\text{Export}_{ij}}{(E)\text{Export}_{ij}} \quad (3)$$

$$(E)\text{Export}_{ij} = \frac{\text{Export}_{iw}}{\text{Export}_{ww}} \times \frac{\text{Import}_{wj}}{\text{Import}_{ww}} \times \text{Export}_{ww} \quad (3.1)$$

In which:

Export_{ij} - exports from country i to country j;
$(E)\text{Export}_{ij}$ - expected exports from country i to country j;
Export_{iw} - exports from country i to all destinations;
Export_{jw} - exports from country j to all destinations;
Export_{ww} - total world exports from all countries;
Import_{ji} - imports from country j by country i;
Import_{ij} - imports from country i by country j;
Import_{wi} - imports from all origins by country i;
Import_{wj} - imports from all origins by country j;
Import_{ww} - total world imports from all countries.

The trade orientation index is the ratio of two trade shares. The numerator is the share of bilateral trade with a partner j in the whole trade of the country under study i. The denominator is the share of the country i in total world trade. We may also calculate the trade orientation index using export or import shares instead of trade shares. This index allows us to measure the relative trade intensity between trading partners compared to trading with others. An index value greater than 1 indicates that a given country i is more focused on cooperation with partner j than with the rest of the world.

In turn, the trade intensity index is calculated as the ratio of the actual volume of trade between two countries i and j to the expected value of trade between these partners, in which the expected intensity of bilateral trade cooperation is defined by the importance of these economies as importer and exporter in the world trade. The trade intensity index higher than 1 indicates that the trade relationship between partners is stronger than expected, given both countries' shares in world trade. If the value is below 1, it implies that the relationship is weaker than expected (Srivastava & Green, 1986, p. 626).

RESULTS AND DISCUSSION

The Institutional Framework of UK-China Relations After Brexit

All partners of the United Kingdom accepted its decision to leave the European Union with bewilderment and anxiety. The most concerned partner was China as it had invested much in a privileged relationship, extensive trade, and investment in the UK, and the countries shared many years of fruitful cooperation. Only a few years before Brexit did the British government announce the golden era in Sino-British relations and wanted the UK to be 'China's best partner in the West' (BBC News, 2015; HM Government, 2017). The UK used to be a stepping stone into the EU market with a secure investment environment where Chinese companies could establish and strengthen their brand on the way to the continent. Many Chinese companies decided to establish their European headquarters in London, *i.e.*

Huawei. The plans for cooperation were huge: the construction of a GBP 24 billion Hinkley (Somerset) nuclear power station and other nuclear plants at Sizewell (Suffolk) and Bradwell (Essex), a GBP 42.9 billion high-speed rail network linking London and Birmingham, or the plans to make London the leading Western renminbi hub (Carrington, 2015; Topham, 2015; HM Treasury, 2016). The UK was not only a gateway to the bloc but also a means of projecting economic and political power, influence, and technology (Leavenworth, 2016; Phillips, 2016). Despite the traditional diplomatic restraint, when visiting the UK in October 2015, Chinese President Xi Jinping supposedly expressed China's support for the British stay in the European Union (Brown, 2016). With such a solid long-term commitment, China must have been appalled by the British voters' decision.

At the same time, the UK cannot ignore China's significant market potential that can stimulate its economic growth. Therefore, the UK has been courting China hoping for investment within the last decade: its prime ministers (David Cameron, Theresa May, Boris Johnson) abandoned their dangerous human rights rhetoric for a lenient win-win approach. Within the EU, the UK had been the strongest supporter of granting China market-economy status, pushed for EU-China FTA negotiations, and has blocked higher EU tariffs on Chinese steel (Kuo, 2018; Cameron Irritates Brussels by Pushing EU-China Trade Deal, 2013; Mason, 2016). As a significant European economic power, the UK was the first prominent G7 member and a leader of European countries that joined the China-led Asian Infrastructure Investment Bank (AIIB) as a founding member in 2015.

As a member of the European Union, the UK benefited from the grouping's acquis which provided the basis for bilateral cooperation between the EU's members and third countries, including China. Therefore, disentangling the UK from the EU requires setting new regulations for cooperation between partners under new circumstances created by Brexit. Since Brexit, economic cooperation between the UK and China has been regulated by a bilateral investment treaty (BIT) signed in 1986 when trade and investment were significantly smaller. As trade and investment relationships between the UK and China have become closer, trade and market access gains now depend on their reciprocal openness and coordination of bilateral policies. Therefore, the agreement signed nearly four decades ago is highly outdated. The relationship requires new regulations on such issues as intellectual property protection, market access, and tariffs, to mention a few. To meet the current challenges, the UK needs to create a new legal framework for cooperation with China, including signing trade and investment agreements to regulate the post-Brexit reality.

Partners need a free trade agreement (FTA) and a new comprehensive agreement covering trade in goods and services, financial flows, and new fields such as sustainable development. New rules should make regulations more transparent and determine such issues as freedom of capital flow and transfer of funds, investors' protection (*i.e.* prohibition of discriminatory measures, protection against expropriation), reciprocal treatment (*i.e.* most-favoured-nation treatment), *etc*. According to Hoekman (1999), deep FTAs are the standard that countries aiming to strengthen economic cooperation should adopt.

The need is even more pressing as the EU signed a new investment agreement in December 2020, opening the Chinese market to services. According to Miller from the British Chamber of Commerce in China (Miller, 2021), the UK needs to work out its trade and investment deals with China that will reduce both tariff and non-tariff barriers to British exporters and investors and can be better targeted at the UK's strong services sector which has long been underrepresented in China. Other issues that need further regulation are enhanced market access for UK goods and services, free-trade agreement, fair competition with Chinese SOEs, IP protection, and mutual recognition of qualifications.

Therefore in 2021, prime minister Boris Johnson declared he was 'fervently Sinophile' and intended to improve bilateral relations despite all the contentious issues. As a result, both countries agreed to resume cooperation: the 11th China-UK Economic and Financial Dialogue (Wang, 2021) and trade talks with Beijing via the Joint Economic and Trade Commission (Courea, 2022b) happened in 2022. Furthermore, in 2022 the UK government allowed the sale of the UK's most significant semiconductor plant in Wales to Nexperia, a Dutch subsidiary of the Chinese technology company Wingtech (Courea, 2022a).

The Reality of Post-Brexit Economic and Political Relations Between the UK and China

Brexit created a new background for bilateral cooperation between the UK and its partners from all over the world. The British decision to leave the EU also changed complex relations with China, though not as much as presumed. China's bilateral trade and investment inflow remains stable and the pre-Brexit scenario of becoming over-reliant on China has not fulfilled. Nevertheless, within the last years, bilateral political relations started to deteriorate. Together with the Covid-19 pandemic and the war in Ukraine, Brexit ousted the UK from the leading position among China's European partners due to China's unclear stance on the conflict in Europe and the global suspicion over its role in the pandemic outburst. Mistrust between partners was even strengthened by China being a single country with trade benefits due to extended lockdowns in Europe and China's initial handling of the pandemic, thus enabling it to strengthen its global trade position.

As a result, the UK hardened its strategy towards China, trying to advance British interests. In its policy document issued in March 2021, entitled *Global Britain in a Competitive Age: The Integrated Review of Security, Defence, Development and Foreign Policy*, the Cabinet characterized China as the UK's 'biggest state-based threat to economic security' (HM Government, 2021). Following the decision of the National Cyber Security Centre (NCSC) to consider Huawei a high-risk vendor, the British government excluded the company from its 5G network construction over unclear security practices and links to the Chinese government (Kleinmam, 2021; NCSC, 2020). In the same year, political tensions rose when the UK decided to provide special visas for Hong Kongers with British Nationals (Overseas) status and their family members in response to a new national security law for Hong Kong. According to the British government, the law violated agreements between the UK and China during the Hong Kong handover in 1997 (Kirk-Wade & Gower, 2022, p. 3). As a result, the authorities suspended the dialogue in bilateral economic forums. Moreover, in the following years, authorities blocked some attempted sales to Chinese companies (*i.e.* Perpetuus, a specialized graphene manufacturer) and some companies confronted resistance to continued partnership (*i.e.* CGN building a nuclear power plant in Suffolk). Furthermore, as part of a government strategy, the UK continues to reduce reliance on China for rare earth minerals (*i.e.* lithium) (Courea, 2022b).

Furthermore, the geopolitical environment around China changed because of the traditional alliances of the Western powers. In 2021, the UK signed up for the trilateral security pact with Australia and the US (AUKUS). In February 2022, the UK joined the US in a diplomatic boycott of Beijing's 2022 Winter Olympic Games. China has to compete with the aligned Western economies, committed to free trade rules and anti-dumping measures. The traditional British support for the US was extended to its tensions with China over trade, support for North Korea, or navigation freedom in the South China Sea. The rising assertiveness of China under Xi Jinping, with its 'wolf-warrior diplomacy,' disinformation campaigns, and open hostility towards the US and Australia, has revealed a new quality in bilateral relations. In the UK, the feeling of uncertainty increased with the Russian aggression against Ukraine in February 2022, met with the Chinese tactical restraint (Martina, 2022). The new UK's position on China concentrates on two aspects: engagement where necessary while remaining realistic about China's authoritarianism. Owing to such a pragmatic stance, the British diplomats have recently managed to improve the chances of UK companies bidding for contracts from state-owned enterprises and secured GBP6 million worth of licences to launch fund management in China, while openly expressing national security concerns (HM Government, 2023).

Hence, as China is driven by its strategic interests, in 2022, bilateral trade and investment remained high. China continues as one of the UK's most important economic partners. In 2022, it was the fourth-largest trading partner accounting for 6.5% of total UK trade (HM Department for International Trade, 2023). The mainstays of UK goods exports to China include cars, crude oil, medicinal and pharmaceutical products, and non-ferrous metals, and imports from China consist of telecoms and sound equipment, office machinery, clothing, and metal manufacturers. Since 2019, China has risen in trade in goods above France and the Netherlands, and in services, exports to China grew by almost 250% between 2010 and 2019 (Patel & Xu, 2021). The largest share in services is travel and 'other business

services' (*i.e.* accounting, legal, advisory, *etc*.), which account for over half of the UK's services exports to China (2022). Other significant categories include intellectual property, financial, and transportation services (HM Department for International Trade, 2023). The growth was caused by an increased market opening in many sectors due to the post-pandemic re-opening.

Chinese FDI flows to the UK remain stable though there is visible competition with other European partners, notably Germany, attracting Chinese companies with its advanced robotics companies. The UK hosted more investment than other EU members in 2016-2018, despite the depreciating pound sterling (Percy, 2019). The most significant deals included the Chinese takeover of a warehouse company Logicor (USD 14.4 bn), telecoms Global Switch (USD 7.6 bn), HSBC (USD 12.7 bn), and Barclays (USD3 bn). At the same time, China has been attracting investment from the UK by opening the services sector. In 2021, China was the top priority investment destination for 39% of British companies and the second or third priority for another 18% (BCCC, 2022a).

According to the British Chamber of Commerce in Beijing, British investors face disadvantages, particularly concerning market access barriers. In the technology or food and beverage industry (BCCC, 2021), the disadvantages include delays in receiving licenses, problems with accessing or moving company finances, and Chinese cyber and IT restrictions. Furthermore, due to strict cyber security regulations in China, British businesses fear their local operations will be separated from their global networks (Yang & Mitchell, 2020). Other challenges include state-sponsored competition (*i.e.* subsidies), employment of foreign staff, enforcement of laws and regulations (BCCC, 2023, 2022b, 2020), and fear of being blacklisted under China's corporate social credit scheme in the case of cooperation with a penalised company (Yang & Mitchell, 2020). A rather pessimistic outlook of British businesses results from the growing geopolitical tensions and a slowing global economy (BCCC, 2023).

Trade Orientation and Intensity of Trade Cooperation Between the UK and its Main Trade Partners

An analysis of the trends in the UK's trade with its main trading partners depicts the diverse nature of the country's trade relationships with China, Germany, and the US (Figure 1). Until 2021, trade relations with the US remained relatively stable and roughly balanced, mainly with the UK surplus. In 2022, there was a significant increase of USD 38 billion (65%) in imports from the US. Due to this, the UK recorded a deficit of USD 34 billion. Regarding trade connections with Germany, imports and exports have been slowly declining. In contrast, imports from China have been gradually increasing over the past few years, generating a significant trade surplus in China's favour. As a result, China has become a leading supplier of goods to the UK market. At the same time, British exports to China display an upward trend with some fluctuations.

Until 2020, the UK's bilateral trade relationships with major partners were stable with no significant fluctuations. The most considerable observed change concerns imports from the US and China in 2021-2022 (Figure 1). However, determining whether the current situation is a result of post-Brexit adjustments or the Covid-19 pandemic is challenging as both phenomena have simultaneous consequences. However, undoubtedly, the increased UK demand for medical products, such as masks, ventilators, pharmaceuticals, and electronics, has shown a dangerous dependence on Chinese supplies. Over the past year (2022), the UK's total trade with China has reached almost USD 140 billion (ITC, 2023).

Geographic trading patterns and interdependence between countries are linked to the volume of bilateral transactions. The relative importance of bilateral relations with country j for country i is measured by the trade share (1), which is calculated as the ratio of total trade between countries i and j and the total trade of country i with all the partners. In addition to the general indicator of trade share based on total trade turnover, exports and imports can be separately taken into account. The trading relationship between two countries can be characterised by the following shares: $Export_{ij}/Export_{iw}$, $Export_{ji}/Export_{jw}$, $Import_{ji}/Import_{wi}$, and $Import_{ij}/Import_{wj}$, which help assess the mutual importance of partners in bilateral trade cooperation. The values of these indicators prove that Germany, the USA, and China have been important trading partners of the UK in recent years. However, this is a one-sided dependency, as the UK does not play such a significant role in the foreign trade of its partners (Table 1).

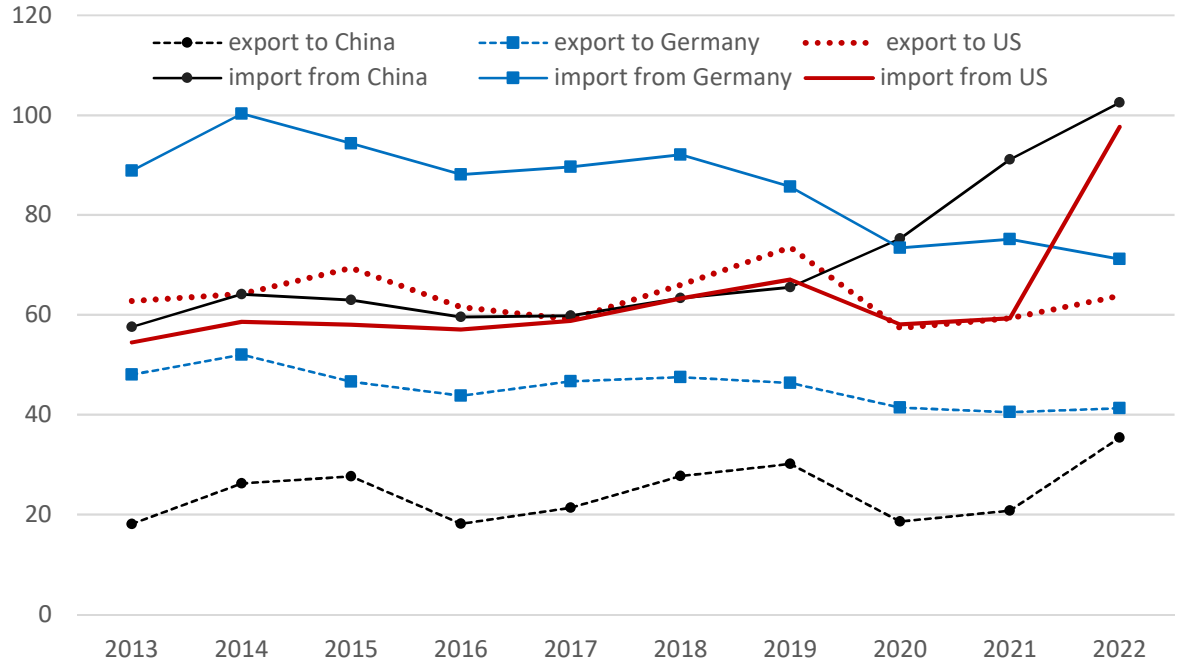

Figure 1. Trends in the UK's trade with China, Germany, and the US (billion USD)
Source: own elaboration based on International Trade Centre Database; ITC, 2023.

Table 1. Shares in mutual foreign trade between the UK and its partners: China, the USA, and Germany (%)

Trade relation	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
China in UK's export	3.3	5.1	5.9	4.4	4.8	5.6	6.4	4.6	4.4	6.7
US in UK's export	11.5	12.6	14.9	15.0	13.4	13.4	15.7	14.3	12.7	12.0
Germany in UK's export	8.8	10.2	10.0	10.6	10.6	9.7	9.9	10.3	8.6	7.8
UK in China's export	2.3	2.4	2.6	2.7	2.5	2.3	2.5	2.8	2.6	2.3
UK in Germany's export	6.5	7.0	7.4	7.1	6.6	6.2	6.0	5.6	4.7	4.7
UK in US's export	3.0	3.3	3.7	3.8	3.6	4.0	4.2	4.1	3.5	3.7
China in UK's import	8.8	9.2	10.0	9.4	9.3	9.4	9.5	11.9	13.1	12.6
US in UK's import	8.3	8.4	9.2	9.0	9.2	9.4	9.7	9.2	8.5	12.0
Germany in UK's import	13.5	14.4	15.0	13.8	14.0	13.7	12.4	11.6	10.8	8.7
UK in China's import	1.0	1.2	1.1	1.2	1.2	1.1	1.2	1.0	1.0	0.8
UK in Germany's import	4.4	4.2	4.0	3.7	3.5	3.4	3.4	3.4	2.7	2.5
UK in US's import	2.3	2.3	2.6	2.5	2.3	2.4	2.5	2.1	2.0	1.9

Source: own elaboration based on International Trade Centre Database; ITC, 2023.

In turn, the trade orientation and intensity indices measure the relative trade intensity between trading partners compared to other countries. If indexes are greater than 1, it means that the country is more focused on trading with its given partner than with the rest of the world and the relationship is stronger than expected. Figure 2 shows the orientation and trade intensity indices calculated from the UK's perspective. Based on historical data from 2013 to 2022, an analysis of the UK's trade orientation indicated a decline in the importance of Germany as a trading partner and an increase in the significance of China and the USA after 2018. Throughout the study period, all trade orientation indicators with analysed trading partners exceeded the value of 1. The US had the highest indicator level of 4.32 in 2022. Moreover, the analysis of trade intensity revealed the lowest trade intensity between the UK and China after 2013 compared with Germany and the USA. The values of the trade intensity index with China are constantly changing, lying between 0.30-0.60. This indicates that there is still potential to increase exports to China. In turn, the trade flows of the UK with Germany are decreasing with the trade intensity indicator greater than 1 for the whole period. The trade intensity remained high in 2013-2022 but the indicator's value has a decreasing tendency. In the case of the US, the indicator's value fluctuates around 1. This may indicate

that countries have come close to the limits of further intensification of mutual trade and the possibilities of continued trade expansion have run out due to the well-established trade relations.

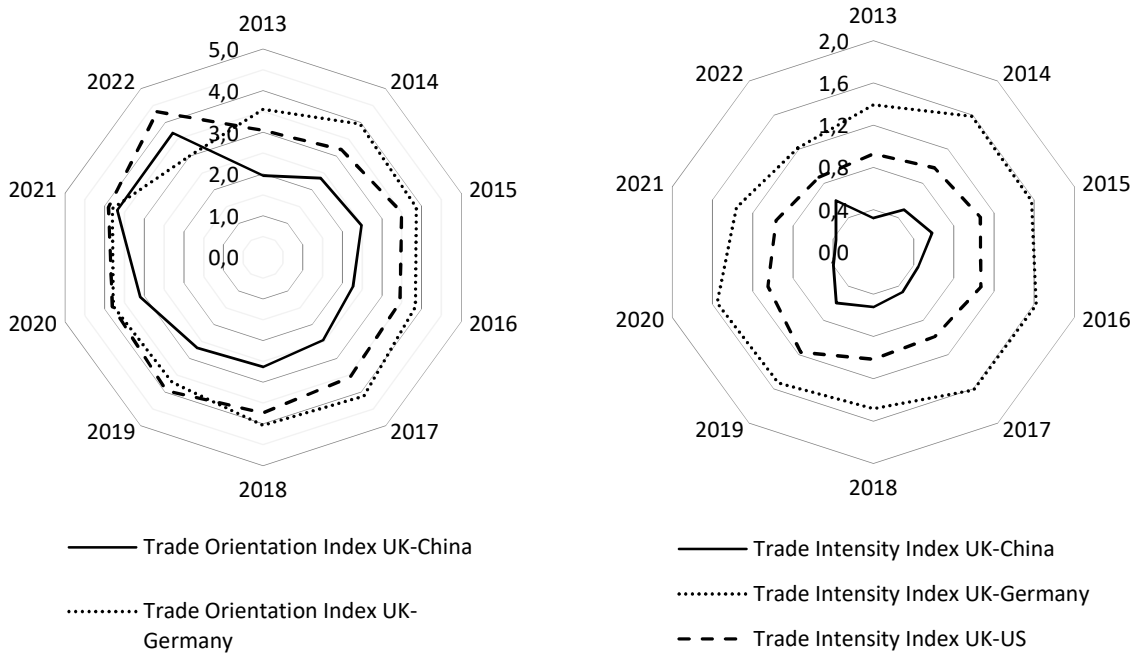

Figure 2. Trade orientation and intensity indicators between the UK and its partners: China, the USA, and Germany, 2013-2022

Source: own elaboration based on International Trade Centre Database (ITC, 2023).

CONCLUSIONS

The early analysis of the Brexit implications on bilateral UK-China relations proves that they are various yet undetermined. Since 2016, China has been reconsidering the UK as a desirable investment location, given it lost its most crucial appeal as a gateway to the EU and as an ally, through which China has successfully pursued its 'divide and rule' tactics on EU partners. Thus, Brexit lowered the rank of the UK among China's economic and political partners. With the constant risk of the Scottish and Northern Irish secession and the continuous competition with Germany as a technological hub, the UK's position has become even worse. Nevertheless, the UK remains China's important trade and investment partner, though it lost much of its ability to influence China when acting alone without the EU's support. On the other hand, the UK is not particularly dependent on China as well.

Initially, it was estimated that the long-term consequences of Brexit will include a loss of 4% in economic output. The Covid-19 pandemic even aggravated the economic slowdown. Therefore, strengthening bilateral trade and investment with China should be a necessary instrument to support the post-Covid recovery. The future shape of the relationship between the UK and China will largely depend on a new agreement that will provide the basis for bilateral cooperation between partners. The UK is pragmatic about its partnership with China. It wants to keep all the possibilities open in a balanced dialogue, where it can have practical economic cooperation with no human rights concerns engaged. Notably, the past linkages between the UK and EU member states – such as infrastructure, production and consumption chains, and business networks – still exist and limit the reorientation of trade and investment flows.

Currently, the UK has to face the challenges caused by the consequences of Brexit and the Covid-19 pandemic. It is too early to assess whether the trends in bilateral relations result from post-Brexit adjustments or the pandemic. There is still little clarity on the implications of both phenomena in the long run; more precisely, how both issues will influence the development of the UK,

its trade, international cooperation, and relations with the main economic partners. The long-term implications of Brexit are still to be uncovered.

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The state of the art in sustainability of Central-Eastern European family firms: Systematic literature review

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ABSTRACT

Objective: The aim of the systematic literature review was to assess the state of the art in sustainability and trajectories in Central-Eastern European family firms, identify the research gaps, and delineate future research avenues.

Research Design & Methods: We conducted a systematic literature review of 30 articles from the Web of Science and Scopus that address the subject of sustainability in Central-Eastern European family firms. To identify the state of the art, analysis of keywords co-occurrence was employed as an analytical tool, using Biblioshiny software.

Findings: We identified the most influential journals and subject areas. The research allowed for the identification of seven consistent clusters, which prove the great variety of topics in the discussion on the sustainability of family firms in Central-Eastern Europe. The findings showed vast dispersion of research interests and a lack of a single, accurate or dominant research area addressing the phenomenon in this region. Additionally, our findings revealed that the results reported in CEE countries are only partly consistent with the findings presented in Western literature or referenced in other, economically well-developed regions.

Implications & Recommendations: We recommend further research on the specific characteristics of family firms and their impact on sustainable development. Moreover, the lack of comparative studies on family and non-family businesses should be addressed. There is also a need to include the cultural context of Central-Eastern Europe countries in research.

Contribution & Value Added: Our systematic literature review systematizes the existing literature on the sustainability of family firms in Central-Eastern Europe, isolates main research interests, identifies future research avenues, and provides several important hints for researchers.

Article type:	research article
Keywords:	family firms; sustainable development; Central-Eastern Europe; systematic literature review; socioemotional wealth; CSR
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INTRODUCTION

The growing global concern for sustainable development has generated a great demand for research on this topic. Considering the environmental and social impacts of companies' activities accordant with the concept of 'triple bottom line' (Elkington, 1994), much attention has recently been devoted to the unique role of companies, which are often seen as key players in increasing sustainability (Kuckertz & Wagner, 2010). As a result, companies should be threefold oriented towards sustainable development, including not only entrepreneurial growth (Firlej *et al.*, 2023) but also social and environmental aspects (Schaltegger & Hansen, 2017). Consequently, the relationship between entrepreneurship, the environment and sustainable development has become the subject of growing interest among scientists representing various disciplines (Schaltegger & Wagner, 2011).

The issue of sustainability has emerged as a prominent research topic concerning family firms (FFs), because of their specific features. In numerous countries, FFs constitute the most prevalent form of enterprise (Gómez-Mejía *et al*., 2007). They are considered invaluable drivers of economic growth (Memili *et al*., 2015). Moreover, they improve income distribution, create employment opportunities, and form the basis for economic structure redesign (Schulze *et al*., 2010). They generate business, employment, and social opportunities, but also severely hinder sustainable development. Given the critical role of FFs, scholars indicate that they act as active players in introducing the concept of sustainable development, as per the fact that long-term social, economic, and environmental development seems to overlap with the business philosophy of long-lived, multigenerational family firms (Boyd, 2010).

Although the concept of sustainable development has been long recognized, research in this area, with respect to FFs (Pistoni *et al.*, 2016), is scarce. The systematic literature review (SLR) supported by bibliometric analysis constitutes a significant research development (Caputo *et al*., 2018; Dabić *et al*., 2020; Jin *et al*., 2019), because it enables systematisation of the knowledge on the subject currently discussed by representatives of many scientific disciplines. The adoption of this method allowed the implementation of a rigorous approach, which facilitated the assessment of the current state of knowledge, the development of the research topic, and the delineation of future research directions (Gaziulusoy & Boyle, 2013).

In recent years, several literature reviews have begun to pave the way for integrating sustainable development with research on FFs. These contributions highlight the context of the internal factors determining sustainable development (Broccardo *et al.*, 2018), as well as the significance of Italian and Spanish small and medium FFs in terms of sustainability (Curado & Mota, 2021) and corporate social responsibility (CSR) activities (Kašparová, 2018; Kuttner & Feldbauer-Durstmüller, 2018; Mariani *et al.*, 2021; Su *et al.*, 2022). These analyses cover only a part of this research area.

The regional context in which FFs operate affects their practices. In particular, interest has been growing in how and why FFs differ across contexts, which is why the need to bring cross-country context into the study of family firms has been voiced over the past decade (Welter, 2011). The majority of studies cover a Western setting (Bornhausen, 2022). Due to the specificity of Central-Eastern European (CEE) countries, *i.e.* the legacy of communism and the birth of a free market economy in the early 1990s, they are way 'behind' with respect to the more developed countries (Pakulska, 2021). The transformation of economies has led to rapid economic growth and affected all areas of life. However, this does not mean that these processes can be equated with sustainable development (Cichowicz & Rollnik-Sadowska, 2018; Steurer & Konrad, 2009.).

Central-Eastern European countries are somewhat backward compared to Western countries, which results in a literature gap. The aim of the article is to provide a systematic literature review from the perspective of the relevance of research on Central-Eastern European FFs' pursual of sustainable development. Additionally, much attention was devoted to isolating the thematic clusters on the sustainability of CEE family firms. The validity of Western literature confirmations in the regional and cultural context of CEE was also verified. The aim of the SLR was to assess the state of the art in the sustainability of CEEs family firms, determine the differences across global literature, identify the research gaps, and delineate future research directions. Our results are based on a content analysis of 30 studies addressing this topic.

The article proceeds as follows. The literature review and theoretical framework will be described in the subsequent section, followed by an explanation of the methodology employed for the SLR. The article will conclude with results and discussion, providing some practical insights, specifying the limitations, and raising suggestions for further research.

LITERATURE REVIEW

The literature deals with the aspects of engaging companies in sustainable development (Schaefer *et al.,* 2015; Terán-Yépez *et al*., 2020). Researchers have examined the impact of various business and entrepreneur sustainability characteristics (Olson *et al.*, 2003; Jenkins, 2009; Hoogendoorn, 2016). They indicate that future-oriented entrepreneurs pay greater attention to the long-term consequences

of their business decisions and actions (Jahanshahi *et al.,* 2017). One of the significant goals of FFs is to transfer business to succeeding generations (Ward, 1988), which is why they avoid actions and initiatives that may negatively impact future generations' ability to meet their business needs (Dyer & Whetten, 2006). One of the reasons for this behaviour lies in the desire to preserve socio-emotional wealth (Berrone *et al.,* 2012; Gómez-Mejía *et al*., 2007). Given this context, the response yielded a growing number of scientific publications on the role of FFs in sustainability as entities operating for long-term business success, growth, and survival (Sharma, 2004; Le Breton-Miller & Miller, 2016).

Family firms are perceived as the backbone of economic development (Zahra & Sharma, 2004) and play a significant role in creating economic stability (Astrachan, 2003). Campopiano and De Massis (2015) confirmed that FFs are sensitive to social, environmental, and economic aspects, because of their multigenerational orientation and relationships with the local community. Moreover, commitment to sustainable development can help to build a positive reputation for FFs within communities and maintain stakeholder relationships. Furthermore, since long-term social, economic, and ecological development intertwines with FFs' philosophy of long-lived, multigenerational businesses (Boyd, 2010), they continually expand their sustainable development activities (Zahra *et al.*, 2008). The aptness to pass the business on to the next generation determines the long-term plan development (Le Beton-Miller & Miller, 2006), which implies a tendency to adopt strategies guaranteeing long-term investments in line with the idea of sustainable development (James, 1999). Generally, FFs differ from non-FFs by way of their longer-term orientation to ensure business continuity (Martín & Gómez-Mejía, 2016). These longer planning horizons can result in commitment towards actions for society and the environment (Lumpkin & Dess, 2013). Hence, research suggests that FFs are more likely to engage in sustainable activities than their non-family counterparts (Berrone *et al.*, 2010; Borralho *et al*., 2022; Cruz, 2014; Gavana, 2017; Randolph *et al*., 2019). The potentially higher priority of sustainable development practices renders FFs a unique research object.

Although the concept of sustainable development has been long known, more research is required to identify the mechanisms associated with the sustainability of FFs (Arzubiaga *et al*., 2019; Benavides-Velasco *et al*., 2013; Yu *et al*., 2015; Ernst *et al*., 2022). Blodgett *et al.* (2011) and Setthasakko (2012) found that the cultural and regional context in which FFs operate affects their conduct in the implementation of sustainable activities. Therefore, the need to bring cross-country context into the study of FFs has been voiced over the past decade (Picone *et al.*, 2021; Welter, 2011). As the literature shows, some countries have attracted significant attention, while others are quite under-represented, with the majority of studies conducted in a Western setting (Bornhausen, 2022).

The determinants of FFs sustainability are fundamental in the context of the specificity of CEE countries (Radulescu *et al*., 2018). These countries not only share geographical location but are also similar in terms of their shared history of the impact of the communist system (Paprotny, 2016). This period is connected with a deterioration of the environment attributable to the pressure on industrial development. The communist authorities refrained from enforcing environmental legislative standards, because they were presented as a barrier to development (Jancar-Webster, 1993).

With the fall of the Iron Curtain (Allina-Pisano, 2009) and the transition to democracy and a free market economy, the expectation of economic development in line with the environmental and social aspects of sustainability emerged (Costi, 1998). Initially, the concept of sustainable development was interpreted in terms of eco-development. The focus was on, so to speak, catching up with the more advanced environmental practices of Western European countries (Baker, 2006). Such an understanding of this idea prevailed for a long time in CEE countries, which was understandable, considering the dramatic condition of the natural environment after the previous system. Over time, insistence on environmental protection that goes hand in hand with the support of social development began to transpire (Costi, 1998). The changes that took place after the communist period resulted in an increased emphasis on research on the sustainable development of enterprises (Cichowicz & Rollnik-Sadowska, 2018). Thus, we focused on FFs as entities which may play a unique role in sustainable development. Following the call for expanded cross-country research (Picone *et al.*, 2021; Welter, 2011), we focused on CEE, which is 'behind' Western countries in implementing sustainable development

activities and research. We adopted the definition of CEE countries after Pickles (2014). The countries included in this group will be listed in the methodological part of the article.

Global research has revealed several, frequently discussed, research topics addressing FFs sustainability. One of such topics is the impact of family involvement, in terms of both ownership and management, on sustainable development (Ardito *et al*., 2019; Arena & Michelon, 2018). Findings show that greater involvement of the family allows those companies to acquire, retain and share knowledge, as well as achieve common goals in the long term (Duarte Alonso *et al.*, 2018; Perez-Perez, *et al*., 2019). In contrast, family firm ownership can negatively impact the firms' corporate social responsibility (Su *et al.*, 2022). It is worth verifying whether research covering CEE confirms these findings.

Some research also focuses on the topic of family values (Chou *et al.*, 2016) and family religiousness (Pieper *et al.*, 2020), which influence the level of FFs' sustainability. Considering that CEE FFs constitute a large homogeneous group with a similar cultural and religious background (Dick *et al.*, 2021), it is worth verifying whether these aspects have been investigated.

Another recent topic pertaining to FF's sustainable development entails consideration of the influence of market pressures (Curado & Mota, 2021). As pro-ecological activities are often a result of the increase in environmental regulations imposing restrictions on enterprises and encouraging the implementation of new business behaviours (Zheng *et al.*, 2019), it is worth verifying whether CEE FFs focus on sustainable development merely because they must meet the requirements of the constantly changing markets (Curado & Mota, 2021).

An interesting research topic raised by world literature involves the influence of customer awareness of sustainable goods and services on companies' activities towards sustainable practices (Zaman & Shamsuddin, 2017). Le Breton-Miller and Miller (2016) indicated that competition strengthens the level of companies' involvement in social issues.

In the proposed literature review, we seek to verify whether the research topics frequently raised in CEE, regarding FFs' sustainable development, coincide with those presented above. We shall additionally verify whether the findings presented in world literature have been confirmed by research on FFs sustainable development in CEE. This allows us to address the following research questions:

RQ1: What are the most relevant research topics addressing the sustainability of CEE family firms?

RQ2: Does CEE literature confirm the findings of Western literature?

RESEARCH METHODOLOGY

We conducted a systematic literature review complemented with bibliometric indicators. The application of both methods to analyse new research areas provides a solid basis for identifying the key aspects of the topic and speculating on new perspectives (Rialti *et al.*, 2019). The systematic literature review opens the topic, maps the literature, and enhances academic discussion. Bibliometric analysis, in turn, identifies and recognises the potentially 'hidden patterns' in the course of the literature review process (Benavides-Velasco *et al.*, 2013; Kraus *et al.*, 2022).

Our SLR aimed to establish a framework for new findings on the sustainability of CEE FFs and link them to previous research (Randolph, 2009).

It is a kind of a hybrid review of the domains (concept-field hybrid) (Kraus *et al.*, 2022) based on the SLR within the entrepreneurship procedure developed by Kraus *et al.* (2020) adapted from Tranfield *et al.* (2003). The survey was conducted in three stages: (1) planning the review, (2) study identification and evaluation, and (3) data extraction and synthesis.

Initially, a preliminary analysis of the literature revealed that to date, no literature studies on the sustainable development of FFs in the CEE region have been published (Kašparová, 2018). We thus decided to develop a protocol which outlined the data search parameters. We decided to use a database-driven approach, which is a search approach most widely used in management research (Hiebl, 2021). The search was carried out using the Web of Science Core Collection (WOS) and Scopus database. These databases represent major academic search engines in social sciences and provide the highest quality publications (Caputo *et al.*, 2019; Raghuram *et al.*, 2019), which ensures compliance of

all selected articles with the basic requirements of theoretical and methodological rigour (Anessi-Pessina *et al.*, 2016). This approach eliminates biases or omissions that could occur when considering sets of relevant journals only (López-Fernández *et al*., 2016) and allows for future replication of our study (Van Eck & Waltman, 2014). To cover the full range of scientific articles, the databases were searched without setting a time frame (Kubíček & Machek, 2020). The research was conducted in May 2023.

Keywords enabling identification of family businesses (Broccardo *et al.*, 2018) were used, adopting the following search criteria either in titles, keywords, or abstracts: (‘family firm*’) OR (‘family business*’) OR (‘family enterprise*’) OR (‘family ownership*’) OR (‘family company*’). Additionally, to narrow the search to articles concerning CEE, various expressions and acronyms defining this geographical region had to be considered.

The selection of CEE countries for the research sample was justified on the following grounds:

1. Political and economic transformation. In the early 1990s, as a result of the collapse of socialism (Allina-Pisano, 2009), these countries underwent similar transformation processes, transitioning from a communist to a democratic system, and moved from centrally planned to market-based economies. The disintegration occurred simultaneously throughout the region, despite the diverse political and economic situation in individual countries, prompting some commentators to accept the thesis that all Eastern European countries were basically identical political regimes, kept in power by the presence of the Soviet Union military (Ekiert, 2011).
2. Geographical and cultural positioning. The CEE countries share similar geographical, cultural, and historical contexts. Therefore, studies may provide information about patterns, phenomena, and trends specific to this region.

Based on the above, we decided to include Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Kosovo, Latvia, Lithuania, Slovakia, Slovenia, Macedonia, Moldova, Montenegro, Poland, Romania, Serbia, Ukraine (Pickles, 2014), as well as adjectives of nationality, *e.g.* Albanian* etc. We have additionally included terms frequently used in the studies from the region, *i.e.* ‘CEE,’ ‘post-soviet,’ ‘communist,’ ‘Visegrad Group,’ ‘Balkan*.’

Due to its size, history, diverse ethnoculture, and geopolitical positioning, Russia should not be compared with other CEE countries, as this could distort the results on account of its unique characteristics (Verdery, 2003; Wallerstein, 2004; Szczerbiak & Taggart, 2008).

The search queries yielded an initial list of articles (n = 676). Firstly, the WoS and Scopus search results were merged, and duplicates were removed, which allowed the isolation of 520 unique publications for further screening. We chose to include articles published in peer-reviewed journals, because these can be considered to present validated knowledge, as observed by Podsakoff *et al*. (2003). We decided not to exclude conference proceedings, as proposed by Jiang *et al.* (2018) and (Kraus *et al.*, 2020), because CEE authors often publish their work in that wise. The exclusion of these articles would affect the final quality of the analysis.

In the next stage, we identified and evaluated the studies. The method of searching the articles selected was consistent with a systematic review process (Pukall & Calabrò, 2014; Goel & Jones III, 2016; Hernández-Linares & López-Fernández, 2018; Fries *et al.*, 2021). With respect to the publication language, in keeping with the best SLR practices (Michiels & Molly, 2017; Combs *et al.*, 2020), as well as the nature of our research, only articles written in the English language were selected, to avoid translation-related problems. Subsequently, 416 articles remained, which were reviewed with regard to titles, abstracts, and keywords, by double-checking the selection criteria (Araya-Castillo *et al*., 2021, Kraus *et al.*, 2020). We excluded articles not dealing with the topic of ‘family firms’ (38). Ultimately, a list of articles discussing issues of CEE family firms was outlined. This constituted the basis for data extraction. To ensure the systematicity and transparency of the data extraction, we drafted a dedicated extraction sheet in the form of a table. Tables are considered useful overview support and offer a clear matrix for subsequent synthesis of results (Kraus *et al.*, 2020). To prevent bias, ensure objectivity, and avoid the omission of important data, data extraction was carried out. For this purpose, the articles selected were checked manually and categorised through a more detailed analysis of the content, to verify they addressed sustainable development (Broccardo *et al.*, 2018). More specifically,

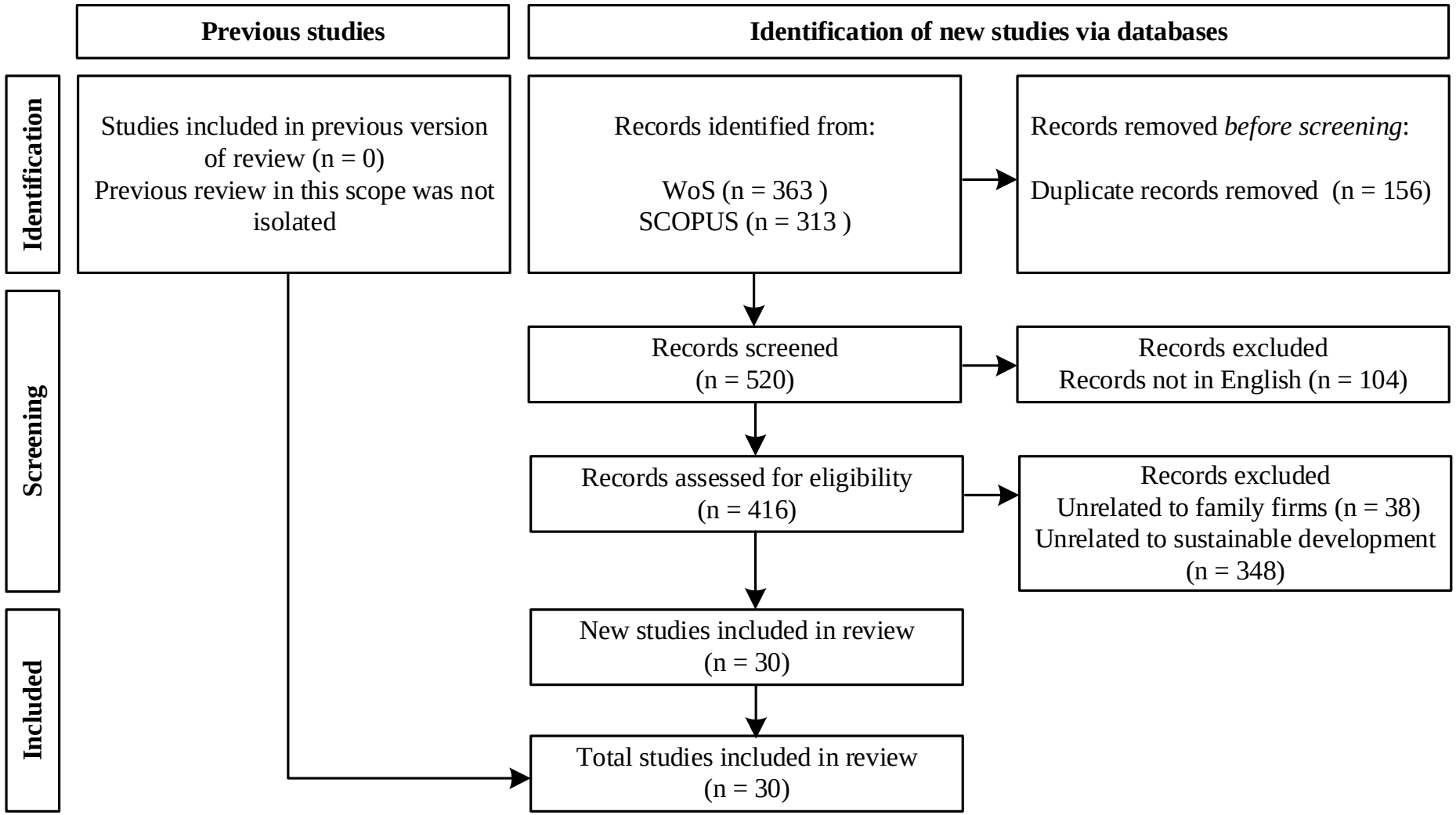

Figure 1. Schema of article selection

Source: own elaboration.

since sustainable development entails a combination of environmental, social, and economic aspects, articles discussing businesses' social commitment, their environmental and sustainable-development issues, as well as environmental, social, and governance (ESG) problems or CSR aspects, were selected. At that stage, 30 articles remained for further detailed analysis (see Figure 1). Despite the small size, the sample resembles those of previous SLR studies on FFs sustainable development (Block & Wagner, 2014; Campopiano & DeMassis, 2015; Broccardo *et al.*, 2018). Based on the 30-item database of full texts obtained, each article was read, examined, and coded by at least two authors. Inconsistencies in coding were discussed with other authors to ensure credibility and resolve discrepancies.

Data synthesis constitutes one of the most important steps in SLR, as it necessitates analysis and comparison of the existing literature, rather than mere summarisation (Jones & Gatrell, 2014). As suggested by Kraus *et al.* (2020), the focus needs to be placed on concepts, not authors. For this reason, bibliometric analysis, specifically co-occurrence analysis, was applied. Using Biblioshiny software, seven thematic clusters were created. All articles in each cluster were analysed by two authors to identify their distinctive contribution to the description of sustainable development of FFs operating in CEE.

RESULTS AND DISCUSSION

The analysis revealed that articles on the sustainability of CEE FFs were published between 2014 and 2022, though the outset of the search period was not limited to any particular timeframe. There has been visible growth in the number of articles in recent years, with the fewest articles published in the first years under analysis and the greatest number published in 2021 (Figure 2). This increase indicates that the topic has become more popular over the last two years. To the best of our knowledge, the analysis unfolds that family firm sustainability represents a relatively new research subject for scholars in CEE.

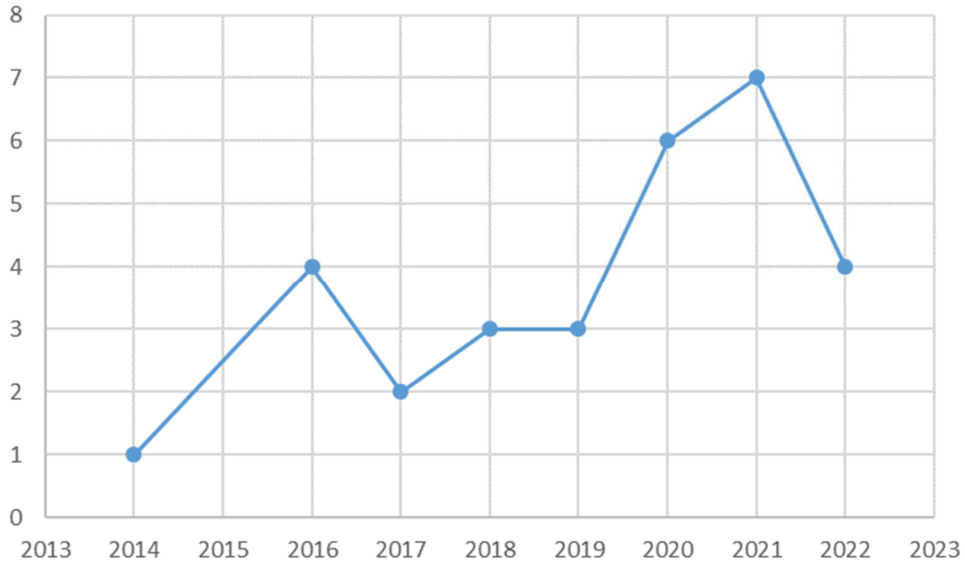

Figure 2. Articles per year
Source: own elaboration.

We identified 18 journals with articles in this field (Table 1). It is worth noting that the results of the sustainable development research of CEE family firms were published in numerous journals of various fields and are not limited to the mere context of business, management, and family businesses. Only one journal, *i.e. Sustainability*, which is dedicated to issues of sustainable development, environment, and business ethics, included more than one article. It may be surprising to note that only one article from the sample was published in one of the leading and most relevant family business journals, *i.e. Family Business Review*. Four articles were published in conference proceedings.

The significant number of authors, *i.e.* 65, who dealt with the sustainability of FFs in CEE, possibly indicates that this topic is not the main subject of those authors' interest and was only addressed on

the occasion of other research. Moreover, only two authors are listed more than once, which may indicate a certain randomness of the study.

Table 1. Journals presenting research on the sustainability of CEE family firms

List of journals	Numbers of articles
Sustainability	9
Acta Facultatis Xylologiae Zvolen res Publica Slovaca	1
Amfiteatru Economic	1
Business Strategy and the Environment	1
E a M: Ekonomie a Management	1
Economics & Sociology	1
Ekonomika Poljoprivreda-Economics of Agriculture	1
Entrepreneurship and Sustainability Issues	1
Energies	1
Family Business Review	1
Forum Scientiae Oeconomia	1
Geographia Polonica	1
Journal of East European Management Studies	1
Journal of EU Research in Business	1
Quality-Access to Success	1
Scientific Papers-Series Management Economic Engineering in Agriculture and Rural Development	1
Studies in Agricultural Economics	1
Technological Forecasting and Social Change	1

Source: own elaboration.

Noteworthy, the study did not cover all CEE countries (Table 2). Out of the 20 countries included in the search queries, only seven yielded results. This means that FFs sustainability has not been studied in the remaining 13 countries, *i.e.* 1. Albania; 2. Belarus; 3. Bosnia and Herzegovina; 4. Estonia; 5. Hungary; 6. Kosovo; 7. Latvia; 8. Lithuania; 9. Slovenia; 10. Macedonia; 11. Moldova; 12. Montenegro; 13. Ukraine or that research on this topic has been published in articles not indexed in the Web of Science or Scopus. This presents a research gap that needs to be filled. Most articles discussed the sustainability of family firms in Poland (Bielawska, 2021; Bukalska *et al.*, 2021; Dacko-Pikiewicz, 2019; Dick *et al.*, 2021; Domańska *et al.*, 2022; Górska-Warsewicz *et al.*, 2020; Haddoud *et al.*, 2021; Pijet-Migoń & Królikowska, 2020; Sadkowska, 2018; Szczepkowska, 2018), the Czech Republic (Horváthová *et al.*, 2020; Jurásek *et al*., 2021; Kašparová, 2017; Mikušová *et al.*, 2020; Myšáková *et al.*, 2016; Rydvalová *et al.*, 2016); and Croatia (Horvatinčić *et al*., 2016; Kopecki *et al.*, 2014; Svetlačić *et al.*, 2017).

Table 2. Countries under analysis

Country	Frequency
Poland	10
Czech Republic	6
Croatia	3
Serbia	2
Slovakia	2
Bulgaria	1
Romania	1
Slovenia	1

Source: own elaboration.

The division of the research avenues in CEE countries involved the use of the Biblioshiny software, by the adoption of the methodology referred to above. Ultimately, seven clusters were isolated (see Figure 2). Due to the diversity of the issues presented in the analysed articles, certain articles were included in more than one cluster.

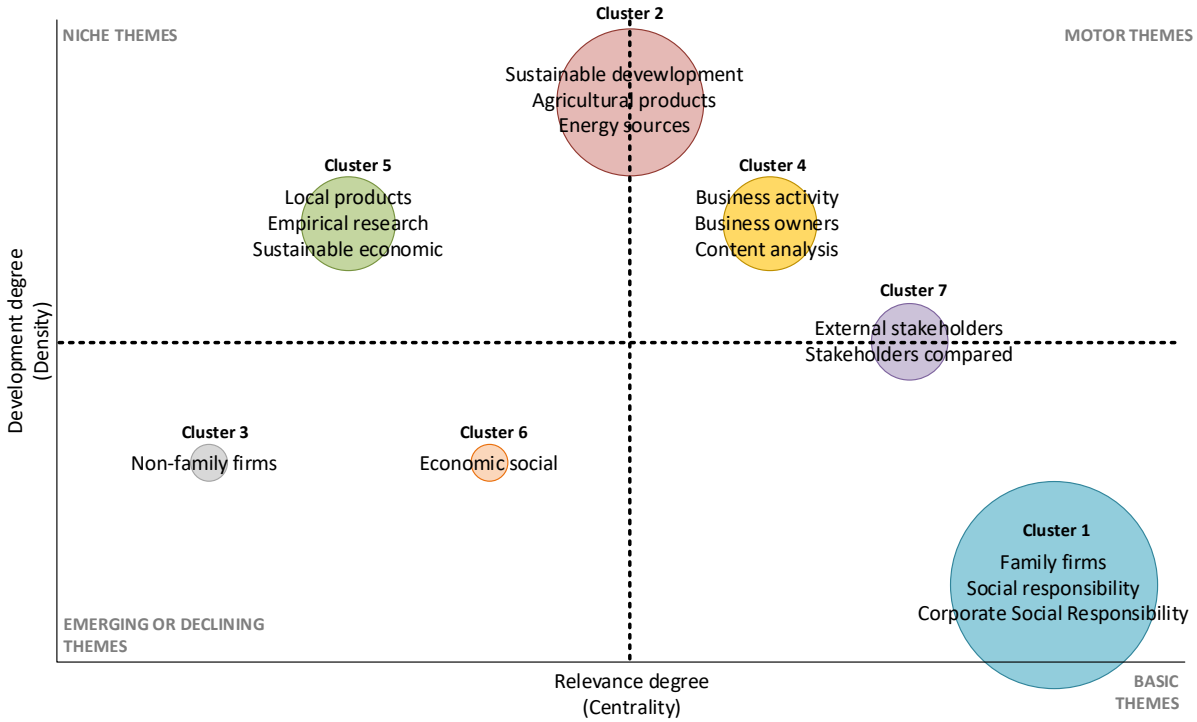

Figure 3. Clusters extracted
Source: own elaboration.

Each article in each cluster was analysed by two authors to identify their distinctive contribution to the description of sustainable development of FFs operating in CEE.

The more profound and contextual analyses allowed for the recognition of individual Clusters as the following:

- Cluster 1, roots of sustainable development.
- Cluster 2, inclusion of sustainable develop-ment.
- Cluster 3, the lens of family vs non-family firms.
- Cluster 4, pro-sustainable activi-ties.
- Cluster 5, regional embeddedness.
- Cluster 6, issues of small scale.
- Cluster 7, external stakeholders' outlook.

The clustering provided evidence leading to an answer to RQ1, *i.e.* what are the most relevant research topics addressing the sustainability of CEE family firms?

The first cluster 'roots of sustainable development' reveals the existence of numerous studies on the impact of 'familiness' on sustainable development, which is the basic theme. Various aspects related to family ownership, family involvement, and characteristic features of a family firm were analysed.

The first debate (article published in 2014) pertained to the possibility of transforming FFs into companies of Economy of Communion (EoC; Kopecki *et al.*, 2014), due to their focus on long-term development and survival as well as numerous relationships with external stakeholders. Other studies confirmed the propensity of CEE family firms to undertake socially responsible activities (Szczepkowska, 2019). Moreover, Kašparová (2017) shows that FFs most often provided information on their socially responsible activities within the community. Subsequent research dealt with the issue of the impact of FFs on local development through their social and image-enhancing activities (Rydvalova *et al.*, 2016). Myšáková *et al.* (2016) and Pijet-Migoń and Królikowska (2020) confirmed that development in municipalities, especially rural ones, can be largely based on FFs.

Another stream of research investigated the impact of familiarity, individual approach, and close relations between the owner and customers (Horská *et al*., 2020; Lulcheva, 2021) on the change of mindset about business in countries with a history of a centrally controlled economy (Górska-Warsewicz *et al*., 2020). Research also showed the importance of implementing the concept of heritage interpretation into business strategy, which is a relatively new trend in Europe (Svetlačić *et al.*, 2017), and preserving tradition (Tošović-Stevanović *et al*., 2021), as these activities support the long-term perspective of FFs operating in harmony with the society. Moreover, researchers noticed that, in the previous economic system of CEE, decisions on socially responsible activity were implemented by state-owned enterprises. Currently, decisions concerning social involvement are personal decisions of entrepreneurs, with support from the family, successor, and a team of competent and committed employees, whereas good social relations with stakeholders make the decisions to *e.g.* engage in philanthropic activities and voluntarily donate a part of assets to those in need much easier (Bielawska, 2021). Similarly, Rožman and Tominc (2022) confirmed that leadership structure, employee relations, and intergenerational synergy positively affect family firms' sustainable management. In turn, Sadkowska (2018) provided empirical evidence that family involvement decreases the likelihood of establishing good partnerships with customers, suppliers, vendors, competitors, non-profit organizations, and local communities, but only in the case of FFs not managing projects.

Other research focuses on the context of FFs' socio-emotional wealth (SEW) in supporting socially beneficial activities within their environment. Family members involved in business often prioritise social and affective factors in the decision-making process. This encourages ethical and socially responsible activities as well as builds interest in public well-being (Jurásek *et al.*, 2021). Similarly, Bukalska *et al.* (2021) verified that FFs play a pivotal role in achieving sustainable development goals, justifying their findings with the combination of these companies' SEW, family endowment, CEO attitudes, and conservative financial strategies.

Compared to relevant global research addressing the above issues (Anderson & Reeb, 2003; Cleary et al., 2019; Cordeiro et al., 2020; Denison et al., 2004), the findings regarding CEE do not differ. However, some examples show a cultural connotation in the approach to SEW. The richest American families are not always sentimental about family firms and socio-emotional wealth, and often financial benefits are more important than the social aspects (Haque *et al.*, 2019; Nason *et al.*, 2019). This aspect can serve as an interesting research thread in relation to family firms in CEE.

Surprisingly, the research conducted by (Rumanko *et al.*, 2021) did not confirm the findings of Western literature regarding the differences between family and non-family firms in terms of sustainable development implementation (Meroño-Cerdán & López-Nicolás, 2017; Naldi *et al.*, 2017; Zellweger, 2017). Research has only proven that non-family entities show a higher degree of formal processing of social activities and social responsibility. Similarly, Korauš *et al*. (2020) indicated that there are no differences between non-family and family SMEs in the perception of the importance of various elements related to innovation activities aimed at sustainable entrepreneurship. Subsequently, Horváthová *et al.* (2020) demonstrated that non-family and family firms do not substantially differ in human resource management, which contradicts the findings from other countries (Chopra *et al*., 2017; Gauci *et al*., 2019; Lin *et al*., 2012; Michiels, 2017).

Differences between the determinants of firms' greenness, depending on the country group, were also shown by Horbach *et al.* (2022), who surveyed Eastern European Union (EU) countries, other Eastern countries, Balkan countries, and South European countries. These results confirmed the positive influence of family ownership on firms' greenness but indicated a negative correlation of female top managers. Importantly, in Eastern EU countries, this negative effect of female managers is smaller. Moreover, Kocianová *et al*. (2022) presented results that are inconsistent with other findings. Family and its cohesion are a prerequisite for a company's sustainability activities. An important element that can push them in this direction is strategic planning (Ittner *et al*., 2003). This relationship was not confirmed in the research on CEE family firms, because the surveyed enterprises, despite the lack of strategic planning, perceived themselves as more environmentally friendly than other enterprises (Kocianová *et al*., 2022). Furthermore, CEE managers are not as used to strategic planning as their Western counterparts. Due to the experience (nationalization of FFs in 40'), a

sort of uncertainty may still exist in the mindset of managers, which means that other factors that are pushing CEE family firms towards sustainability may be at play.

Furthermore, Haddoud *et al.* (2021) discussed certain differences between findings from CEE and literature from other parts of the world, showing that commitment to environmental issues is likely to boost both product and process innovation (Chang, 2016; Suasana & Ekawati, 2018; Surroca *et al.,* 2010). Research conducted in Poland confirmed this for process innovation only. This may stem from the resource insufficiency typical for CEE companies, which translates into a greater propensity towards savings strategies, which explains the preference for labour-reducing process innovations, as opposed to product innovations (Ingram *et al.*, 2020).

In turn, Dick *et al*. (2021) found that some FFs limit socially responsible activities, because it affects control and thus their socioemotional endowment. This relationship is true only in founder-controlled firms. The important role of younger generations has been confirmed by Domańska *et al.* (2022), who have demonstrated that the second generation positively affects the implementation of sustainable development principles by FFs. Similarly, Hategan *et al.* (2019) observed a positive correlation between social responsibility and succession. Given that CEE family firms are at a stage of transferring from the founders to the next generation, this group constitutes a great homogeneous sample of a similar cultural background, in terms of research on the changes in the company during the succession process. Moreover, the influence of different SEW, associated with successor generation and psychological traits, on sustainable development activities could serve as an interesting research topic.

The second cluster, 'inclusion of sustainable development,' encompasses publications based on a variety of sustainability-related studies, primarily emphasizing the environmental aspect, assessed within a societal context. This includes organic food production, renewable energy sources, small family hotels, and the sustainable financing thereof.

The impact of investments on the profitability of organic food production was studied by Barjaktarović *et al*. (2016). Their findings were compared with those from international studies by Halberg *et al.* (2006), and Kasperczyk and Knickel (2006). Tošović-Stevanović *et al.* (2021) utilized the analytic hierarchy process (AHP) model to investigate the principal economic determinants of small farm profitability in Serbia. Their study indicates that the highest-ranked determinants of profitability are agricultural product prices, followed by well-structured agricultural product distribution channels. Horvatinčić *et al*. (2016) focused on identifying new competencies and the knowledge necessary for sustainable food production in Croatia. They underscore the importance of agricultural education to help farmers meet green development standards. Related studies were conducted by Kwasek (2012) and Gold (2009). Korauš *et al*. (2020) stress the significance of innovative activities in Slovakian agricultural SMEs and identify key factors directing these activities towards sustainable development. Myšáková *et al.* (2016) examined the role of biogas plants as a renewable energy source in the Czech Republic, emphasizing their substantial environmental protection impact. They discuss the current state of the country, highlighting the potential for development in this area. Domańska *et al*. (2022), in turn, categorize FFs based on their commitment to sustainable development realization, indicating that there are different types of enterprises and institutions supporting sustainable development which should adapt their offer to a given stage of family firm development.

Cluster 3, 'the lens of family vs non-family,' pertains to the differences between family and non-family firms. Bukalska *et al.* (2021) showed that FFs, in contrast to non-FFs, are characterized by a much greater potential to implement activities related to sustainable entrepreneurship. Similarly, Kašparová (2017) indicated that FFs managers show great interest in sustainable intergenerational development, which is why they strive to build a positive company image and/or continue to protect it. These results confirmed the Western findings (Meroño-Cerdán & López-Nicolás, 2017; Naldi *et al*., 2017; Zellweger, 2017). It should be borne in mind, however, that other studies examining in detail the relationship between family involvement in business and sustainable development have produced conflicting results (Rumanko *et al*., 2021; Korauš *et al*., 2020; Horváthová *et al*., 2020).

Socio-emotional wealth is a unique resource for FFs, and attention to it, particularly in terms of family reputation in the view of various stakeholders, leads FFs to intuitively undertake pro-sustainable

activities. Cluster 4, 'pro sustainable activities,' includes articles indicating how family values and behaviours support the performance of FFs. In tourism, such aspects support sustainable development practices and a particular pattern of business growth (Presas *et al*., 2011; 2014). Górska-Warsewicz *et al*. (2020) confirmed this in a study of Polish FFs providing accommodation services, which build their company brand by highlighting their family character. Despite much smaller financial and organisational resources, compared to large hotel chains, they do benefit from their individual approach to guests, close relationships with clients, family atmosphere, and hospitality. This also confirms American results (Craig *et al*., 2008), which show that family-based brand identity positively impacts customers' decision-making. As a part of marketing campaigns, FFs refer to the unique social, psychological, and emotional values resulting from SEW. Jurásek *et al*. (2021) confirmed that, regardless of the firm size, the owners of Czech FFs declare the same values as Western FFs, *i.e.* they show interest in public well-being and socially responsible conduct. Moreover, one way to create an image of a responsible and ethical organization is to present information on CSR activities via the company's website. Czech FFs presented the most extensive information on their community activities, followed by employee and environmentally-focused activities (Kašparová, 2017). This information was scattered, however, and not very visible to stakeholders, as opposed to the information presented on the websites of family businesses owned by European billionaires (Palma *et al*., 2022). Nevertheless, it should be noted that the two studies were conducted at different time periods, during which corporate CSR reporting obligations in EU countries have changed significantly, which is why the current analysis of sustainable reporting on Czech FFs' websites may yield dissimilar results.

Studies included in cluster 5, 'regional embeddedness,' refer to FFs as pro-sustainability players in the regional context. The first study presents Lower Silesia's viticulture and winemaking industry as an example of a rural area in Poland (Pijet-Migoń & Królikowska, 2020). The authors presented a general profile of the local winemakers and their contribution to the regional economy. The main findings confirmed that winemakers could enrich the regional economy and change the economic landscape by implementing sustainable aspects of regional truism development. Other examples of local FFs are dairy farms in Slovakia (Horská *et al*., 2020). The authors emphasised that short supply chains are seen in rural and food policies as a driver of the transition to sustainability in the agri-food system. More sophisticated studies refereeing to the wood-processing FFs in Slovakia (Kocianová *et al*., 2020) have confirmed the hypothesis that most wood-processing enterprises in Slovakia perceive themselves as more environmentally friendly than enterprises from other industries. The relationship between the EoC and sustainable development was the subject of a study by Kopecki *et al*. (2014). Following the considerations of Freeman (2010), Kopecki *et al*. argue that the leaders of multinational companies should consider new external stakeholders, *i.e.* the local community and environmental activists, in addition to their current shareholders, customers, employees, and suppliers. Based on previous findings, the authors provide evidence that the new value of post-material management (*e.g.* culture of giving, gratuitousness, profit distribution, ecology, and responsibility for future generations) can impact the sustainable development of FFs. The regional or local context of family firm research was the subject of numerous Western studies. Colli *et al*. (2003), for instance, have indicated the need to consider FFs in Britain, Spain, and Italy, both in the perspective of the nineteenth and twentieth centuries, in national and regional contexts, in order to better understand their various capabilities and characteristics. Karlsson (2018) provides evidence that FFs grow more slowly than the average non-family firms across the urban-rural context. Baù *et al*. (2019) stated that FFs benefit more than non-family firms from local embeddedness and thus achieve higher levels of growth. Similar results were presented by Backman and Palmberg (2015), who claim that urban-rural context influences FFs and non-FFs employment growth differently, with FFs exhibiting greater employment growth, compared to non-FFs in rural areas.

Cluster 6, 'issues of small scale,' encompasses studies addressing matters of the obstacles faced by small-scale business entities. Tošović-Stevanović *et al*. (2021) emphasized that farms are crucial in creating new jobs (self-employment), providing family income, adjusting to local resources and preserving tradition. This multifunctional nature is translated into actions taken to maintain the sustainability of rural areas and largely shape the economic tradition. Kopecki *et al*. (2014) go further in their article and propose that the idea of EoC is associated with a culture of giving, profit distribution, ecology, and responsibility for future generations. The authors mention that EoC can positively impact smaller firms in new job and

business creation and, therefore, can contribute to the development of sustainable systems able to exist for centuries, provided that they successfully overcome the transfer of ownership to the next generation.

Cluster 7, 'external stakeholders' outlook,' covers articles related to pivotal family firms' success factors related to external stakeholders. With the concept of an EoC (Kopecki *et al*., 2014), FFs operate responsibly towards primary stakeholders (*i.e.* employees, customers, and suppliers). Additionally, special attention is given to environmental protection. As a result, family firms receive a level of trust and unity, developing sustainable systems that can exist over decades. However, Sadkowska (2018) examined the impact of the difficulties in building relationships with external stakeholders and revealed that project-managing FFs devote greater attention to the management of people in projects compared to building the relations with groups of external project stakeholders. Rumanko *et al*. (2021) found that the concept of social sustainability is strongly connected with a considerable number of stakeholders, compared to the environmental and economic aspects of sustainability. They concluded that the examined FFs cannot be distinguished as bearers of social sustainability in Slovakia, since they generally process the monitored activities at a lower level, compared to non-family businesses. In the context of sustainable development engagement of FFs, relationships with external stakeholders were also the subject of extensive studies. For example, García-Sánchez *et al*. (2021) suggest that in comparison with non-family firms, FFs exhibit higher CSR performance and are more likely to integrate external and internal stakeholders' expectations into their strategic choices, to protect their family identification and image. There is no clear evidence, however, of whether FFs are more oriented towards internal stakeholders (Mayo & Gómez-Mejía *et al*., 2016), or favour external stakeholders (Carney, 2005; Gómez-Mejía *et al*., 2011). We extracted relevant confrontations from the articles analysed, to answer RQ2 regarding the question of whether CEE literature confirms the findings of Western literature. Two aspects were distinguished, *i.e.* comparison of the results presented in the articles against other (Western) findings and the question of whether they align with the 'Western' literature results. The findings from this analysis are presented in Table 3.

Given the data in Table 3, only ambiguous answers to RQ2 could be obtained. The results related to CEE countries are not continually compared to other findings, mainly in Western publications. This observation leads us to formulate the following recommendation for the authors: 'If you present your findings, you should provide comparisons to other research, to enrich your contribution.' Additionally, in terms of comparisons, CEE results were only partly consistent with Western findings. If there was at all a reference to the specifics of the CEE region, it most often pertained to the relatively shorter period of FFs' operation (30 years), and therefore management was still in the hands of the founder generation or assumed involvement of at most second generations. Few articles indicate that the long-term perspective of FFs in CEE entails a change from past behaviour when private entities operated under constant threats to ownership rights from the State.

In terms of comparison of the results obtained in CEE countries against those from Western Europe, FFs show similar attentiveness to SEW and engage in activities conducive to their sustainability. These activities are mainly aimed at achieving sustainable development goals and interest in public well-being. Nevertheless, it seems that the differences and similarities identified, juxtaposed against Western studies, still need to be verified, since there are no large-scale and international studies. In our opinion, the isolation of contrary results requires more profound studies or perhaps an exciting avenue for further research.

CONCLUSIONS

Different contributions emerge from the exploration of the topic of sustainability in CEE family firms. The impact of 'familiness' on sustainable development is a complex subject. Western literature has been addressing this research topic for more than 30 years (Lank, 1991; Post & Altma, 1994). In turn, CEE literature began to explore this topic relatively recently. The oldest article isolated via SRL was published in 2014. Thus, there is a significant time gap between publications in Western countries and CEE.

Table 3. Confrontation of CEE findings with Western results

Author/s	Is the regional/cultural context considered?	Are comparisons made against the 'Western' results?	Are the findings consistent with 'Western' results?
Barjaktarović *et al*., 2016	Yes	n/a	n/a
Bielawska, 2021	Yes	No	No
Bukalska *et al*., 2021	No	Yes	Yes, not directly
Dacko-Pikiewicz, 2019	No	No	n/a
Dick *et al*., 2021	Yes	No	Yes
Domańska *et al.*, 2022	No	Yes	n/a
Górska-Warsewicz *et al*., 2020	Yes	Yes	Yes
Haddoud *et al*., 2021	Yes, indirectly	Yes	No
Hategan *et al*., 2019	Yes	Yes	No
Horbach *et al*., 2022	Yes	Yes	Yes
Horská *et al*., 2020	No	No	No
Horváthová *et al*., 2020	No	No	No
Horvatinčić *et al*., 2016	Yes	No	n/a
Jurásek *et al*., 2021	Yes	Yes	Yes
Kašparová, 2018	No	No	No
Kašparová, 2017	No	No	n/a
Kocianová *et al*., 2022	No	Yes	Yes, partially
Kopecki *et al*., 2014	No	No	No
Korauš *et al*., 2020	No	No	Yes
Lulcheva, 2021	No	No	n/a
Mikusová *et al*., 2020	Yes	No	n/a
Myšáková *et al*., 2016	No	No	No
Pijet-Migoń & Królikowska, 2020	Yes	No	n/a
Rožman & Tominc, 2022	No	No	Yes
Rumanko *et al*., 2021	No	Yes	No
Rydvalová *et al*., 2016	Yes	No	n/a
Sadkowska, 2018	Yes	No	Yes
Svetlačić *et al*., 2017	No	No	n/a
Szczepkowska, 2019	No	No	No
Tošović-Stevanović *et al*., 2021	No	No	n/a

Source: own elaboration.

Firstly, let us make a crucial remark on the number of publications. While only 30 articles on FFs sustainability indexed in the WoS and Scopus have been published in CEE countries since 2014, in countries with a longer history of free market development, the set of publications is visibly wider. This could lead to the conclusion that sustainability in CEE is still a 'fresh' subject of scientific interest. Considering the fact that sustainable development is set to become an inevitable business philosophy (Curado & Mota, 2021; Delmas & Gergaud, 2014; Zheng *et al*., 2019), a parallel growth of works devoted to this issue must emerge.

The above conclusion is supported by the fact that many research topics have not yet been addressed, as most articles focus only on specific sustainability issues, *i.e.* the social (Bielawska, 2021; Kašparová, 2017; Kašparová, 2018) or environmental aspects (Haddoud *et al.*, 2021; Horvatinčić *et al.*, 2016; Myšáková *et al.*, 2016). Consequently, the research covers only a part of the complex research area of sustainable development.

The results of studies in CEE largely cover the findings from different parts of the world. However, some differences can be observed. Research shows that family involvement constitutes the starting point for the sustainable development of FFs across the world (Ardito *et al*., 2019; Arena & Michelon, 2018) and in CEE (Domańska *et al*., 2022; Kopecki *et al*., 2014). Moreover, global research indicated

that solid family values (Chou *et al*., 2016) and family religiousness influence the level of FFs' sustainability (Pieper *et al*., 2020). Bielawska (2021) also concluded that social involvement in CEE derives from the values and attitudes of the owners' families. Similarly to the findings of Broccardo *et al*. (2018), the SRL also indicated that deep attachment to the local community fosters such sustainable initiatives as environmental protection, social commitment, and CSR (Horská *et al*., 2020; Kocianová *et al*., 2020; Kopecki *et al*., 2014; Pijet-Migoń & Królikowska, 2020). The context of regional embeddedness is more detailed in CEE than in studies conducted in Western countries (Backman & Palmberg, 2015; Baù *et al*., 2019; Karlsson, 2018). This may result from the fact that FFs in this region are operating regionally rather than internationally.

Findings distinguishing CEE literature from other studies are related to the cultural connotation in the approach to SEW. In the USA, for example, FFs are not always sentimental about the social aspects, and often the financial benefits are more prioritized (Haque *et al*., 2019; Nason *et al*., 2019), whereas a different attitude in this regard is observed in CEE (Bukalska *et al*., 2021; Jurásek *et al*., 2021). This difference may result from the fact that in the USA, FFs are now managed by the generation succeeding the founders. This generation is not as emotionally attached to the firms as their founders. In CEE, the founders still manage or influence the management of FFs, thus non-financial goals still play a significant role.

Dick *et al*. (2021) and Domańska *et al*. (2022) also highlight the differences in sustainable development activities related to the founder generation in CEE family firms. Similarly, the context of the succeeding generation has been investigated by Hategan *et al*. (2019) and Szczepkowska (2019). Because FFs in CEE constitute a large homogeneous group of founders with a similar cultural and religious background (Bielawska, 2021; Domańska & Zajkowski, 2022; Hadryś-Nowak, 2020), they can serve as an interesting sample for research on the impact of family firms' long-term orientation on sustainable development, especially in the context of the successive generations of owners.

Furthermore, Western findings indicate that increased customer awareness of sustainable goods and services boosts companies' focus on sustainable business practices (Zaman & Shamsuddin, 2017), which has been confirmed for CEE by Kopecki *et al*. (2014) and Rumanko *et al*. (2021). Similarly, the impact of market pressures (Curado & Mota, 2021) and regulations (Zheng *et al*., 2019) as factors prompting sustainable development of FFs was confirmed by CEE research (Kašparová, 2017; Sadkowska, 2018). The presentation of information on socially responsible activities to stakeholders depends largely on the legal requirements. In the CEE countries that are part of the EU, the legal regulations are the same as for other EU members. The situation may differ for CEE countries outside the EU. Taking this into consideration, it seems that cross-country studies on how FFs communicate their sustainability measures to stakeholders would pose an interesting research direction.

Importantly, some of the studies comparing CEE family and non-family businesses did not confirm the Western findings (Horváthová *et al.*, 2020; Korauš *et al*., 2020; Rumanko *et al*., 2021). Considering the conflicting results and the fact that only nine out of the 30 analysed articles presented a comparison of aspects concerning the sustainable development of non-family and family enterprises, this may also indicate an interesting research gap.

To sum up, the results contradicting the findings in the world literature encourage to undertake research on the sustainable development of FFs in CEE. As Kašparová (2018) notes in her bibliometric review, existing research mainly focuses on FFs in Western Europe, Asia, and the USA, thus there is a lack of CEE-relevant research in this field. Since FFs in CEE constitute a large homogeneous group with a similar cultural and religious background, they may also present as an interesting group for future research (Bielawska, 2021; Dick *et al*., 2021), especially in the context of generational ownership change.

The identification of differences between Western and CEE findings can direct scholars towards future research directions. Moreover, new research trends can offer theoretical and practical implications for businesses, managers, and other scholars. We conclude this SLR with a general call for further research in the field of sustainable development of FFs in CEE.

Furthermore, if we were to assume that sustainable development and implementation of the Sustainable Development Goals will gain momentum in the coming years, our findings could provide some guidance for practitioners, mainly in relation to the design of a business environment capable of supporting and facilitating the pursuit of this development path.

Our SLR attempted to follow the guidelines recommended by Kraus (2020), although some limitations surfaced. The use of two databases (WoS and Scopus) may have resulted in the inclusion of non-relevant articles in the sample (Hiebl, 2021), especially since, as noted by Mongeon and Paul-Hus (2016), the social sciences are underrepresented in the WoS and Scopus. Moreover, authors of studies within the CEE region often publish their research in non-indexed journals or in their native languages; such studies were not included in our review. The use of other databases (*e.g.* EBSCO or CEJSH) could enrich the study. As with any SLR, subjectivity cannot be completely excluded from our review. Nevertheless, our SLR identified research gaps and recommend directions for future research in the context of sustainable development of FFs in CEE countries. Regrettably, our conclusions and recommendation are based on a small number of existing studies (30). Short *et al*. (2016) suggest 50 articles as the minimum number of research items to be included in a literature review, although Hiebl (2021) consider the setting of such limits arbitrary. In this case, research on the sustainability of FFs in post-socialist countries is still at a preliminary stage, thus the resultant number of research items is justifiable. Certainly, an assessment of the state of knowledge in the entire CEE region remains difficult, as some countries are not represented in our sample. Nevertheless, the above shortcomings do not significantly affect the quality of our SLR.

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Disrupting fast fashion: A case study of Shein's innovative business model

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ABSTRACT

Objective: The objective of this article is to explain an ultra-fast fashion business model and to distinguish it from the fast fashion business model as a new, innovative concept in the fashion industry that was created during turbulent times to cope with new challenges.

Research Design & Methods: The article is a single case study with an emphasis on undertaking an integrative literature review.

Findings: This ultra-fast fashion business model changed the balance of power in the fashion industry. Taking advantage of digital-only presence, extensive use of social media, AI and big data analyses, collaborative consumption, quick response, frequent assortment changes, low prices, and an ambiguous approach to the principles of corporate responsibility, the ultra-fast fashion model adapts very well to new technological and social developments, is difficult for competitors to imitate, and thus effectively creates value for price-sensitive consumers.

Implications & Recommendations: Our findings suggest that a proper combination of strategic choices and innovations in this business model can lead to competitive advantages and remarkable market performance. Indeed, right timing, the use of appropriate technologies, and favourable initial conditions all play crucial roles in the process and make the ultra-fast fashion business model potentially transferable to other industries, while at the same time difficult to imitate by established companies. Its social and economic consequences, future applications, modifications as well as the positive conditions necessary for transferability to other industries should be the subject of further studies.

Contribution & Value Added: Our central contribution involves deciphering the complex interplay and fusion of already established rules and new elements during the process of a new business model creation in the fast fashion industry. Shein's ultra-fast fashion business model offers a new strategic configuration of a business model that is very difficult to imitate and yet extends the competitive order in the industry at the same time. This article provides a framework for analysis of this model and enhances the understanding of the importance of particular business model choices and their connections for a firm's successful competitive strategy.

Article type:	research article
Keywords:	business model; fast fashion; ultra-fast fashion; business model innovation; competitive advantage
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INTRODUCTION

This article establishes the characteristics of a new business model – ultra-fast fashion – based on the choices and activities of Shein. The ultra-fast fashion business model has not yet been studied to the same extent as the fast fashion strategy and has rather been a subject of press articles and reports until now (Cao, 2022; Ciment, 2022; Fashion Revolution, 2022; Jones, 2021; Nguyen, 2021; Olcott & Eley, 2021). However, its inclusion as a separate topic of academic analysis is now neces-

sary, because the ultra-fast fashion business model is an important extension of the fashion industry's competitive order (Gavetti & Porac, 2018). In this article, we explore the origins of this phenomenon that has created favourable asymmetries (Brandenburger & Stuart, 1996) that are advantageous to one company, Shein, over others in the industry.

Shein has achieved remarkable success and is currently the most popular garment retailer worldwide because of its scale, scope, and speed. However, there are visible differences between the business models and development paths of Shein and its biggest competitors, namely Zara and H&M. Shein was born digital and it focuses primarily on an online presence and extensively uses large databases and artificial intelligence (AI) algorithms. At the same time, it offers only limited transparency of its internal operations and is a subject of heated discussion regarding human rights violations and sustainability hazards despite its declared pro-environmental attitudes. For these reasons, it is important to understand better the logic of its business model better and more clearly. Therefore, we seek to extend that understanding by asking the following research question:

RQ: What innovations in the business model led to Shein's remarkable market performance and competitive advantage?

By drawing on the strategy and business model literature and an analysis of Shein's operations, we aim to contribute to the empirical research on the current disruptions in the fast fashion industry and gain a more precise understanding of how Shein's new business model differs from the existing fast fashion models.

A common definition of competitive advantage in strategic management relates to a company's attribute that satisfies simultaneously two conditions: (a) it is important to its customers and (b) it is difficult for competitors to imitate (Obłój, 2010; Obłój *et al.*, 2010). As Porter (1980) notes, each advantage has two dimensions, namely cost and differentiation. According to the resource-based view, at their roots are a company's specific resources or skills (Lee *et al.*, 2021). The theory also uses the very practical business model concept (Massa *et al.*, 2017), which has become extremely popular given the prevalence of the Internet and the ongoing trend towards the digitalisation of organisational activities (Zott *et al.*, 2011). It helps explain in a fairly holistic way the key organisational choices, solutions, and activities (Osterwalder *et al.*, 2010). Moreover, it highlights how those key activities are interrelated, creating create value for the recipient (Massa *et al.*, 2017). It also helps to understand how certain models of company activities generate new quality and change the market (Zott *et al.*, 2011). It is also consistent with the hypothesis of Gavetti and Porac (2018) stating that great strategies extend a market order during a time of turbulence.

We illustrate this development using the global fashion industry, which had revenues of approximately USD 0.99 Trillion in 2022. Most of it (USD 312.20 Billion) was generated in China (Statista, 2022). The recent changes in this industry were triggered mainly by the Covid-19 pandemic. Supply chain problems due to a shortage of materials, transportation bottlenecks, and rising transportation costs, the increase in the share of sales in the online channel (from 22.8% in 2019 to 33.8% in 2021) and the associated need to invest in digitalisation, rising inflation, and also periodic drops in demand and shrinking margins created opportunities for new entrepreneurial players (Wach & Głodowska, 2022). An example of such a player is Shein. The advantage of its business model is underscored by the fact that Shein has captured the U.S. fast fashion market in just two years, increasing its share from 18% in 2020 to 40% in 2022 and achieving a 568% sales growth (Bloomberg, 2022). In 2022, its estimated value was USD 100 Billion (Scott, 2022) and thus Shein has become a new giant in that industry.

Hence, this article revolves around the case of Shein as an example of an innovative ultra-fast fashion business model. Therefore, in the following sections, we will provide a literature review, an analysis of Shein's strategy, and its specific business model innovations. Finally, we will provide conclusions on this model.

LITERATURE REVIEW

Strategy and Business Model

In one of the first definitions of strategy, Chandler (1962) emphasised the importance of long-term goals that were to be achieved through specific courses of action and proper allocation of necessary resources. Then, Mintzberg (1987) focused on the pattern of decision-making and a company's activities. Porter (1997) defined strategy as a position of a company in the industry that allows it to act successfully to the impact of five environmental forces and achieve a higher return on investment as a consequence. Conversely, Barney (1991) puts effective competition at the centre of strategic management and ties it to satisfactory company performance.

Although the strategy literature has been characterised by conceptual proliferation, most of the approaches converge on the definition of strategy as a coherent concept of action based on a few key and complementary choices, the overall goal of which is to take advantage of opportunities, build a competitive advantage, and achieve above-average results (Obłój, 2009; Rumelt, 2022). There is also general agreement that economic success is the ultimate goal of any particular strategy. A major group of researchers associate successful economic performance with the adoption of one of three generic strategies: cost leadership, differentiation, and focus (Porter, 1980). Porter argues that companies should pursue only one strategy, otherwise, they become stuck in the middle and this conclusion was further confirmed in later studies (Adner *et al.*, 2016; Crook *et al.*, 2008; Lee *et al.*, 2021; Porter, 1985).

Definitional diversity also applies to business models. Magretta (2002) defines a business model as a story that explains how businesses work, while Amit and Zott (2010) take a narrower view and focus on the content, structure, and governance of transactions that are constructed to create value by taking advantage of business opportunities. Finally, in their review of business model definitions, Saebi, Lien, and Foss (2017) argue that many contributions stress certain necessary elements of a business model, namely, the firm's value proposition, the crucial market segment, the architecture of the value chain, and the mechanisms of value capture. In these, as well as in many other attempts to define the concept of a business model, there are frequent references to the idea of value creation and capture (Obłój & Zemsky, 2015), wherein value can be seen as the user's assessment of the novelty and relevance and appropriateness of the product or service it offers (Lepak *et al.*, 2007), which eventually leads to organisational high performance.

While improved performance may originate from improved value creation, value capture, or the combination of both, a novelty in business model design may not be enough to secure a competitive advantage over already established companies in the industry. That advantage is more about the configuration of business model activities, and indeed, research shows the importance of making compound decisions rather than discrete ones (Leppänen *et al.*, 2023). Hence, the interdependences between activities are equally crucial for maintaining a competitive advantage as making strategic choices regarding superior interdependent activities (Lanzolla & Markides, 2021).

The link between a business model and company strategy is still neither evident nor simple (Casadesus-Masanell & Ricart, 2010; Magretta, 2002; Teece, 2010; Zott *et al.*, 2011; Zott & Amit, 2010). As Teece argues, even if a good business model provides the customer with value and at the same time ensures that its creator captures a portion of it, it is insufficient to guarantee a sustainable competitive advantage. A business model must be complemented by the right strategy to guard against any imitation by competitors or to protect against the emergence of other, more innovative business models. Therefore, the business model should be linked to the strategy and the basic structure of the company (Teece, 2010; 2018).

Another approach that simultaneously links and delineates strategy and business model states that a business model should be viewed as (1) the company's theory of value creation, (2) the implementation of that strategy, (3) the monetisation of economic consequences of the strategy, (4) the organisation of the company, and a combination of the four elements, while taking into account value creation opportunities and the process of managerial decision-making (Bigelow & Barney, 2021).

In their scheme of the competitive process, Casadesus-Masanell and Ricart (2010) place the business model, especially the choice of the logic of value creation and capture, at the first level of strategy. The second level is tactical and consists of implementation choices and actions as determined by the original choice of business model. In their view, every company has a business model, because it must make certain choices and performs particular activities. However, not every organisation has a strategy understood as a definite plan of action for the various contingencies that may occur. From this perspective, which we adopt here, strategy is the creation of a system of actions that will allow the company to compete successfully and the chosen business model is its reflection (Casadesus-Masanell & Ricart, 2010; Massa *et al.*, 2017).

To sum up, strategy and business model choices play a substantial role in a company's success. They should become a comprehensive combination, because a good strategy without a proper business model may not be enough to create long-term customer value (Braun *et al.*, 2019). As presented in the following sections, the case of Shein is a complex and novel example of such a combination.

Fast Fashion

As defined by *Merriam-Webster Dictionary*, fast fashion is 'an approach to fashion design, creation and marketing that emphasises making products that are in line with current trends available to consumers quickly and cheaply.' (*Fast Fashion*, 2022). On the other hand, Barnes and Lea-Greenwood define fast fashion as 'a business strategy which aims to reduce the processes involved in the buying cycle and lead times for getting new fashion product into stores, to satisfy consumer demand at its peak' (Barnes & Lea-Greenwood, 2006, p. 2). Caro and Martınez-de-Albeniz (2015) indicated an interesting aspect when defining fast fashion. They refer to the concept of lean retailing. Many researchers described fast fashion by focusing on its negative social impacts, including environmental impact and overuse of resources at various stages of the production cycle (Allwood *et al.*, 2006; Bick *et al.*, 2018). Hence, numerous studies emphasised the need for fast fashion companies to act more consciously and responsibly and have a greater orientation towards a sustainable business model, production, and supply chain (Oliveira *et al.*, 2022; Pedersen *et al.*, 2018; Todeschini *et al.*, 2020). In the context of fast fashion, the 'throwaway culture' concept is mentioned and analysed in terms of consumer attitudes and consumer behaviour (Cline, 2012; Pedersen *et al.*, 2018).

What distinguishes fast from traditional fashion is the way the clothes are produced and how the value chain is shaped (Camargo *et al.*, 2020; McNeill & Moore, 2015). The supply chain in this sector is analysed, *e.g.*, through (1) JIT (just in time), which focuses on current deliveries and reducing warehousing, (2) agile supply chains, emphasising the importance of shorter and more flexible supply chains, responding to current demand, facilitated by the close location of production and an analysis of sales data, (3) quick response (QR) systems, the rapid replenishment of a customer's inventory by the supplier through direct supplier access to data from the customer's point of sale (Collins English Dictionary, 2018). They increase cooperation and integration and – just like demand chains – improve the efficiency of physical supplies (Barnes & Lea-Greenwood, 2010; Camargo *et al.*, 2020). Consequently, fast fashion is distinguished from traditional fashion by shorter runs, smaller quantities, and the constant change of seasons (even up to 24), and even artificially induced out-of-stocks creating a feeling of scarcity and uniqueness in consumers (fear of missing out, FOMO), and thus the need to buy immediately (Bayley & Nancarrow, 1998).

Ultimately, according to Caro and Martınez-de-Albeniz (2015), three elements determine whether a company belongs to the fast fashion sector, namely, (1) quick response (2) frequent assortment changes, and (3) fashionable clothes at affordable prices. Control of the entire value chain allows garments to be delivered almost on demand, as the production is focused on individual products rather than entire collections.

A typical fast fashion assortment can be divided into three categories, using the so-called fashion triangle (Abernathy *et al.*, 1999; Caro & Martínez-de-Albéniz, 2015): basic (40-70% of the assortment) produced in larger quantities in countries with low labour costs, fashion-basic with a more fashionable cut, and products that are produced in smaller quantities, in a closer location, using quick response systems. Decisions and authorisations are made so quickly that these products can go on sale within just six

weeks. They are products that generate quick customer interest, although basic clothing is the primary source of recurring revenue. This division of the assortment requires the maintenance of dual supply chains and provides for a balance in terms of cost and production time. It also allows for frequent introduction of new products, up to 20-24 times a year. Key companies in the sector defined in this way are H&M, Zara/Inditex, Gap, Uniqlo/Fast Retailing, and Topshop (Caro & Martínez-de-Albéniz, 2015).

Technological developments, digitalisation, the changing expectations of new generations of consumers, and, finally, the consequences first of the 2008 economic crisis and then the Covid-19 pandemic have contributed to further transformations in this market segment (Monroe, 2021). Now, the segment has split into two parts: 'traditional' fast fashion and ultra-fast fashion represented by new companies like BooHoo, ASOS, MissGuided, and Shein. Their business models extended the market organisation because they focus primarily on an online presence. The ultra-fast model is based on a 'test and repeat' approach (Olcott & Eley, 2021), *i.e*., producing very short runs (about 300-500 items), releasing them, and if the testing proves to be successful, repeating the procedure. It is also supported by very aggressive online marketing and celebrities/influencers' support. The entire production cycle has been shortened to the maximum, even to as short as two or three weeks, so consumers will have a sense of new things materialising ceaselessly and thus the need to buy them (Camargo *et al.*, 2020; Research, 2017). The prime example of this new business model is Shein.

RESEARCH METHODOLOGY

While Shein's immediate competitors have been studied extensively as key players in the fast fashion industry (Caro & Martínez-de-Albéniz, 2015; Drake & Marley, 2010; Jin & Shin, 2020; López *et al*., 2022), mentions of Shein have only been appearing predominantly in press releases, blog posts, articles, and reports. Academic publications concerning the company are scarce. Thus, an interesting research gap has appeared and we decided to approach the phenomenon from the perspective of the strategic choices that shape Shein's strategy and business model. Following Ghauri's (2004, p. 109) suggestion that the 'case study is a useful method when the area of research is relatively less known' and also in accordance with the process-based tradition (Langley, 1999), we adopted an exploratory single-case study as the research method. Such an approach allowed us to better understand how this new business model develops and matures and compare it with those models that are currently dominant in the fast fashion industry (Yin, 2014). An emphasis was put on literature analysis as we did not have direct access to the company and the company does not disclose specific information on its operations and strategy.

Thus, our data collection began by gathering all the primary literature sources we could access, including the company's website, archival and current web news, press articles, social media sites, and the scarce reports and records published online. Our secondary literature analysis consisted of an extensive review of articles in academic and non-academic journals, industry reports and books, also accessed mainly online, using the Web of Science and Google Scholar databases. For statistical data, we consulted the Statista database. We used an integrative literature review (Torraco, 2005), recognising the key themes, and indicating and conceptualising the emerging ones to offer a thick description (Ponterotto, 2015) and a specification of the analysed business model. Taking into account that this article tackles a quite new phenomenon and potentially will encourage other researchers to further investigate it from different vantage points, a single case study based on all available, including non-academic sources, seemed to be sufficient and effective at this point.

RESULTS AND DISCUSSION

Shein sparingly manages information about itself, though its sites are the most visited in the fashion industry worldwide. With the right choice of content and marketing tools, Generation Z organises shows of purchased clothes on their social media ('Shein hauls') without the company having to finance these activities but taking advantage of impulsive shopping (Camargo *et al.*, 2020; Morgan & Birtwistle, 2009). Up to 6000 new products are added to the online store every day and the trend analysis is handled by AI, which is applied to the entire process of clothing production and distribution. Trends

are captured on social media within 48 hours and it can take just two weeks to deliver the final product to customers (Cargo *et al.*, 2020)

Strategic Choices of the Ultra-Fast Fashion Business Model

Several choices and activities distinguish ultra-fast fashion from fast fashion, but the most important aspects seem to be: the greater power of consumers whose needs and expectations matter for both design and production (demand-driven supply chain) (Drake & Marley, 2010), an online-only presence, vertically-integrated e-commerce platforms, local production that is shortened even to days, minimal inventory, and flexible, lean, reactive supply chains (Camargo *et al.*, 2020). Shein has managed to develop a considerable competitive advantage over companies by using a fast fashion business model, reinforced by the use of AI and operational efficiency, specifically focused relationships, and a networked structure of suppliers.

The results presented in Table 1 summarise the similarities and differences between strategic choices that have been used by fast fashion companies and the ultra-fast fashion Shein's model (Camargo *et al.*, 2020; Caro & Martínez-de-Albéniz, 2015; Drake & Marley, 2010; Jin & Shin, 2020) supplemented by an additional element of responsible business. We will elaborate on all the elements in the following paragraphs.

Table 1. The differences between fast fashion and ultra-fast fashion business models

Strategic choices	Fast fashion	Ultra-fast fashion
Born digital	No Stationary stores: Zara 3.000, H&M 5000 Website Indirect (cost) and direct sales Investment in offline and online integration, online development	Yes Website Mobile app Direct sales – savings
Artificial intelligence and big data	Yes/No. In selected areas	Yes, at every level of the value chain
Shared consumption	Yes, the tendency to throw away clothes that are no longer wanted	Yes, the tendency to throw away already unwanted clothes + very aggressive marketing and influencers
Quick response	Yes Local production, also in Asian and African countries Cooperation with large factories Author celebrity collections Transportation costs, storage, bottlenecks	Yes Locally produced in China Matrix structure of suppliers Cloud-based management Small and medium-sized companies Individual designers
Wide range	Yes/No Approximately 500 new items per week	Yes Approximately 1000 new items per day Plus size fashion
Low prices	Yes	Yes, up to 50% lower than competitors' prices
Responsible business	Yes/No. Individual initiatives, reports	No. No transparency, no information, rather a declaration

Source: own elaboration based on Camargo *et al*. (2020); Caro and Martínez-de-Albéniz (2015); Drake and Marley (2010); Jin and Shin (2020).

Jin and Shin (2020) have listed three disruptive innovations of an ultra-fast fashion business model. The first is the online-only business (born digital), which involves the direct sale of relatively high-quality, complementary products at competitive prices, with a free offline trial. Shein operates primarily online, selling a wide range of products via its website and extremely popular app (177.49 billion downloads in 2021, 80.48 million by May 2022 (Thomala, 2022)). Since Shein does not have brick-and-mortar stores, there is no need for regular delivery and replenishment of the assortment, producing savings in transportation and storage. In this way, Shein also avoids additional postage and customs fees for

transporting larger quantities of goods to international locations. The lack of physical stores also proved to be beneficial during the lockdown of many economies during the Covid-19 pandemic. Unlike *e.g.* Zara and H&M, Shein did not experience losses from stores closures and border-stopped deliveries. Orders were shipped directly from China warehouses and because the country has attained 'developing' status under the World Postal Union, Shein benefited from significant delivery discounts. Furthermore, individual shipments of less than USD 800 in the USA, GBP 135 in the UK, and EUR 150 in the EU are not subject to import duties. Low prices and a huge selection compensate shoppers for a slightly longer shipping time. Shein also establishes *ad-hoc* stationary stores in various locations that operate temporarily to reinforce the power of the brand. Customers can bring their no longer needed Shein clothes to exchange them for coupons and promotional points.

The second business model innovation is the use of AI and big data for design, trend analysis, sales forecasts, marketing, and product presentation (Jin & Shin, 2020). The data comes from customers' website profiles, apps, and social media, and its analysis allows Shein not only to predict and create trends, but also to plan production volumes and select suppliers (Li, 2021). With the help of advanced AI algorithms, Shein makes realistic demand forecasts, adapts and personalises products and styles, and also captures and creates new fashion trends. Moreover, AI enables further savings due to more flexible production and fewer errors when forecasting supply. Shein's lead in applying algorithms and relying on an extensive big data system corresponds with the custom-made tool coupled with Google Trends Finder (Li, 2021).

The third element is the development of collaborative consumption, such as flexible offerings that include renting, exchanging, and reusing a given product, usually based on consumer platforms (Jin & Shin, 2020). Shein is not yet active on a large scale in this area, although a program to exchange used items for discounts and coupons may be the first sign (Ciment, 2022). Furthermore, the use of gamification, *i.e*., likening shopping to a virtual game with rewards in the form of more promotions, encouraging customers to organise Shein hauls, and stoking interest online, has made this brand one of the most popular on social media (Ahmed, 2021).

Shein's Business Model Specifics

The presence of Jin and Shin's (2020) generic choices in Shein's business model might be sufficient to explain the company's key competitive advantage. However, its business model also includes new, innovative elements that make its low-cost strategy difficult to imitate and more sustainable.

Firstly, Shein's response speed has been reinforced by the specific structure of its supply chain. The vast majority of production occurs in the industrial region of Guangdong in South-eastern China. Shein carefully builds and nurtures relationships with clothing manufacturers – smaller factories that work with Shein on an exclusive basis, and designers. Collaboration with small and medium-sized companies allows Shein to receive orders daily and reduce the size of those orders down to approximately 100 pieces. To reinforce suppliers' loyalty, Shein uses short payment terms – 30 days instead of 90 days, the standard in the industry. Communication occurs using a mobile app similar to the one used by Uber (Nguyen, 2021). Hence, supply chain management is done in the Cloud, which allows for fast and automatic ordering of even more of the products that are currently selling well (Olcott & Eley, 2021). Shein's matrix structure of suppliers and cloud management of the supply chain have created new dimensions of competitive advantage, because it has enabled the company to process information more efficiently and develop key product innovation capabilities that translate into cost and time reduction versus its competitors (Camargo *et al.*, 2020; Peterson *et al.*, 2010). In total, Shein works with a team of more than 1000 designers and 3000 garment factories in China (Cao, 2022).

The effectiveness of the QR system in the ultra-fast fashion sector is primarily evidenced by vertical integration, real-time communication, the introduction of technological and process innovations, efficient logistics, and flexibility and cooperation at every level of the value chain – design, production, and distribution (Camargo *et al.*, 2020; MacCarthy & Jayarathne, 2010). Favourable production conditions resulting from the 2004 regulatory liberalisation, extensive infrastructure including delivery by passenger cars, low labour and material production costs, vertical integration of the supply chain, the introduction of innovative management and communication methods, and innovations, such as solar-

powered cars are an important and successful combination of factors that can hardly be replicated (Drake & Marley, 2010; Li, 2021; Peterson *et al.*, 2010).

Secondly, Shein adapts to market trends and manages frequent assortment changes better and faster than its competitors, which may be directly related to the effectiveness of QR. On average, 1000 new items appear on Shein's website per day, which was most evident during the pandemic and shipping bottlenecks – the number of new items offered by Shein outperformed Boohoo by 1385%, H&M by 6584%, and Zara by 4259% (Cao, 2022; Marci, 2022). Thus, its customers feel that Shein can meet their expectations better than other competitors, also with reference to plus-size clothing, which accounts for 19% of the assortment and outperforms Boohoo's 15% and Forever 21's 14% (Marci, 2022).

Thirdly, Shein excels in offering fashionable clothes at affordable prices. Shein's prices are lower than those of its competitors (up to 30%-50% lower than those of Zara or H&M (Cao, 2022)) and also attributable to the structure and operation of the supply chain. Cost reductions throughout the production process, even in terms of wages, may be among the plausible explanations (Jackson, 2022). The lower prices are also linked to savings in distribution, warehousing, transportation, customs, and postage. These prices, aggressive marketing, contextual advertising, the activities of influencers, and ordinary social media users, as well as discounts, coupons, and promotions, make customers add more products to their shopping carts and often even repeat purchases.

Finally, Shein's advantage over its rivals derives from the initial conditions of doing business. The Chinese giant is subject to different laws and is not burdened with the obligation to publish detailed reports. Therefore, there is no certainty about how it addresses principles related to environmental protection, sustainability, corporate social responsibility, and ensuring decent working conditions. The rather specific treatment of intellectual property rights and principles of political correctness manifests itself in products that are almost identical to those offered by rivals, or that contain sometimes religiously, socially or politically controversial symbols (Olcott & Eley, 2021).

To summarise, our description of the ultra-fast fashion business model is based on research on the fast fashion industry. As this is a new phenomenon that can be compared with the long-established one, we took recourse to the findings of Jin and Shin (2020), Caro and Martınez-de-Albeniz (2015), Camargo *et al.* (2020), Drake and Marley (2010) related to strategic choices in this industry, with an additional element referring to sustainability. Such a configuration of strategic choices may be perceived as a starting point for the analysis of the ultra-fast fashion business model.

CONCLUSIONS

This study enhanced our understanding of the importance of business model choices and the links between strategy and innovative elements of the business model. We used Shein as an example, because despite a relatively short history of development, it exhibits extraordinary performance in both financial and market terms. Our main contribution relates to the explanation of how Shein's strategic choices and innovations in the business model led to its low-cost and speed-related competitive advantages, which in turn produced remarkable market performance.

Summarising these results, we would like to point to three elements that in our view are important, both theoretically and in terms of managerial recommendations. The first is the value of timing a strategy. Much has been written about the first-mover advantage (Suarez & Lanzolla, 2007), but Shein's case study underscores very well how important are the timing of strategic choices and their implementation. While existing competitors in the fast fashion industry have tried to add an online dimension to the traditional operations that constituted the core of their business model and develop omnichannel capabilities, as a new player, Shein was able to focus entirely on the fastest growing online market segment, thereby making online domination the essence of its business model. The second significant element is the use of multiple modern technologies, which allows Shein to maintain low-cost operations despite their growing scale and scope. Thirdly, Shein's example confirms once again the importance of initial conditions for a company's success (Chandler & Hikino, 1994). As a Chinese company, Shein benefited initially from several explicit and tacit market advantages ranging from the

huge scale of the Chinese market, the wide acceptance of mobile telecommunications and online markets, to low-cost suppliers and less restrictive legal conditions when they were doing business.

The managerial implications of our analysis are indeed profound. Shein's new business model contains not only crucial new choices and activities, but overall, it also represents a new strategic configuration that fits into the trends emerging in the business and social environment today. Shein's present success, growing market share, goodwill, and unflagging consumer interest lets us believe that ultra-fast fashion is not a temporary phenomenon, but rather an important business model that has become one of the standards in the fashion industry and may migrate to other industries in which online presence and the use of mobile apps can become a key competitive advantage. Further, it can be difficult for existing companies to emulate such business models as a basis of their low-cost strategy, because that would demand a change in organisational architecture (Henderson & Clark, 1990).

While the nature of a single-case study method like the one we have presented here has obvious limitations typical of qualitative studies – because it has limited external validity and does not allow generalisations – the critical case of Shein seems to demonstrate the value of mixing old principles with a new approach to business strategy in turbulent times.

Therefore, further study of this model, especially regarding its organisation and supply chain management, responsible business, marketing and communication, and the psychological issues related to impulsive buying, FOMO, the tendency to throw away and replace unwanted products with new ones may be of particular interest to understand fully the social and economic principles and consequences of its application. However, taking note of Shein's approach to managing information about their business, future research in this area could be hampered by limited access to empirical data and thus be forced to rely on second-hand analysis of the literature and web sources, which were both the limitations of this article.

Nonetheless, the ultra-fast business model noted here seems to be extending and replacing the market order in the sense expressed by Gavetti and Porac (2018). Given the possible transferability of its elements to other industries, the ultra-fast fashion business model may find its true followers and become a new standard that should be further investigated in greater detail. Whether this change will last and to what extent it allows for imitation is the question of the future, which must take into account changing market circumstances and especially the customers' growing environmental awareness and potential shift towards sustainability, less consumption, and a slower pace of life (Guillén, 2020).

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Online financial calculator as a microlearning tool for entrepreneurs in business modelling

Ludmila Walaszczyk, Sandra Dingli

ABSTRACT

Objective: The article aims to present the opportunities of the practical use of an online financial calculator considered as an improvement when compared to already existing tools and as a supplement to Osterwalder and Pigneur's business model canvas. It facilitates the calculations required by entrepreneurs and start-ups to assess data related to financial forecasting.

Research Design & Methods: The article adopts a conceptual analysis approach and a statistical evaluation of the proposed financial calculator by 58 Polish entrepreneurs. The latter tested the calculator and assessed its functionality, listing the most interesting aspects.

Findings: The results demonstrate that forecasting the payback period over several years is the most useful function offered by the proposed online financial calculator. The second most important element is its calculation of an estimation of investment costs, which is useful for start-ups and entrepreneurs. The conceptual analysis findings consider the tool to be a form of 'microlearning' and an improvement on existing tools. The article demonstrates how it can be easily used by entrepreneurs and start-ups for conducting financial calculations.

Implications & Recommendations: An analysis of the already existing financial tools indicates that they are either too simple or too complex. The proposed online financial calculator supplements the information inputted into the cost structure and revenue model elements in the business model canvas. The financial calculator ought to act as a tool that significantly supplements the business model canvas.

Contribution & Value Added: This article addresses a gap in the literature related to criticism directed towards the business model canvas. The latter does not allow for any financial calculations. The inclusion of the financial calculator with the business model canvas enables the provision of new financial insights. It enables entrepreneurs to assess when economic viability will be achieved. Considered a simple and easy-to-use microlearning tool, the financial calculator is user-friendly and it allows for the inputting of data (multiple times, if required) in a brief period, being both cost-effective (as it is publicly available online at no cost) and efficient due to the brief period required to use it. To date, there is no other adequate tool that may be used to determine the optimisation of assets of either a start-up or of an already existing enterprise. Neither is there an adequate online financial tool that addresses the cost structure and revenue streams elements in the business model canvas.

Article type: research article

Keywords: business models; financial calculator; NPV; IRR; microlearning

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INTRODUCTION

This article proposes the use of an online financial calculator as a supplement to the cost structure and revenue streams elements in Osterwalder and Pigneur's (2010) business model canvas (BMC). This tool is available as part of the 'Understanding and Developing Business Models in the Globalisation Era' (ProBM2) project, financed by the European Commission under Erasmus+ (University "Dunarea de Jos" of Galati, 2023). The project was based on the fact that more and more enterprises

are established every year, but less than 40% of them survive for more than the first five years. One problem appears to be that entrepreneurs and start-ups do not sufficiently appreciate or value the power of business models nor do they pay adequate attention to the quantification of financial elements that would lead to increased sustainability and eventual scalability that are both important considerations, particularly at the stage of enterprise creation.

The use of an online financial calculator, which is presented as a form of 'microlearning,' is considered as an improvement when compared to already existing tools, some of which are discussed in this article. Its use facilitates the calculations required by entrepreneurs and start-ups to assess data related to financial forecasting, including the break-even point (BEP) and internal rate of return (IRR). Therefore, the article aims to present an online financial calculator, which the authors consider as an improvement when compared to already existing tools and as a supplement to Osterwalder and Pigneur's business model canvas. This is in line with the views of Rauch and Hulsink (2015) who researched the effectiveness of entrepreneurial behaviour. In their view, 'teaching people how to write a business plan is not enough' (p. 201). They suggest that entrepreneurship education ought to apply theoretical concepts to the real world. The online financial calculator is an easy-to-use and user-friendly microlearning tool. It allows for the inputting of data (multiple times, if and when required) in a brief period, thus being both cost-effective (as it is publicly available online at no cost) and efficient, as the time required to use it is approximately 15 minutes. To date, there is no adequate tool that may be used to determine the optimisation of assets of either a start-up or of an already existing enterprise. Neither is there an adequate online tool that addresses the cost structure and revenue streams elements in the business model canvas in financial terms and which allows for an evaluation of investment costs and a consideration of the time required by an enterprise to break even.

This article was inspired by Lehman and Bidmon (2021) who suggested the use of a Business Coaster as a tool to support students to better deal with the financial elements (i.e. the revenue streams and cost structure) on Osterwalder and Pigneur's (2010) BMC. Their proposal aimed to support 'students and entrepreneurs alike' to overcome what they claim is a 'difficult task,' to address questions related to the 'profit formula' and to deal with the manner in which an enterprise can monetise the value it creates. Lehman and Bidmon (2021) correctly draw attention to the fact that problems related to financial viability may arise, due to the absence of specific financial elements in the BMC. They further claim that students who learn about business models would rightly expect to learn more about the commercialisation and monetization of their new business ideas. This article claims that the proposed online financial calculator is an improvement on Lehman and Bidmon's (2021) Business Coaster proposal. It offers entrepreneurs a simple and explicit microlearning method to calculate costs related to investments when conducting business modelling. It is easy to complete, and it offers clear and concise results.

The article will start with a critical discussion of Osterwalder and Pigneur's (2010) business model canvas and provide an overview of business models. An assessment of existing available financial tools will follow, including a discussion on financial literacy. The research methodology will be then outlined, followed by an analysis and discussion of the results of this research. The article will conclude with a summary and some reflections.

The article addresses a gap in the literature concerning criticism directed towards the business model canvas, which does not include any financial calculations or financial forecasts. Supplementing the business model canvas with the financial calculator enables entrepreneurs and start-ups to assess when economic viability will be achieved and it enables the provision of new financial insights.

The paper is structured as follows. At first, we will focus on the definitions of business model concept, the identification of available tools for assessing the financial aspects of business models and the presentation of a financial calculator as a micro-learning tool. Subsequently, we will elaborate on the methodology of our study. We will then present our findings and finally, we will discuss the usefulness of the developed financial calculator in the business creation process.

LITERATURE REVIEW

The Business Model Canvas

Osterwalder and Pigneur's (2010) business model canvas (BMC) has achieved a great deal of success and popularity, mainly because it enables users to either design or visualize their business model through the completion of a clearly laid out template. The BMC offers the possibility to outline and assess one (or more) of its nine elements and to appraise the relationships between the elements. There has been a great deal of criticism directed towards Osterwalder and Pigneur's (2010) BMC. This is mainly directed towards three areas: (1) the sequence in which the BMC ought to be completed; (2) the absence of any financial quantification, and (3) the lack of strategic elements or strategy direction.

This article focuses on the financial element, mainly by proposing the use of a developed online financial calculator which acts as a tool to provide a better visualization of possible investments in an enterprise. The proposed online calculator may be used to (1) determine the optimisation of assets of a start-up or an already existing enterprise, and (2) demonstrate whether, where and how an enterprise's investments costs could be decreased to achieve optimal results related to two elements in the BMC, that is, cost structure and revenue streams. Although financial aspects are related to almost all the elements of the BMC, this article focuses mainly on the cost structure and revenue streams elements.

Some Basic Definitions of a Business Model

At the most basic level, a business model is defined in terms of an enterprise's economic model that provides a consistent logic for earning profits (Morris *et al.,* 2005; Andreini *et al.,* 2022; Paiola *et al.,* 2022). This approach treats a business model as an economic concept that, on the one hand, generates revenue for the company, and on the other hand, produces costs that will be incurred to ensure the continuity of revenue generation. This approach to business models has been adopted by various authors, whose definitions of the term echo Drucker's (1994) theory of business, where a business model is considered to be a set of assumptions about what a company gets paid for.

Authors who treat a business model as an economic concept include:

- Stewart and Zhao (2000) who define a business model as 'a statement of how a firm will make money and sustain its profit stream over time' (p. 290);
- Rappa (2010) who states that a business model is 'the method of doing business by which a company can sustain itself – that is generate revenue' (p. 2);
- Teece (2010), who states that 'a business model articulates the logic and provides data and other evidence that demonstrates how a business creates and delivers value to customers. It also outlines the architecture of revenues, costs, and profits associated with the business enterprise delivering that value' (p. 173);
- Gambardella and McGahan (2010), for whom a business model is a plan for profit generation that assumes the design of activities and the accumulation of resources 'that drive a wedge between operating costs and revenues by making the firm more efficient than rivals' (p. 263);
- Chesbrough (2012) who defines a business model as 'a useful framework to link ideas and technologies to economic outcomes' (p. 79).

These definitions focus on the financial components of a business model, namely, the cost structure and revenue streams, and their impact on the success of the enterprise. It is, therefore, necessary to understand how an enterprise makes and spends money and to visualise both the cost structure and revenue streams of a company (Dudin *et al.*, 2015), particularly when utilizing Osterwalder and Pigneur's (2010) BMC, *i.e.* the architectural configuration that helps entrepreneurs or business owners picture all the building blocks of a business model, which are portrayed as nine elements.

The cost structure element in the BMC refers to the various types of expenses a company incurs in its day-to-day operations. It covers investment costs, such as fixed costs (*i.e.* costs that do not change with an increase or decrease in the amount of goods or services produced or sold), and variable costs (*i.e.* costs that change, depending on the volume of production). The cost structure element further

addresses the question: How are costs allocated? This is a key element in a business model, because the maximisation of profits requires minimisation of costs and proper cost allocation. This may be done based on in-depth analysis and understanding of all costs incurred, which enables the reduction of certain costs (without affecting the quality of the products or services offered) and an increase in the profitability of certain products or services.

The revenue streams element describes the different sources of income that an enterprise receives in exchange for the services or products it offers to each of its customer segments. It addresses the question: How much income can be generated? A thorough consideration of the revenue streams element is important, because this helps entrepreneurs to better understand the nature of individual income streams and to predict their cyclicality. It further measures an enterprise's ability to monetize value offered to customers and provides increased financial stability for business development (Remenova *et al.,* 2020).

The cost structure and revenue streams elements provide support to entrepreneurs when assessing the operational and financial sustainability and scalability of their business activity, but without providing any financial projections.

Assessing Available Financial Tools

Running an enterprise requires a calculation of costs and financial skills (Tajpour *et al.,* 2021). Finding a tool that supports this process is not a simple task. Tools available online are either commercial solutions or they do not include all the necessary elements. Some are too simple, others unduly complicated. Some include online templates, while others are narrative descriptions of the process or an outline of the steps one needs to go through to compile a profit and loss statement. This section discusses some tools available online.

The U.S. Small Business Administration provides online instructions aimed at potential entrepreneurs, supporting them in writing a business plan that includes most of the BMC elements and providing a template with steps that entrepreneurs can follow to calculate their start-up costs (Small Business Administration, 2022). Another website, Small Business Trends (Small Business Trends, 2022) provides an online calculator and instructions for potential entrepreneurs to calculate their start-up costs.

Although Tim Berry (2012) does not provide a specific financial calculator, they provide a rather complicated step-by-step description of how start-up costs ought to be calculated. A valuable feature is the provision of numerous useful definitions of key terms, such as: 'Startup costs are expenses incurred before the business is running. These are the bills and expenses you will need to cover leading up to the launch of your business.'

Zoho Finance (2022) provide several definitions and downloadable Excel sheets that may be used to calculate fixed costs and variable costs.

Lehman and Bidmon (2021) admit that 'validating the profit formula of a business idea is a difficult task for students and entrepreneurs alike' (p.i). Their model, which they call 'a reduced P&L on a beer coaster' (p.iii), is composed of 11 lines, together with a column for comments. Figures may be inputted either 'top-down' (*i.e.* working from sales to profits), or 'bottom-up' (*i.e.* working from profits to sales). Numbers are inputted manually into only one column every month. This is a rather simple model with several shortcomings, mainly because it is designed to be completed manually and provides space only for numbers relating to one month, with no indication of when the break-even point would be achieved.

Financial Calculator as a Microlearning Tool

One of the main lines of criticism directed towards Osterwalder and Pigneur's (2010) BMC is the absence of quantification related to the financial viability of the enterprise concerned. It is, however, to be admitted, that the BMC refers 'in the first instance to a conceptual, rather than a financial, model of a business' (Teece, 2010, p. 173). Missing out on the numbers could, nonetheless, prove to be a critical mistake. Relevant questions that ought to be addressed include:

- Once the target markets have been identified under customer segments, how many people are there in each of the target markets?
- How many units (of the product or service) can you expect to sell in one year?

- How much does it cost to acquire a customer?
- If the enterprise is a new start-up, when can it expect to achieve a break-even point and, subsequently, profitability?
- Can variable costs be tweaked to either increase profitability or achieve a break-even point earlier than initially expected?

This process is not easy, particularly for those persons with limited financial education or with poor financial literacy. The creation of the proposed online financial calculator aims to simplify and extend this process.

Based on the needs of the entrepreneurs, their engagement in doing work and their lack of time to spend on a long training course, the ProBM2 project developed a financial calculator that fulfils the conditions of being a microlearning tool (Taylor & Hung, 2022). Microlearning incorporates:

- focus on the specific educational needs of the learner and it leads to the achievement of a specific goal, providing one training unit per issue. The financial calculator focuses on a specific competency, that is, how to estimate costs in order for an investment to be effective,
- in addition to educational content, elements that allow learners or entrepreneurs to practice and check the content discussed in a given training unit (*e.g.* tests, quizzes, self-reflection). The proposed tool is presented in the form of a template in which learners or entrepreneurs may input the numbers of different cost categories in the investment planning process. If they have problems with inputting the appropriate numbers, they may analyse examples that are available on the website,
- brevity (depending on the source, the exercise should take a maximum of seven (COL, 2021), eight (Omer, 2017) or 15 (Buchem & Hamelmann, 2010) minutes. The time used to input the data into the financial calculator can be brief. The learner or entrepreneur may complete the template quickly to check whether their projections are acceptable or whether there is a need to improve them. This process is expected not to take longer than 15 minutes,
- the educational content in an interesting multimedia or digital form (*e.g.* video, podcast, animation, game, infographic, interactive document or presentation). The proposed tool is interactive, which means that learners or entrepreneurs may complete the template as many times as they wish or as often as is necessary,
- technologies and applications available on mobile devices. The financial calculator is available from the ProBM2 project website. It is possible to work with the tool through mobile phones, therefore, users may apply the calculator at any place and at any time,
- access to the presented content at a time that is convenient for the learner or entrepreneur,
- a design that allows for its use at different stages of the training cycle, *i.e.* as an independent short training course or as part of a larger training programme. The financial calculator may be added to the modules related to the revenue streams and cost structure of the BMC. On the other hand, users may apply the financial calculator independently, without any need to access the modules (Buchem & Hamelmann, 2010; Hug, 2006; COL, 2021; Omer, 2017).

The fact that the financial calculator considered as a microlearning tool is available online is relevant and in line with the views of Lin and Sekiguchi (2020), who conducted a systematic literature review on journal articles from the domains of both e-learning and entrepreneurship/management. They claim that 'the topic of e-learning in entrepreneurship education is facing urgency in practice and scarcity in research' (p. 40). Kossen and Ooi (2021) and Nur Fitria (2022) draw attention to the fact that when designing training in the form of microlearning, several issues should be considered (see Table 1).

Like any other educational method, microlearning has its advantages and disadvantages (COL, 2021; Pappas, 2016; Shail, 2019). Training in the form of microlearning allows for time-saving and cost-reduction. These types of courses are quick to prepare and often use freely available technology and social media platforms which enable content sharing and may be displayed on various devices, anywhere and anytime. This provides users with the opportunity to take control of what they learn and when they access the available material. Thanks to the simple and concise presentation of the financial calculator, microlearning allows the cognitive load to be reduced and the content provided to be as-

similated more effectively. In addition, thanks to the digital technologies used, it provides an opportunity to ask questions, discuss the content presented, and receive feedback, mainly because the synchronous and asynchronous communication channels generally used in microlearning (*e.g.* discussion fora, instant messaging, blogs, e-mail) provide learners with an opportunity to contact other course participants, teachers, and mentors. In the case of the financial calculator, the feedback is not direct, which means that there are no fora or chat functions, but users may simulate the calculations as many times as they wish. The level of net present value (NPV), the internal rate of return (IRR), and also the payback period will reveal whether the estimations are correct.

Table 1. Issues to be considered when designing microlearning

Issues to be considered	Linkage to the financial calculator
Where will the microlearning be stored and from where (how?) will it be made available?	The financial calculator is publicly available directly from the ProBM2 project website. ProBM2 project: (https://probm2.cti.ugal.ro/site/en/financial-calculator/).
How will participants have access to it?	Through the ProBM2 project website.
How will participants find out about it?	The financial calculator is available to everyone. It is disseminated through social media platforms and via face-to-face meetings and training sessions in Poland, Malta, Romania, Greece, Italy, Portugal, and Switzerland.
How long will the content be available for?	The ProBM2 project sustainability is five years, therefore, the financial calculator will be available until at least 31 March 2027. However, because there is no similar tool available, the project coordinator will ensure that the project website is maintained and left available for longer.

Source: own elaboration.

The fact that microlearning responds to the specific training needs of learners also gives them a greater sense of fulfilment and satisfaction with the results achieved and the learning outcomes.

However, despite the many advantages, there are some disadvantages. First of all, this form of training is ideal for simple issues but unsuitable for complex and extensive educational content. Microlearning uses various digital technologies, which for some learners and teachers may be associated with problems resulting from a lack of knowledge or their ability to use or access them. Microlearning gives learners a great amount of control over the training process (it is the learner who decides when and where to learn), but if the learner lacks motivation, self-discipline, and time management skills, the effectiveness of this training is at risk (Kohnke, 2023). Microlearning generally constitutes a part of a larger educational programme. Individual educational units refer to specific bits of knowledge transferred as part of a more extensive training programme – a learner may have problems identifying links between individual educational units and achieving the overarching goal of education provided for the entire course (Nastase & Popescu, 2023). The only disadvantage of using the proposed financial calculator may be the fact that the users may not fully understand the dependencies between different numbers. They could attempt to estimate the investments for the business, but there are no further explanations related to whether or why the estimations are correct or not as the tool does not provide any form of judgement.

RESEARCH METHODOLOGY

The main objective of the ProBM2 project was to improve entrepreneurs' skills and knowledge about business models, providing several online modules that include the financial calculator. The knowledge and skills acquired by the target groups (*i.e.* educators, trainers, and entrepreneurs) were expected to directly contribute to the design and practical use of a good business model.

This study adopted both a conceptual analysis approach together with a statistical evaluation of the proposed financial calculator by 58 entrepreneurs from start-ups in Poland. The authors decided to apply such a method due to the following reasons:

- Clarifying concepts: conceptual analysis helped to clarify the meaning of concepts used in the online financial calculator. Several concepts were initially not very clear for the respondents, therefore, there was a need to clarify them.
- Rigorous examination: conceptual analysis involves a systematic and rigorous examination of concepts. It entails the breaking down of complex concepts into their constituent parts, exploring relationships, and identifying underlying assumptions. This analytical process helped researchers achieve a deeper understanding of the concepts incorporated in the proposed tool.
- Critical evaluation: conceptual analysis allowed for the critical evaluation of concepts related to the financial calculator. It enabled the authors to assess the strengths, limitations, and applicability of existing tools. Through this evaluation, the authors were able to identify gaps and weaknesses in the developed financial calculator, stimulating further research and theoretical advancements.

The selected entrepreneurs came from different regions of Poland, from micro or small enterprises, and they considered the estimation of investments in their enterprise as crucial for their future existence. The enterprises represented three kinds of sectors:

- tourism sector,
- education and training sector,
- food sector.

The authors decided to choose these three different sectors to check whether the use of the financial calculator is equally important for all these sectors. The number of enterprises represented for each sector is presented in Figure 1.

Figure 1. Number of enterprises from different sectors participating in the research
Source: own elaboration.

Respondents tested the online financial calculator and assessed its functionality, listing what they considered to be the most interesting aspects.

The complete research methodology included four steps:

- Step 1: The literature review on business model elements, available financial tools, microlearning and financial literacy that formed the basis for the conceptual analysis provided in this article;
- Step 2: The creation of the financial calculator;
- Step 3: The first and second assessments of the financial calculator as an element of the module 'cost structure' were conducted by educators, students, and entrepreneurs in seven countries (Poland, Malta, Greece, Italy, Romania, Portugal, and Switzerland);
- Step 4: The third testing of the financial calculator was conducted in Poland during the sustainability phase of the project.

In Step 3 and Step 4, the authors used a semi-qualitative questionnaire in which they included questions related to the usefulness of the financial calculator. The semi-qualitative questionnaire method was used as the number of enterprises was not so high, so the authors had the opportunity to obtain the responses with the use of the face-to-face form. In step 4, to confirm the correctness of the qualitative results, the analytic hierarchy process (AHP) method (quantitative analysis) was used to show the hierarchy of the most important and interesting elements of the financial calculator, *i.e.* the elements that were especially appreciated by the respondents. This article describes the results of Step 4.

RESULTS AND DISCUSSION

Due to shortcomings perceived in each of the calculation tools surveyed, the ProBM2 project developed a simple online tool (see Figure 2) that incorporates the following aspects:

- the estimation of investment costs,
- the identification of core risks underlying business activity,
- the identification of fixed costs (per year),
- the identification of variable costs (per service),
- the calculation of the Break-Even Point (BEP), and
- financial forecasting including an estimation of the payback period over several years (the calculation of the Net Present Value or NPV, Internal rate of return or IRR).

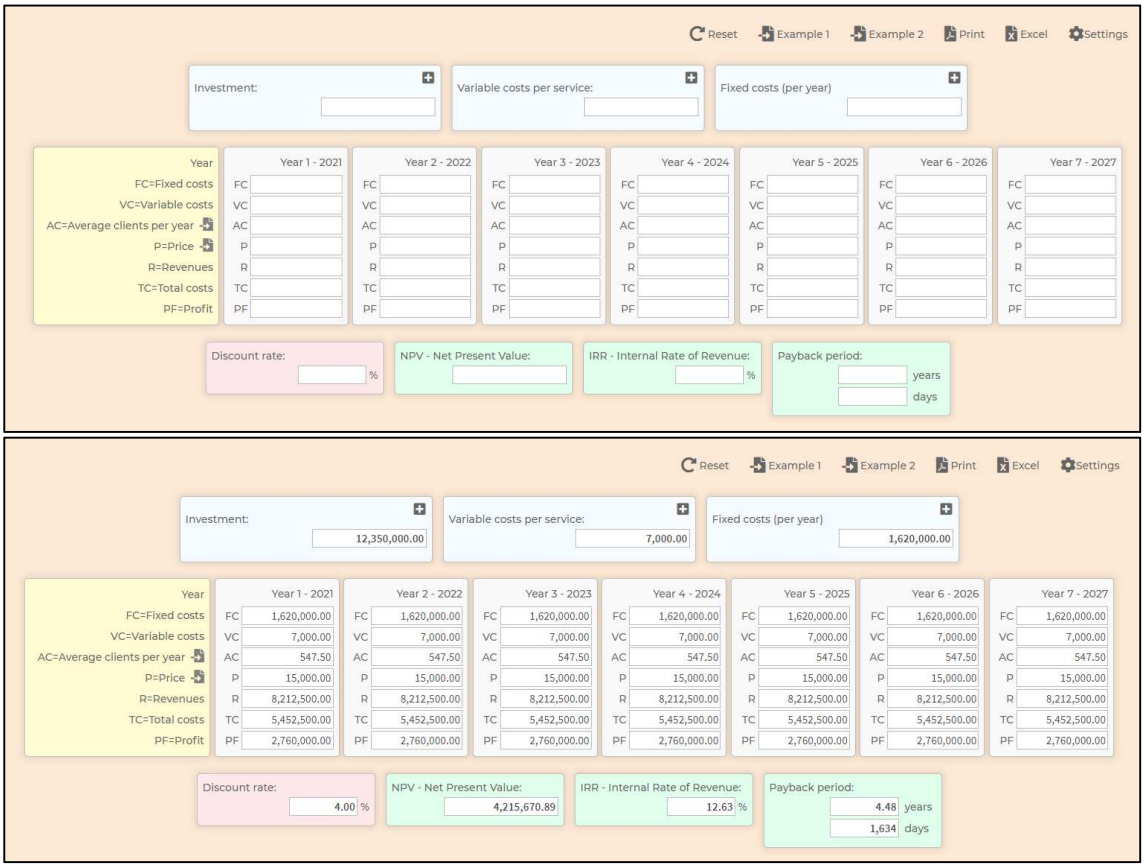

Figure 2. The template and an example of the financial calculations using the financial calculator tool
Source: own elaboration based on ProBM2.

There are many advantages to using an online financial calculator, because there is a need for the calculation of the net present value (NPV), internal rate of return (IRR), or payback period. Using regular mathematics may create difficulties for learners or entrepreneurs, because the calculations could prove to be rather complicated. On the other hand, the online financial calculator provides the following advantages:

- It allows users to input the numbers and the results appear automatically.
- It is possible to change the numbers inputted, if required, and the results change immediately.
- It is not necessary to be familiar with advanced mathematics or to be very skilled in finance to be able to calculate these numbers.

The proposed online financial calculator allows users to make detailed calculations that will indicate when the enterprise is likely to achieve a break-even point, when it is expected to be profitable, and what the payback period will be, allowing for a span of up to eight years.

The online financial calculator allows for the tweaking of the figures inputted to, for example, visualize whether lower operating costs could be achieved to reach the break-even point earlier than expected. Lower operating costs could be achieved mainly by:

- Reviewing variable costs – these are costs that are not fixed but are volume related, dependent on the amount of goods or services produced or delivered. They are directly related to the volume of sales, such as the cost of raw materials (which depends on the amount required), packaging and utilities.
- Economies of scale – the more goods or services that are produced or delivered, the more the cost per unit would decrease.

Clearly defining the target market (as part of the customer segments element of the BMC) and quantifying the number of potential customers for each product or service produced would facilitate the quantification of the expected number of goods or services to be sold.

Although Step 3 (performed between June and October 2021) is not described in this article, it is worth underlining that the idea of the financial calculator was assessed positively (Walaszczyk, 2022). The elements of the calculator were rated as adequate and excellent for practical use.

Out of the 58 entrepreneurs from start-ups (in Poland) who tested the online calculator, 78% found this tool to be highly engaging, because financial competency and skill are extremely important, especially for entrepreneurs and for the continuity of their enterprise. What the entrepreneurs liked the most was the simple and comprehensible language of the tool. They were able to calculate different aspects related to the potential investments at different stages of the enterprise's business life.

During the testing phase, all respondents indicated what they considered to be the top three most interesting aspects of the proposed online calculator (see Table 2).

Table 2. Relative frequency of times the elements are ranked in the top 3

Elements	Frequency (number of times)	Relative Frequency (%)
The estimation of investment costs	43	25
The identification of core risks underlying business activity	32	18
The identification of fixed costs (per year)	5	3
The identification of variable costs (per service)	13	7
The calculation of the Break-Even Point (BEP)	29	17
Financial forecasting including an estimation of the payback period over several years (the calculation of the Net Present Value or NPV, Internal rate of return or IRR)	52	30

Source: own elaboration.

The research shows that the most important function of the online calculator is to forecast the payback period over several years. Participants were able to easily calculate the NPV and the IRR. It is very difficult to calculate these values, but they are very important for the business establishment and business continuity if an entrepreneur does not have a financial background. On the other hand, participants stated that even if it is possible to find the mathematical formulae on the Internet, these are often very complicated and, therefore, cannot easily be used to calculate these values.

The second position belonged to the estimation of investment costs. Participants were satisfied to be able to include these figures, and they received the results immediately. This allowed them to assess whether the business is profitable or not. Users could conduct simulations for their projected future business and assess whether the values were correct or whether they needed to be changed.

The least interesting aspect seemed to be the calculation of the fixed costs. This may seem rather obvious, because entrepreneurs generally know what the fixed costs of the company are, so this is not particularly difficult. This aspect was included in the research, because it is one of the elements that is required for the financial calculations.

The results from Table 2 were confirmed through the use of the AHP method, which is adequate for the hierarchisation of different elements (see Table 3).

The results showed that the quality of the tool is very good. The tool was considered user-friendly, the content and the methodology were found to be useful and comprehensive and the materials pro-

vided were well-targeted to address entrepreneurs who are interested in the topic of business models, thereby achieving their training needs. Most of the participants stated that the materials developed were good or excellent, they were effective in supporting end users during the learning process and they were adequate to support further education on business model application. Moreover, the ease of use and the comprehensiveness of the training material were appreciated. The online tool received very positive evaluations, especially regarding its usability and the organisation of the training materials.

Table 3. Values of the weight of each criterion with the use of the AHP method

Normalised matrix	K1	K2	K3	K4	K5	K6	Average value
The estimation of investment costs	0.330	0.167	0.529	0.290	0.273	0.514	0.318
The identification of fixed costs (per year)	0.066	0.083	0.059	0.032	0.091	0.385	0.066
The calculation of the Break-Even Point (BEP)	0.110	0.167	0.176	0.290	0.273	0.026	0.203
The identification of variable costs (per service)	0.165	0.333	0.059	0.097	0.091	0.043	0.149
The identification of core risks underlying business activity	0.330	0.250	0.176	0.290	0.273	0.032	0.264
Financial forecasting including an estimation of the payback period over a	0.082	0.028	0.882	0.290	1.091	0.128	0.475
Value of the weight of each criterion	0,318	0.066	0.203	0.149	0.264	0,475	–

Source: own elaboration.

The positive results obtained on the potential use of the financial calculator showed that it can be a useful tool for entrepreneurs as the owners of enterprises, but also for managers and students. It may provide entrepreneurs with benefits in the following areas:

- *Financial projections*: Entrepreneurs can use the online financial calculator to create accurate financial projections for their investment plans. By inputting relevant data, such as projected revenue, expenses, growth rates, and timelines, they can obtain comprehensive forecasts of their investments' financial performance.
- *Risk assessment*: financial calculators can assist entrepreneurs in assessing the risk associated with their investments. They can calculate metrics such as the NPV, IRR, and payback period. These calculations provide insights into the profitability, time value of money, and liquidity of the investment, aiding entrepreneurs in evaluating the associated risks and making risk-adjusted investment decisions.
- *Break-even analysis*: Entrepreneurs can utilize online financial calculators to perform break-even analysis. By inputting fixed costs, variable costs, and expected unit prices, they can determine the number of units or sales revenue needed to cover their costs and reach the break-even point. This analysis helps entrepreneurs set realistic sales targets and pricing strategies.
- *Capital budgeting*: financial calculators assist entrepreneurs in evaluating the feasibility of capital investments. By considering factors such as initial investment, cash inflows, cash outflows, and the project's lifespan, entrepreneurs can calculate metrics such as NPV, IRR, and payback period.

Overall, online financial calculators provide entrepreneurs with valuable tools for analysing, evaluating, and planning their investments. By leveraging these calculators, entrepreneurs can make informed financial decisions, assess risks, and optimize their investment strategies for better outcomes.

CONCLUSIONS

Lehman and Bidmon (2021) claim in their conclusion that they conceive ‘entrepreneurship to be the ability to turn financially valuable ideas into action’ and that ‘the business model is at the heart of this process’ as ‘it describes the process of value creation, delivery and capture’ (p.vii). Their solution consists of the development of a simple template that fits onto the back of a beer coaster and may lead users towards a better understanding of the financial viability of their ideas (Tajpour, 2023).

This article concludes that an online financial calculator ought to be attached to the BMC to supplement the information inputted in the cost structure and revenue streams elements. Compiling fi-

nancial projections is an important part of any business model as the BMC on its own does not provide information related to profitability, sustainability, scalability, or to the break-even point.

Financial projections will provide new insights which, together with the information inputted on the BMC, will enable the enterprise to achieve one of its primary objectives, namely that of achieving economic viability. Undoubtedly serious financial projections lead towards a more realistic BMC. The online financial calculator is proposed as a microlearning tool which makes it user-friendly and adds to its ease of use. Microlearning is a teaching method that is part of e-learning, where educational content is presented in the form of short, concise, simple, and absorbing training units (Pawlicka, 2021; COL, 2021; Hug, 2006). Microlearning is an important component of lifelong learning and a training solution often used in the workplace as it constitutes a supplement or an alternative to more time-consuming and formalised learning, such as a classroom or online training (Buchem & Hamelmann, 2010). The proposed financial calculator is a simple tool and it is presented in a concise form. Its aim is mainly to be used online, but if an educator wishes to use it in a classroom, the financial calculator may easily be utilised as a good example for a classroom-based exercise.

However, we can observe the research limitations of the use of a financial calculator. The authors focused only on selected elements that are important for investment. If there was a need to use a calculator for more complex calculations, it might not fulfil its task as it is designed for quite simple calculations.

Future studies could focus on testing the financial calculator with real-life investment activities and verifying its usefulness and assessing how helpful it is for establishing the calculations. An additional area for future research could consist of the implementation of the digital learning approach for entrepreneurship and business models proposed in this article in educational settings and evaluating its impact through student feedback and empirical research.

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Conflict of Interest

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The path to Industry 4.0: The evolution of industry in the national economies of the European Union in 2009-2020

Michał Niewiadomski, Agata Niemczyk, Zofia Gródek-Szostak, Jacek Strojny

ABSTRACT

Objective: This study aims to present the economies of EU countries in the context of transformations in the industrial sector to increase the share of branches with higher technological intensity (changes in the industrial turnover structure). The analysis was carried out at different time horizons.

Research Design & Methods: Research has a quantitative character. The vector elimination method was used to analyse the industrial turnover structure from 2009 to 2020 in 17 EU countries, based on EUROSTAT data.

Findings: The research identified the following national economies: 1) with intensive and long-term but not permanent changes in the structure during the study period; 2) stagnated in the industrial turnover structure due to high-tech; 3) with unambiguous transformations in their industrial turnover structures due to high-tech, aimed at the development of medium-high-tech industries. The research identified countries in which industry did not undergo significant transformations or these transformations were relatively slow. The adopted research hypothesis was confirmed.

Implications & Recommendations: The observed structural changes in the industries of the studied countries allowed us to identify ongoing transformations and assess their stability. Currently, transformations in the industrial sector are associated with innovation and the implementation of new technologies. The development of modern industries in the EU countries affects the economic position on the international stage. Therefore, it is reasonable to constantly monitor the changes that take place in the industrial structure of individual countries, which can provide important recommendations to their respective governments. The results of the research indicate the development directions for the industrial sector, which can significantly facilitate the introduction of regulations that support the development of modern industries.

Contribution & Value Added: The novelty of the paper is that it illustrates changes in the industry turnover structure due to the advancement of technology. The rule of Industry 4.0 development was confirmed, although with uneven dynamics in respective European economies. It will be interesting to study this phenomenon in the future given the impact of the pandemic and the war in Ukraine on the studied phenomenon. The applied method proved useful for this type of analysis and was deemed useful in other areas of studies of the turnover structure in other markets, such as nutrition, which will be undertaken by the authors in the future.

Article type:	research article
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INTRODUCTION

The industrial revolution has come a long way. It started with the water and steam drive to mechanize production (First Revolution). Next, there was the electric drive, enabling mass production and the division of labour (Second Revolution), followed by production automation, using electronics and IT (Third Revolution), as well as cyber-physical systems, and the internet of things and services (Fourth Revolution)

(Siuta-Tokarska, 2021). The latter, also called Industry 4.0, connects the cyber and physical worlds, revolutionizes the production and delivery of goods and services by connecting products, processes, and consumers (Lee, 2015; Teixeira & Tavares-Lehmann, 2022). Industry 4.0 leverages many new technologies (Zhang & Chen, 2020; Adamczyk & Gródek-Szostak, 2022), such as the internet of things (IoT), artificial intelligence (AI), cloud computing, autonomous robots, and sensors (Xu, 2020). As they are implemented more extensively, they impact the evolution of the industrial sector. These changes are reflected in the structure of industrial turnover. At the same time, customers are kept informed about the latest production developments (Bai *et al.,* 2020; Ghobakhloo, 2020; Furstenau *et al.,* 2020).

Manufacturing methods and processes have developed over the decades, allowing companies to increase production, efficiency, and productivity (Luthra & Mangla, 2018; Sharma *et al.,* 2021). The comparative advantage of developing countries in terms of low-skilled and low-cost production is threatened by the increasing automation of repetitive, low-skilled tasks. Today's hub infrastructure increases efficiency and cuts some costs. It also reduces capital costs and delays overseas export to lower-wage countries (Burritt & Christ, 2016; Bonilla *et al.,* 2018; Brozzi *et al.,* 2020).

Industry 4.0 is therefore characterized by a combination of smart products, smart factories, smart logistics, and the internet of things to enable real-time information on a number of operations throughout the supply chain (de Sousa Jabbour *et al.,* 2017). Liu *et al.* (2020) predict that the new era of smart production will be driven by the principles of sustainable development. Along with its technologies, Industry 4.0 is a new business mindset that helps organizations transition to sustainable development. Smart systems that take advantage of the possibilities of Industry 4.0 have several consequences in terms of sustainable development, such as an optimized use of resources and technology (Quezada *et al.,* 2017; Felsberger *et al.,* 2020).

The transformations in question are also determined by the state of the economy of a country resulting from its social, economic, or technological capabilities, *i.e.* its potential. Bearing this in mind, an attempt was made to fill the research gap and to recognize the structures of industry in the economies of EU member states that have appeared on the way to the Fourth Industrial Revolution. Hence, we formulated the following research question:

RQ: What is the time span of transformations in the industrial sector, which are to increase the share of high-tech industries?

The structure of industrial turnover was analysed within a twelve-year period.

The research hypothesis is as follows. Among the national economies that undergo industrial transformations that increase the share of high-tech sectors over time, some countries undergo this transformation in a short period. The applied research methodology was desk research. The analysis was based on a public dataset from EUROSTAT in 17 EU counties between 2009 and 2020. The vector elimination method was used in the study.

The following section will review the related literature on the subject and develop the hypotheses to be verified in the article. Section 3 will describe the methods and data used, while section 4 will present the results of the analysis. Section 5 will provide conclusions.

LITERATURE REVIEW (AND HYPOTHESES DEVELOPMENT)

The term 'Industry 4.0' appeared in the strategy of the German industry project in 2011. It was approved in 2015 at the World Economic Forum (WEF) in Davos and used in the book by Schwab (2017), the founder and president of WEF. In this aspect, please note how Ślusarczyk (2019) comments on the concept of Industry 4.0, *i.e.* that it was created by the German government as an attempt to mitigate the effects of the global financial crisis (2007-2009). At the request of the German government, in 2014, the 2011 concept became the national strategy for the development of the German economy (Rao & Prasad, 2018).

From the historical point of view, Kondratiev's observations on Industry 4.0 seem to be significant, as he had identified the waves of economic changes in time intervals. In his research, he distinguished

three waves of similar duration (Kondratiev, 1935; Tinbergen, 1981). Kondratiev found that long business waves are caused, *e.g.* by the expansion of capital goods. The stimulus to induce change is technical progress that occurs in waves. This concept was developed by Schumpeter (1934), who pointed to three economic waves related to the emergence of breakthrough technical or technological developments. Kondratiev's theory is not accepted by most academic economists. However, it is generally agreed that Kondratiev waves are based on pattern recognition. On the other hand, the authors of this study believe that it was Kondratiev, who was the first to emphasize the importance of technological progress for economic development, which is reflected in the contemporary concepts of Industry 4.0.

The Fourth Industrial Revolution involves the implementation of new technologies in the processes of business digitalization (Ghobakhloo, 2018). According to Čater (2021), Muller *et al*. (2018), and Nosalska *et al.* (2019), the main benefits brought about by the introduction of new technologies are: increased productivity, resource savings, process transparency, higher quality, improved working conditions, and more profitable business models. However, according to Terziyan *et al.* (2018), Industry 4.0 is a new way of operating in business (in terms of production and management). The authors believe that Pereira and Romero (2017) were correct in saying that the implementation of Industry 4.0 is beneficial to many areas. For example, it improves production, provides new business and economic opportunities, and affects the transformation of the current environment.

Many authors of works on Industry 4.0 indicate that the main pillars of its development are the development of the internet, ICT technologies, the internet of things and big data (Woźniak *et al.,* 2018; Boyes *et al.*, 2018, Zhong *et al.*, 2017). Technological progress causes dynamic changes in the industry, but as Woźniak *et al.* (2018) emphasize, it is a complicated process that requires knowledge and determination. New technologies are currently a factor enabling changes in standard methods of production. Currently, in the relationship between industry and market, four basic production paradigms can be distinguished in the periods of industrial production. These include craft production, mass production, mass customization, and personalized production (Furmanek, 2018). These last two paradigms can be implemented only thanks to the development of modern technologies and knowledge of consumer preferences. This requires conducting detailed qualitative research and big data statistical analyses. As emphasized by Furmanek (2018) and Ciechomski (2015), product customization is applied in the automotive, jewellery, clothing, and footwear industries. Flexible, programmable production lines are of key importance to the process as they enable the expansion of the product range at a cost comparable to mass production.

Another important factor in the Industrial Revolution 4.0 is its impact on labour. Bendkowski (2017) and Ittermann *et al.* (2015) argue that it is impossible to assess it unequivocally. On the other hand, other authors point to the process of replacing human labour with high-tech machines (Schlund *et al.*, 2014). When analysing the impact of Industry 4.0 on labour, two main concepts can be identified. One has negative connotations, *i.e.* that employees' know-how will be replaced by software. The other is positive, namely that Industry 4.0 will increase employment in response to reindustrialization processes (Bentkowski, 2017). Today, industry includes not only basic machines and production devices, but also IT and customer service systems. Industry 4.0 is based on technologies that integrate the exchange of information between devices, systems, and people. Its idea is to provide access to information anytime, anywhere. According to Wittbrodt and Łapuńka (2017), these aspects should be strongly integrated and connected. Production companies will therefore integrate systems at various levels (Qina *et al.*, 2016).

Industry 4.0 is associated with the implementation of radical innovations that increase efficiency. Novelty and originality create new markets or change the rules of their functioning (one perfect example is marketplaces). Another characteristic feature of Industry 4.0 is the lack of specific manufacturing structures. However, control over industrial processes can be executed by advanced IT systems implemented at various hierarchical levels. In this case, they constitute the framework for the functioning of industrial enterprises.

Despite the growing importance of services, industry is still an important element of countries in the economies of the European Union. Historically, until the 1990s, this sector was undergoing slow and abrupt transformations. The most intense changes in the industry were observed at the turn of the twenty-first century. The reasons for the transformations of the industrial sector are related to

innovation and technology development. As a result of the development of economies, production processes were automated, with particular emphasis on data exchange. Industry is not a single technology, but a cluster of interconnected technologies. These days, companies are slowly learning how to use technologies that are interconnected using communication protocols and increase the productivity of the industry, especially high-tech. As they are implemented more extensively, they impact the evolution of the industrial sector. These changes are reflected in the structure of industrial turnover. By nature, the changes in question do not appear at the same time in all economies of EU countries, which allows for the verification of the adopted research hypothesis:

H: Among national economies undergoing industrial transformations that increase the share of high-tech sectors over time, some countries undergo this transformation in a short period.

RESEARCH METHODOLOGY

Theoretical Issues Related to the Vector Elimination Method

For the purposes of this study, the vector elimination method was used to analyse the structure of industrial turnover in 2009-2020, because it allows for isolating groups of objects with a similar structure from a cluster (Wasilewska, 2009). The vector elimination method allows for assessing the regularity of economic development. It is easy to use and at the same time, it allows for statistical and substantive analysis of the phenomenon.

The vector elimination method was developed by Chomątowski and Sokołowski (1978). It allows for dividing a set of objects into groups per similarity of their structure. Homogeneous groups are separated following a comparison of objects using the 'peer-to-peer' method (Strojny, 2013). The structures of the studied objects in this study were compared by dissimilarity (Kukuła, 1996).

$$v_{jp} = \frac{\sum_{i=1}^{k} |\alpha_{ij} - \alpha_{ip}|}{2}, \quad (j, p = 1, 2, \dots, r) \tag{1}$$

In which:

α_{ij} - share of the *i*-th structure component of the *j*-th object;

α_{ip} - share of the *i*-th structure component of the *p*-th object.

The coefficient v_{jp} ranges from 0 to 1. If its value is 0, the structures of objects p and j are identical. The coefficient v_{jp} takes the value 1 when the structures of the compared objects do not show any similarity. The higher the value of the factor v_{jp}, the more the structures of the examined objects differ from each other (Luty 2012).

Using the coefficient v_{jp}, a structural differentiation matrix was created. The elements on the matrix diagonal take the value 0, which means that the object was compared with itself (Kukuła 1996):

$$v = [v_{jp}] = \begin{bmatrix} 0 & v_{12} & v_{13} & \dots & v_{1r} \\ v_{21} & 0 & v_{23} & \dots & v_{2r} \\ \dots & \dots & \dots & \dots & \dots \\ v_{r1} & v_{r2} & v_{r3} & \dots & 0 \end{bmatrix}, \qquad (\mathrm{j, p} = 1, 2, \dots, \mathrm{r}), \qquad v_{jp} = v_{pj} \tag{2}$$

In the next stage of the research, the threshold value of structure differentiation ε was established. It was determined based on the arithmetic mean of the non-diagonal elements of the matrix. Specifying the value of the parameter ε allowed us to create the matrix w_{jp} with v_{jp}. This transformation was based on the following assumption:

$$w_{jp} = \begin{cases} 0, if\ v_{jp} < \varepsilon \\ 1, if\ v_{jp} \geq \varepsilon \end{cases} \tag{3}$$

The division of objects into groups was performed using the following algorithm (Kukuła, 1996):

1. Each row of the matrix w_{jp} was summed up and the vector w_{j0} was created according to the formula:

$$w_{j0} = \sum_{p=1}^{r} w_{jp}, \quad (j = 1, 2, \dots, r) \tag{4}$$

2. he maximum value of the vector w_{j0} was identified and the object was eliminated by deleting the corresponding row and column.
3. Each row of the reduced matrix w_{jp} was then summed up again and a new vector w_{j0} was thus obtained. Then the maximum value of the vector w_{j0} was determined and another object was removed from the reduced matrix w_{jp}.
4. The operation was repeated from point 3 until all components of the vector w_{j0} took the value 0.
5. Objects corresponding to the rows in the matrix w_{j0} constituted the first group with a similar structure.

This algorithm was applied to the set of eliminated elements. Repeating the procedure formed a second group. The presented course of action was repeated until all objects were grouped.

The use of the vector elimination method allowed for the formation of clusters. The initial groups formed typical structures that showed features of many objects. The last groups, on the other hand, consisted of a few objects with atypical structures.

The Database

The subject of the study was the structure of industrial turnover as per technological advancement in selected EU countries (Austria, Belgium, Denmark, Finland, France, Italy, Netherlands, Poland, Portugal, Romania, Spain, Czech Republic, Germany, Hungary, Slovakia, Estonia, Greece) in the years 2009-2020.

The above classification of industry turnover was carried out according to Eurostat guidelines (Eurostat Statistics Explained, 2022). The European Statistical Office presents the statistics regarding the manufacturing industry by technology intensity. Based on the statistical classification of economic activities in the European Community (NACE), Eurostat compiles data aggregates related to high-tech, medium-high-tech, medium-low-tech, and low-tech (Eurostat, 2015).

At the time of the research, some of the records in the Eurostat database concerning industry turnover in several categories for European Union countries, such as Bulgaria, Croatia, Cyprus, Ireland, Lithuania, Latvia, Luxembourg, Malta, Slovenia, and Sweden, had significant gaps. Therefore, these countries were not included in the analysis.

The completeness of the data used to conduct the study was important. Therefore, for the selected countries, aggregates of the industrial turnover structure, which had significant data gaps, were eliminated. These include the manufacturing of tobacco products, clothing, and leather products, the production of coke, crude oil products, chemicals and chemical products, repair and installation of machinery and equipment, as well as the production of basic pharmaceutical products and preparations.

Based on a list of available aggregates related to high-tech, medium-high-tech, medium-low tech, and low-tech (NACE Rev. 2 2-digit level, Eurostat Statistics Explained, 2022) the structure of industrial turnover was created as per the level of technological advancement. The main components of the structure were included the following aggregates:

Major component 1: high-tech industry turnover.

Aggregate: production of computers, electronic and optical products.

Major component 2: medium-high-tech industry turnover.

Aggregates: manufacture of electrical equipment; manufacture of machinery and equipment n.e.c.; manufacture of motor vehicles, trailers and semi-trailers; manufacture of other transport equipment.

Major component 3: medium-low-tech industry turnover.

Aggregates: manufacture of rubber and plastic products; manufacture of other non-metallic mineral products; manufacture of basic metals; manufacture of fabricated metal products, except machinery and equipment;

Major component 4: low-tech industry turnover.

Aggregates: production of food; production of beverages; manufacture of textiles; manufacture of wood and cork products, except furniture, manufacture of articles of straw and plaiting

materials; manufacture of paper and paper products; printing and duplication of recorded information carriers; production of furniture; remaining production.

RESULTS AND DISCUSSION

The study of the turnover structure allowed us to select sectors that played an important role in the industry in the economies of individual countries. The analysis also allowed for observing the directions of the transformation of economies in terms of industry.

Groups of objects that showed structural similarity were separated using the vector elimination method. The process of grouping the structures was influenced by the alpha coefficient, established based on the arithmetic mean of the non-diagonal elements of the matrix that represents the structural differentiation of the examined objects. The cut of distance for similar groups was $\alpha = 0.191$. The pairs of objects with a lower degree of differentiation than α were classified in the same group.

The turnover records of high-tech, medium-high-tech, medium-low-tech, and low-tech industries were converted into percentages. In total, 17 countries were classified in 12 periods and 8 subgroups with a significant degree of differentiation were selected. The numbers of the largest clusters were as follows: 106 – the first group (approximately 52% of the population), 48 – the second group (approximately 23% of the population), 19 – the third group (approximately 9% of the population), 15 – the fourth group (approximately 7% of the population) (Table 1). The remaining observations from groups 5 to 7 accounted for approximately 8% of the group.

Table 1. Percentage shares of observations in groups selected by the vector elimination method for the industry turnover structure

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
51.96%	23.53%	9.31%	7.35%	3.43%	2.94%	0.49%	1.47%

Source: own elaboration.

Table 2. Structure of industrial turnover in selected EU countries: Characteristics of groups selected by the vector elimination method

Groups / Numbers of respondents		High-tech industry		Medium-high-tech industry		Medium-low-tech industry		Low-tech industry	
Group	N	$\bar{x}$	V	$\bar{x}$	V	$\bar{x}$	V	$\bar{x}$	V
1	106	4.49%	67.84	29.13%	16.58	26.34%	16.65	40.04%	12.66
2	48	8.48%	45.84	47.65%	9.58	23.62%	10.94	20.24%	20.13
3	19	4.41%	102.87	11.11%	32.23	30.05%	21.28	54.43%	7.16
4	15	18.50%	23.84	19.90%	24.61	19.84%	6.26	41.76%	14.87
5	7	5.96%	90.67	41.14%	2.85	19.93%	9.71	32.97%	14.61
6	6	26.51%	13.04	30.09%	28.31	17.63%	4.22	25.77%	19.84
7	1	16.09%	-	13.32%	-	19.38%	-	51.22%	-
8	3	2.74%	19.99	25.13%	34.12	30.32%	7.47	41.81%	18.78

Note: N – group size, $\bar{x}$ – arithmetic mean, V – coefficient of variation.
Source: own elaboration.

The first group of 106 observations was characterized by a share of approximately 40% of the low-tech industry component. At the same time, the turnover in the medium-low-tech industry was approximately 26%, and the medium-high-tech industry component accounted for approximately 29% of the structure. This group also had an approximately 4.5% share of the high-tech industry. The countries characterized by structural stability in the first group were Austria, Denmark, Poland, and Spain.

The second group consisted of 48 objects. In comparison to the first group, it was characterized by a lower share of turnover in the low-tech industry (by approximately 20 pp), medium-low-tech industry (by approximately 3%) and a higher average share of turnover (by approximately 18.5 pp) in medium-high and high-tech industries (by approximately 4 pp). The average components of the

structure of turnover in the industry in the second group were as follows: high-tech industry – approximately 8.5%, medium-high-tech industry – approximately 48%, medium-low-tech industry – approximately 24, and low-tech industry – approximately 20%. The countries that belonged to the second cluster and showed no variability during the study period were the Czech Republic, Germany, and Slovakia.

The third cluster comprised 19 observations. It was characterized by the highest average share of the low-tech industry component in the structure among all clusters (approximately 54%). At the same time, this group had approximately 30% share of the medium-low-tech industry. In this cluster, the medium-high-tech industry component accounted for approximately 11%, and the average value of the high-tech industry was the lowest among the first four groups and amounted to approximately 4%. The structurally stable country in the third group was Greece.

The fourth group comprised 15 observations. It was distinguished by the highest share of the high-tech industry component, amounting to approximately 18.5%, among the first four numerous clusters. The medium-high-tech industry accounted for approximately 20% of this group. At the same time, the average value of the medium-low-tech industry component was approximately 30% and the average value of the low-tech industry was approximately 42%. The fourth cluster did not include countries that demonstrated structural stability.

The groups from 5 to 8 were characterized by a low number of observations and did not include countries showing a stable industry turnover. In groups 4, 6, and 7, the observed average level of the share of the high-tech industry was higher than 15%. The highest average value of the medium-high-tech industry component, amounting to over 40%, was observed in groups 2 and 5. The turnover in the medium-low-tech industry was approximately 30% in groups 3 and 8. The first cluster, on the other hand, contained the most observations (over 50%) and the components of the structure of industrial turnover were not characterized by any special features.

The structures of the studied countries evolved over time, which resulted in changes in the classification of the taxonomic groups. Based on the above, area clusters were distinguished (Figure 1):

- countries that are structurally stable over time: Austria, Denmark, Poland, Spain, Czech Republic, Germany, Slovakia, and Greece;
- countries with a changing structure of industrial turnover over time: France, Romania, and Hungary.

Based on the research results, a diagram was created to graphically present the movement of countries to particular groups in time (Table 3). Groups 4, 6, and 7 are marked green. In these clusters, the share of the high-tech industry was higher than 15%. The orange colour was assigned to groups 2 and 5, which included medium-high-tech industry values that were higher by approximately 40%. Clusters 3 and 8 are marked with a violet colour. The turnover in the medium-low-tech industry was approximately 30% in these clusters. The observations belonging to group 1 are in white.

Among the countries in which the structure of industrial turnover changed, note Belgium in 2017 and 2020, Italy in 2018, and Portugal in 2009. During these periods, the share of the medium-low-tech industry component in the structure increased in the analysed countries. At the same time, the shifting of Belgium, Italy, and Portugal to the segment marked with a dark grid meant that medium-high-tech and high-tech industries were falling in these countries.

The economies of France and Romania transformed during the period considered changing their industrial turnover structure. They increased the share of the medium-high-tech industry component.

From 2009 to 2014 and in 2020, Finland belonged to the group in which the share of the high-tech industry was greater than 15% (marked by light horizontal lines). The same situation affected the Dutch economy in 2009 and the years 2014-2017. The studied countries moved to Group 1 (Finland from 2015 to 2019, and the Netherlands from 2010 to 2013 and 2018-2020). In this group, the average value of the high-tech industry component was approximately 4.5%.

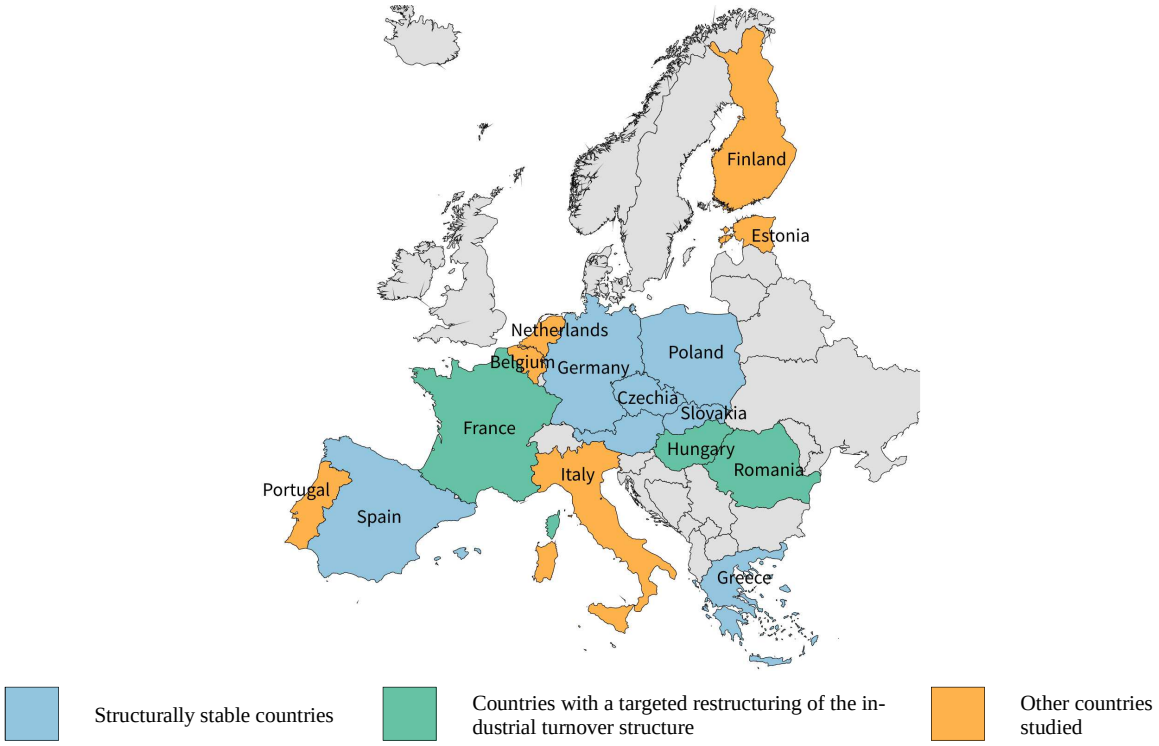

Figure 1. Variability of the structure of industrial turnover over time for selected EU countries
Source: own study in 2023 based ©EuroGeographics for the administrative boundaries.

Table 3. Affiliation of countries to groups obtained by the vector elimination method for the structure of industrial turnover as per technological advancement

Country / year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Austria												
Belgium												
Denmark												
Finland												
France												
Italy												
Netherlands												
Poland												
Portugal												
Romania												
Spain												
Czech Republic												
Germany												
Hungary												
Slovakia												
Estonia												
Greece												

Source: own studies in 2023.

In the Hungarian economy, the structure of industrial turnover changed due to the country's technological advancement. The country moved from the cluster marked by light horizontal lines to the cluster marked in grey. This means that in the analysed structure, there was an increase in the medium-high-tech industry component. At the same time, the share of the high-tech industry decreased. The transformation of the analysed structure in the Hungarian economy was long-term. The observed changes persisted throughout the nine study periods.

On the other hand, for six survey periods (years: 2009-2010 and 2017-020) Estonia belonged to the group marked with a dark grid, in which the share of low-tech and medium-low-tech industry in the structure dominated. In the period from 2011 to 2014, the country shifted to a cluster with a higher share of high-tech industry (averaging over 15%).

The structure of industrial turnover per technological advancement in the economies of the Czech Republic, Slovakia, and Germany was characterized by a high share of the medium-high-tech industry component (over 40% on average) throughout the entire study period. On the other hand, the structure of industrial turnover in Greece was dominated by the medium-low-tech industry component.

The first group included countries such as Austria, Denmark, Poland, and Spain throughout the study period. There were no significant changes in the structure of industrial turnover in these countries. The structures of these countries were characterized by a low value of the high-tech industry component, which was approximately 4.5% on average. In the structure of industrial turnover per technological advancement in the economies of Austria, Denmark, Poland and Spain, the low-tech industry dominated (approximately 40%).

As part of the Industry 4.0 paradigm, production and manufacturing systems are becoming more adaptive and flexible. The point is to meet the growing requirements for the customization of the final product (Profanter *et al.,* 2017). Therefore, according to Nicolae *et al.* (2019), industry will have to adapt to integrating new devices into existing systems without manual intervention. The interest in the concepts related to Industry 4.0 is growing and the implementation of new technologies and their integration with legacy solutions can provide tangible benefits for the economy, society, and the environment. Industry 4.0 also means the digitalization of production through networks of people and machines interacting with each other. Therefore, the main goal of the concept is to improve the competitive position of enterprises by increasing production and minimizing risk. However, as Foresca (2018) indicates, for most companies, the Industry 4.0 concept is still at an early stage. Digital transformation requires overcoming several barriers to its successful implementation. Therefore, there are still many organizations that have not yet applied the Industry 4.0 concept (Foresca, 2018). This is confirmed by the results of the research presented in this paper. To explain the changes in the turnover structure in industry in Romania, France, and Hungary, a study of aggregates of component 2 was carried out (Table 4).

Table 4. The average value of aggregates of the turnover component in the medium-tech industry in the years 2009-2020

Aggregates of component 2 / Countries	France	Romania	Hungary
Manufacture of electrical equipment	11.75%	13.39%	15.69%
Manufacture of machinery and equipment n.e.c.	18.85%	22.35%	14.07%
Manufacture of motor vehicles, trailers and semi-trailers	42.60%	62.37%	63.58%
Manufacture of other transport equipment	26.80%	1.89%	6.66%

Source: own elaboration.

Analysis of data from 2009-2020 showed that the most important aggregate for the component was the production of motor vehicles, trailers, and semi-trailers. On average, it accounted for nearly 43% of the structure of turnover in the medium-tech industry in France. At the same time, this value was approximately 62% for Romania and approximately 64% for Hungary. The average value of the aggregate 'production of other transport equipment' was lower by 2% in Hungary and Romania. In contrast, in France, it was approximately 27%. Aggregates 'production of electrical equipment' and 'production of machinery and equipment not classified elsewhere' accounted for less than 23% in the component structure no. 2 for all three studied countries.

The average value of the aggregate 'production of motor vehicles, trailers and semi-trailers' was higher in 2016-2020 by approximately 31% than in 2009-2015 in France. Moreover, high values in this respect were recorded in Romania and Hungary. In 2016-2020, the average value of the analysed aggregate was 55% higher in Romania and 95% higher in Hungary compared to 2009-2015.

The values of the other aggregates within the component structure no. 2 also showed an upward trend. However, the share of the 'production of motor vehicles, trailers, and semi-trailers' aggregate

in the component structure was the highest. This confirms its high importance for the transformation of the economies of the studied countries in 2016-2020.

The explanation of this situation should be sought in the values of economic indicators. The countries of Central and Eastern Europe (Romania and Hungary) are attractive in terms of investment. This is due, among others, to labour costs that remain low (Table 5). Unfortunately, due to the constantly unstable socio-political situation and the changing business environment, locating industrial companies with advanced technology in these countries is a risky decision.

Table 5. Hourly wage rate in industry in selected EU countries in the years 2004 to 2020 in EUR

Country / Year	2004	2008	2012	2016	2017	2018	2019	2020
Romania	1.2	2.5	2.8	3.8	4.4	5.7	6.2	6.6
Poland	3.2	5.6	5.6	6.3	6.9	7.4	7.9	8.1
Hungary	3.9	5.3	5.7	6.3	7.2	7.8	8.5	8.5
Estonia	2.9	5.3	6.0	7.6	8.1	8.6	9.2	9.5
Portugal	6.8	7.8	8.7	8.6	8.8	9.1	9.2	10.0
Slovakia	3.1	5.2	6.6	7.6	8.1	8.8	9.4	10.1
Czechia	3.9	6.4	7.0	7.4	8.2	9.2	9.9	10.2
Greece	10.1	12.1	11.7	11.7	11.7	11.9	12.3	12.6
Spain	12.8	14.9	16.4	16.8	16.9	17.0	17.2	17.6
Italy	15.1	16.8	19.2	19.4	19.5	19.7	20.2	20.9
France	19.5	22.0	23.6	24.7	25.2	25.6	26.1	26.9
Austria	20.4	21.4	23.8	26.3	26.6	27.5	28.3	29.0
Finland	20.9	23.1	27.5	29.0	29.7	30.3	30.7	30.9
Netherlands	21.3	23.2	25.2	27.9	28.7	29.2	29.7	31.6
Belgium	21.7	24.0	28.8	29.9	30.4	31.1	32.0	32.5
Germany	23.5	25.3	27.3	29.9	30.8	31.5	32.2	32.6
Denmark	26.3	30.3	35.1	37.8	38.7	39.7	40.7	41.2

Source: own elaboration based on Eurostat in 2023.

Please note also that the countries of Central and Eastern Europe have significant infrastructural deficiencies and continue to struggle with problems generated by the command-distribution system. Nevertheless, the example of Romania and Hungary shows that the transformation towards Industry 4.0 is possible.

In France, labour costs are average compared to the richest countries in Western Europe. Combined with high political stability and well-developed infrastructure, this makes France a very attractive investment destination. Therefore, it is not surprising that locating a high-tech business in France can be encouraging. Hence, the dynamics of changes in France in the medium-tech industry is noticeable.

Another noteworthy element is France's research and development (R&D) per capita expenditure ratio (Table 6). Its value for the aggregate 'production of motor vehicles, trailers and semi-trailers' was higher in 2020 by approximately 362% compared to the base year (2009) in Romania. In Hungary, however, this indicator was higher by approximately 431% than the value in the base year (2009).

Table 6. Research and development (R&D) expenditure per capita in selected EU countries in 2004-2020 (2009 = 100)

Country / Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Spain	109	103	97	93	108	105	127	145	149	155	168
Portugal	64	56	46	39	47	53	64	61	56	69	69
Romania	81	124	105	100	162	229	267	314	371	395	462
Finland	84	88	91	107	109	170	172	181	226	237	237
Slovakia	169	125	206	436	381	272	497	736	603	522	294
Hungary	107	115	134	170	177	195	225	279	372	357	531
Czechia	101	119	135	184	174	191	212	288	360	378	289
Italy	108	130	138	145	171	166	176	148	161	168	183

Source: own elaboration based on Eurostat in 2023.

Unfortunately, not all surveyed countries provide such detailed R&D indexes. Therefore, Romania, Hungary, and France cannot be compared to other EU countries. However, the results allow for an unequivocal conclusion that there is an upward trend in research and development expenditures in these countries in terms of the production of motor vehicles, trailers, and semi-trailers. This could impact the transformation of the Hungarian and Romanian economies towards the medium-tech industry in the short term.

CONCLUSIONS

The changes taking place in the structure of industrial turnover per technological advancement confirm that in the economies of some of the surveyed countries, such as France, Italy, Romania, Hungary, Estonia, the Netherlands, Portugal, Belgium, and Finland, the analysed structure was transformed. Based on the analyses, it was found that these countries constituted the majority (approximately 53%) of the surveyed population. However, the changes that were clearly aimed at increasing the share of the medium-high-tech industry component in the structure concerned only three countries, *i.e.* France, Romania, and Hungary (approximately 18% of the studied population). Moreover, no permanent migrations of the studied countries to groups with a higher value of the high-tech industry component were observed. Single-country migrations between groups, as in the case of Belgium, Italy, and Portugal, testify to chaotic and individual changes in the industrial turnover structure. It was also found that the economies of Finland, Estonia, and the Netherlands experienced intense and long-term, yet unstable changes in the structure in the analysed period.

Among all the surveyed countries, approximately 41% of countries (Slovakia, Germany, the Czech Republic, Spain, Poland, Denmark, and Austria) demonstrated stagnation in terms of changes in the structure of industrial turnover per technological advancement. This means that some countries did not develop at all or did so at a slow pace.

The first group accounted for approximately 52% of the total pool of studied countries. It presented the typical features of the structure of industrial turnover per technological advancement. However, it cannot be described as high-tech, because the role of the low-tech industry component was dominant in the structure.

The analysis results confirmed the adopted research hypothesis, *i.e.* among the national economies of the European Union that undergo industrial transformations and increase the share of high-tech sectors over time, some countries undergo this transformation in a short period. The transformations of the structure of industrial turnover per technological advancement, which were aimed at increasing the share of the medium-high tech industry component in the structure, took place unequivocally only in the three analysed countries.

Petrillo *et al.* (2018) emphasize that several advanced economies such as Canada, the USA, Belgium, France, Great Britain, Sweden, Germany, Denmark, the Netherlands, India, Australia, South Korea, China, and Japan are implementing the Industry 4.0 concept. This is partially reflected in the presented research results. In the economies of Belgium, France, and the Netherlands, the structure of industrial turnover technological advancement was transformed in 2009-2020. In Germany, by contrast, the medium-high technology industry dominated throughout the entire study period.

The research demonstrated the usefulness of the applied vector elimination method. Noteworthy, the research has certain unavoidable limitations. Some of the records in the Eurostat database regarding industry turnover in several categories for European Union countries, such as Bulgaria, Croatia, Cyprus, Ireland, Lithuania, Latvia, Luxembourg, Malta, Slovenia, and Sweden had significant shortcomings at the time of the research. Therefore, these countries were not included in the analysis. The authors recommend further monitoring of the analyses in subsequent years with a broader range of objects, all the more that these are years with unpredictable circumstances, such as the war in Ukraine, as well as the energy and economic crisis.

In this context, it can be assumed that the set of countries, in which the changes in the structure of industrial turnover per technological advancement aimed at increasing the share of the medium-high-tech industry component will increase. This is a new hypothesis to be verified in future research.

On the other hand, taking into account the difficult times for the functioning of modern European economies, it could be interesting to expand the research problem. This is to recognize, on the one hand, the progress of the Fourth Industrial Revolution, and, on the other hand, the fact that *the impact, triggered by war, will strongly affect* the economic activity of the surveyed countries.

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Regulation or deregulation of the accounting profession in a sustainable economy? Evidence from Poland

Stanisław Hońko, Marzena Strojek-Filus, Katarzyna Świetla

ABSTRACT

Objective: The article aims to examine how accountants assess the effects of deregulation in the accounting profession in Poland. Our study also included accountants' expectations regarding the regulation of the accounting profession in the future.

Research Design & Methods: The article presents an analysis and assessment of deregulation's impact on the quality of accounting services, the prestige of the profession, and business security, which, in our opinion, are the indicators of the sustainable development of the accounting profession. The data source was the responses of 3307 respondents in a survey conducted by the Accountants Association in Poland.

Findings: Accountants with higher, documented qualifications see more negative consequences of deregulation than accountants without such qualifications. However, a similar relationship was not observed when analysing the age, position, or size of the company with which the accountant was associated.

Implications & Recommendations: The research results indicated disruptions in the functioning of the main pillars of sustainable development of the accounting profession and the need to introduce changes in the regulatory sphere of this profession, including the partial re-introduction of the professional certification.

Contribution & Value Added: Our study contributes to enhancing the knowledge regarding the consequences of introducing deregulation in the accounting profession in Poland from the perspective of a sustainable economy. The results of our study are the starting point for the next research stage concerning the impact of international conditions in the accounting profession on economic development in other countries.

Article type:	research article
Keywords:	accounting profession; accounting; sustainable economy; deregulation of the accounting profession in Poland
JEL codes:	M40, M48

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INTRODUCTION

One of the goals of sustainable development, including economic development, is access to relevant economic information guaranteed to market participants (Goal 8 and Goal 12.8, 2030 Agenda for Sustainable Development). Such access is possible thanks to the accounting system providing information on the condition of various entities, particularly enterprises, through the prepared financial and non-financial statements, which should correctly reflect the economic reality and facilitate the international process of exchanging goods and services. According to the IFRS Conceptual Framework (Conceptual Framework for Financial Reporting, 2018), this information should have appropriate qualitative characteristics, particularly relevance and faithful representation, which guarantee the implementation of the basic accounting concept, namely the true and fair view concept, equivalent to fair presentation concept in IFRS (Garvey *et al.*, 2021; Enyi *et al.*, 2019; Moeinadin *et al.*, 2014; Maines & Wahlen, 2006; Mattessich, 1995; Ijiri, 1975).

However, the correct implementation of the information function of the accounting system in practice depends on many factors, two of which are of key importance. These are the quality of the accounting law, in particular the detailed regulations, and the qualifications and attitude of persons practising the accounting profession (Barac & Tadic, 2011; Moyes *et al.*, 2008; Jackling *et al.*, 2007). Studies conducted in various countries show the great importance of the accounting profession in the process of globalization and the implementation of economic and social changes (Kiestlic *et al.,* 2022; Botes *et al.,* 2014; Parker, 2005; Jennings, 2004).

The guaranteed quality of information presented in the financial and non-financial statements is a prerequisite for achieving the objectives of sustainable economic development (Stryzhak *et al.*, 2022).

Principles-based accounting combined with the true and fair view concept requires accountants to present in-depth knowledge, independence in identifying and solving problems, especially in valuation and reporting, and an ethical attitude in situations requiring separate managerial benefits from solutions allowed by the accounting law. A modern accountant should have professional skills acquired in the education process and improved as part of the professional experience and lifelong learning process (*e.g.* Bui & Porter, 2010; Jackling & de Lange, 2009; Kavanagh & Drennan, 2008). Moreover, research indicates the behavioural determinants of the accounting profession, including cultural, age, gender, and motivation (*e.g.* Kabalski, 2021; Lehman, 2012; Bellou, 2010; Czarniawska, 2008).

In this context, legal and social conditions related to the practice of the accounting profession are particularly important. In Poland, as part of facilitating access to the profession, statutory deregulation in issuing accounting certificates was introduced in 2014. The implemented changes aimed at facilitating access to bookkeeping services (entities providing outsourcing services) and probably could increase the number of people practising accounting. The new regulations abolishing the obligation to obtain an accounting certificate sparked a discussion on their effects, in which numerous critical opinions were presented. Some emphasized that the accountant is a profession of public trust and requires appropriate qualifications. Risks such as lowering the quality of accounting services, reducing the prestige of the profession, diminishing the importance of knowledge acquired at universities, especially in the field of accounting, and undermining the professional satisfaction of accountants in the financial dimension were indicated. The identified threats are contrary to the objectives of sustainable economic development as they disrupt the information function of accounting.

The results of research conducted in recent years in Poland by the Ministry of Finance (MoF), scientists (Buszko & Ciechan-Kujawa, 2020; Ciechan-Kujawa & Szczechowska, 2018), and professional organizations, in particular the Accountants Association in Poland (AAP) – the largest Polish professional organization of accountants – prompted us to join the discussion on the legal status and direction of changes in the field of the accounting profession.

Noteworthy, both regulation and deregulation of the accounting profession have advantages and disadvantages. The main advantage of the regulation is the limitation of the possibility of entering a responsible profession by people without appropriate qualifications, while the disadvantage may be the additional costs of obtaining qualifications and the risk of reducing interest in practising the accounting profession. Therefore, it is necessary to work out solutions that will not lead to overregulation but will indicate precisely the professional development path for accountants.

This research aims to examine how accountants assess the effects of deregulation in the accounting profession in Poland. We investigated the evaluations of this change from the perspective of the accountants as one of the main actors in the accounting service market in Poland. Our study also considered accountants' expectations regarding the regulation of the accounting profession in the future.

We based our in-depth quantitative research on the results of a survey completed by the largest professional organization in Poland, the AAP, in 2022. This accounting organization, functioning for over 100 years, is one of the longest-operating in Europe. The AAP conducts extensive professional consultations on matters important for accountants and the accounting system in Poland and Europe. According to the aim of the research, we adopted the following hypothesis:

H: Accountants with certificates or professional qualifications are more critical in evaluating the effects of the deregulation of service accounting (hereinafter referred to as deregulation) in relation to other persons associated with this profession in Poland.

In the empirical part of the article, we will present detailed hypotheses. In the literature review, we will develop the main hypothesis with the help of detailed hypotheses.

This research adds to the existing source literature by providing the results of the deregulation process in the accounting profession with regard to sustainable development. We concentrated on the accountants' perception of the deregulation consequences introduced in 2014. The research results indicate the need for changes in the legal regulations concerning the practice of the accounting profession in Poland. Partial certification in this profession is recommended.

We adapted the article structure to the problem scope and type of research. The main body of the article will review the literature on the importance of the accounting profession in a sustainable economy. Moreover, we will present the problem of statutory deregulation of this profession against the background of the accounting services market in Poland in connection with the accounting profession regulation models used in various countries. The empirical part will cover the methodology presentation, the results of the study, and the discussed problems. The last part of the article will present the conclusions from the research, taking into account our recommendations. We will also indicate the limitations of our study.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The specificity of the accounting profession and its role in sustainable economic development is closely related to the functioning of the accounting services market. Participants of this market are accountants employed in enterprises, accountants employed in accounting offices (and other outsourcing services), entrepreneurs, in particular owners of accounting offices (bookkeeping services), statutory auditors, and accounting students. Finance and accounting outsourcing is the most common business process outsourcing service (Marcinkowska, 2018). As a result of the globalization process and the development of advanced technologies, many companies decided to use offshoring, *i.e.* outsourcing accounting processes to suppliers located abroad. According to one of the rankings, Poland is ranked sixth in the top 10 offshoring locations for finance and accounting (FAO Knowledge Executive, 2017-2018; Marcinkowska, 2018). Participants in the accounting services market may have a different perspective in evaluating the importance of the accounting profession in the modern economy and in assessing the current situation of this professional group. In this context, scientific research is an important source of knowledge about the accounting profession.

The accounting profession is an occupation of public trust. Accountants of various levels participate directly or indirectly in the process of recording, processing, and reporting financial, and non-financial information (Özsözgün & Çaliskan, 2014). Mistakes they make due to insufficient qualifications or intentional action may result in reporting information that distorts the true and fair view of the financial situation of the entity (*e.g.* Maines & Wahlen, 2006; Alexander & Archer, 2003; Mattessich, 1995). As a result, it can lead to economic misinformation of various scales. Considering that the information provided by the accounting system is the basis for making decisions, especially by capital owners, their distortion may affect the course of economic processes.

From the perspective of the proper functioning of the accounting system in an entity, the primary issue is the appropriate qualifications of the accountant. They are acquired as part of the implemented 'educational path' *i.e*. studies, training, and specialized courses improving the qualifications of accounting practitioners. This process ensures appropriate substantive preparation for the profession of an accountant, particularly proper knowledge and practical skills, including working in an IT environment, referred to as technical skills and functional skills (Drekoy, 2019). Because of the dynamically changing conditions of the accounting profession caused *e.g.* by changes in the accounting and tax law and changes in the accounting services market, the accountant must adapt to new conditions following the life-long learning principle (Accounting Education Change Commission, 1990). To flexibly adapt to

new conditions and constantly update and expand knowledge, one needs adequate predispositions, including a sense of responsibility, self-discipline, and regularity (Paolillo & Estes, 1982). However, appropriate substantive foundations are crucial for further independent 'lifelong learning.' Such foundations should be provided by implementing a suitable 'educational path' in accounting.

In the literature, apart from technical skills, the following are indicated as important: non-technical skills, in particular teamwork, interpersonal, creative, and communication skills, and harmony with corporate culture (Aryanti & Adhariani, 2020; Kermis & Kermis, 2010; Bui & Porter, 2010; Jackling & de Lange, 2009; Kavanagh & Drennan, 2008). Some research accountants' skills from the viewpoint of employers' expectations towards candidates for the job (Kumari, 2014; Kavanagh & Drennan, 2008).

The qualifications of accountants and their 'educational path' are closely related to the problem of their ethical attitude in business practice. High-profile scandals involving global corporations such as Tyco, WorldCom, Enron, and Global Crossing were directly or indirectly connected with the unethical behaviour of accountants and auditors (Grama, 2015; Otalor & Eiya, 2013; Bayou *et al.*, 2011; Low *et al.*, 2008). Smyth and Davis (2004) point to the importance of regulatory or legislative actions in the context of these scandals.

Bayou *et al.* (2011) indicate that 'accounting truth inescapably has a significant ethical dimension.' Jaijairam (2017) showed the relationship between the role of an accountant in the modern economy and accounting profession ethics. Moreover, research indicated the strong position and importance of professional accounting bodies in promoting ethics in the global accounting profession (Jaijairam 2017). Low *et al.* (2008) highlighted that accountants play a significant role in good corporate governance and ethical, sustainable business practices. They postulated the adoption of professional and ethical practices by businesses on a larger scale. The fulfilment of this postulate requires a new look at the role of an accountant in sustainable economic development (Low *et al.,* 2008). Many factors determine the positive, active role of accountants in this process. As a professional group, accountants function in various configurations within the accounting services market.

In this context, accounting ethics education is particularly important (*e.g.* Thomas, 2012; Bayou *et al.*, 2011; Shaub & Fischer, 2008; Milan & McNair, 1992; Smith & Bain, 1990). The importance of ethics in the accounting profession is growing with the introduction of principles-based accounting to an increasing extent (Otalor & Eiya, 2013). True and fair concept linked with the quality characteristic of faithful representation requires an ethical attitude from the accountant as part of professional judgment being an element of valuation. Using the fair value parameter in the current and balance sheet valuation significantly results in the increased importance of ethics in accounting practice. Accountants' succumbing to the interests of, for example, managers, manifested by intentional influence on the information presented in financial statements to achieve the desired image of the company's financial situation may lead to a disruption in the role of accounting in the economy, and thus its sustainable development. This is because such conduct deprives the report users of true and fair information.

In assessing the importance of the accounting profession in sustainable development, the job satisfaction of this professional group is paramount. The job satisfaction problem in the accounting profession has been the subject of research in many countries. The determinants of accountants' job satisfaction include, for example, gender, and age (*e.g.* Piosik *et al.*, 2019; Bellou, 2010; Czarniawska, 2008; Krebs *et al.*, 1994), organizational context (Moyes *et al.*, 2008; Moyes *et al.*, 2019), the prestige of the accounting profession (*e.g.* Piosik *et al.*, 2019; Nishiyama *et al.*, 2014; Jennings, 2004), length of service and employee turnover (*e.g.* Posik *et al.,* 2019; Del Baldo *et al.*, 2019; Nishiyama *et al.*, 2014; Barac & Tadic, 2011; Padgett *et al.*, 2005; Jennings, 2004; Atchison & Lefferts, 1972), cultural aspects (*e.g.* Bellou, 2010).

One of the most critical determinants of job satisfaction is the prestige of the accounting profession. Piosik *et al.* (2019) showed that the perceived decrease in the prestige of the accounting profession is positively linked with accountants' age. The older workers indicated more frequently deregulation in the accounting profession in Poland as the primary source of the decreasing prestige. The research covering accounting students in Ghana showed that the prestige of the accounting profession positively influences the accounting student to pursue a career in accounting (Amaning *et al.*, 2020). In research conducted in the USA, Moyes *et al.* (2006) indicate the relationship between

job satisfaction in the accounting profession and such factors as the character of work, working conditions, policies, and internal motivating elements. Subsequent studies (Moyes *et al.*, 2008) also point to such elements as the level of salaries, educational qualifications, and employer size. The researchers also took into account age, gender, and race.

From the perspective of the article's purpose, the studies conducted on the effects of deregulating accounting services conducted in 2014 in Poland are significant. In other countries, *e.g.* in Denmark, Finland, Sweden, and Great Britain, authorities performed the deregulation of the accounting profession to a different extent, and its effects were assessed in different ways (Ciechan-Kujawa & Szczechowska, 2018).

In 2018-2019, the Ministry of Finance (MoF) conducted research summarized in the report published in March 2019 (MoF report March 2019). The findings showed the multifaceted consequences of deregulating the accounting profession and the functioning of the accounting services market in Poland.

Ogólnopolska Sieć Certyfikowanych Biur Rachunkowych (OSCBR; National Network of Certified Accounting Offices), associating 1700 entities, conducted research in 2022 indicating severe consequences of the introduced deregulation (OSCBR 2022). Almost 69% of the representatives of the surveyed certified accounting offices believe that deregulation negatively influences the quality of accountants' work. In turn, over 67% note that the regulation positively impacts the clients of accounting offices.

Ciechan-Kujawa and Szczechowska (2018) surveyed the owners of 133 accounting offices in Poland. The research shows that almost 60% of the respondents were against deregulation and most definitely did not support the changes introduced in 2014.

For our research, we adopted the following main hypothesis H0: Accountants with certificates or professional qualifications are more critical in evaluating the effects of the deregulation of accounting services (hereinafter referred to as deregulation) in relation to other persons associated with this profession in Poland.

Due to the in-depth analysis of the phenomenon, we formulated partial hypotheses based on the previously selected measures: (1) the quality of accounting services, (2) the prestige of the accounting profession, (3) the assessment of the security of economic transactions, which may result in the need to re-regulate the accounting profession in Poland.

Accountants with certificates or professional qualifications:

H1: Assess the quality of accounting services in Poland after introducing deregulation as worse than average.

H2: Assess the prestige of the accounting profession after deregulation as worse than average.

H3: Assess the security of economic transactions after deregulation as worse than average.

H4: Support/favour regulating the accounting profession to an extent greater than average.

We understand 'average' as the answers provided by the entire collectivity/sample of the respondents. We used a five-point Likert scale to analyse the respondents' reactions to closed questions. In each question, indications from 1 to 5 were assigned statements expressing the degree of agreement with a given statement. For most questions, 1 meant 'definitely disagree' and 5 'definitely agree.' The 'research methodology' section will provide more information on the survey methodology.

Models of Deregulation and Certification of the Accounting Profession: International Perspective

The regulations of the accounting profession significantly impact international trade processes. This is mainly due to the impact of accounting qualifications on the quality of the information in the reports constituting the basis for international decision-making. Therefore, the following section of the article will present the most influential models of regulating this profession globally.

Accountancy Europe (formerly the European Federation of Accountants, FEE) claims that: 'Professional accountants are instrumental in promoting good corporate governance, facilitating a high-quality information flow between management, board, shareholders, regulators, and other stakeholders. They are essential in a system of checks and balances that contributes to more sustainable and responsible organisations and, therefore, economies' (Accountancy Europe, 2018).

This approach focuses on the evolution and flow of information based on the knowledge possessed by market participants, which is primarily determined by a high level of learning both in formal and informal conditions (Schuetze & Casey, 2006). Against this background, the need to update knowledge acquired throughout life, which took the form of lifelong learning, is important.

The dynamics of changes in the work environment of accountants forced a reorientation in the approach to vocational education, which aroused great interest among both theoreticians and educators in this field (Arquero Montano *et al.*, 2001). In his research, Argyris (1991) indicates the strong connection between the success achieved and the need to learn, as well as the frequent lack of understanding of many people in this area. Despite this, the profession of the book is increasingly seen through the prism of lifelong learning (Malan & Stegmann, 2018).

Researchers often indicate that the concept of continuous learning is accepted in the public debate as a justified human action, reflected in their efforts. Billet (2010) also presents the relationship between learning, work, and achieved results in his research. In some areas, vocational training is voluntary, which, despite the lack of regulation, results in high-level performance reflected in the specialization and individualisation of its participants (Green, 2006). Moreover, lifelong learning seekers are most often open to learning new things (Wielkiewicz & Meuwissen, 2014). As researchers of modern science notice increasingly frequently, lifelong learning is at the heart of the professional success of accountants, as pointed out by Drewery *et al.* (2020), he presented the first empirical examination of the relationship between lifelong learning and career success.

An important element of science regulation is the initiative taken by the Commission of the European Communities, which published in 2000 a document with the key definitions of continuous learning, indicating that it is 'all purposeful learning activity, undertaken on an ongoing basis to improve knowledge, skills, and competence' and that 'lifelong learning is an essential policy for the development of citizenship, social cohesion, and employment' (Commission of the European Communities 2000).

The International Federation of Accountants (IFAC) also plays an important role in this area. It developed International Educational Standards to influence international development and raise the profile of accounting professions. As a result, this leads directly to providing services at the highest level to the broadly understood public interest. In October 2003, IFAC published seven International Educational Standards, six of which came into force on 1 January 2005 and the seventh a year later (and the latter concerned Continuing Professional Development). Furthermore, the content of the IES 8 standard was added in 2007.

Due to the article's focus, we should mention the requirements of continuous acquisition of knowledge by accountants in a sustainable economy, the solutions dedicated to them, and contained in IFAC IES 7 of 2017, which emphasizes that 'professional accountants face increased expectations to display professional competence. These pressures apply to professional accountants in all sectors. Continuing development and maintenance of professional competence and lifelong learning are critical if the professional accountant is to meet public expectations' (IES 7, 2018).

As the economy constantly changes, it is necessary to include this evolution in the transformations in the presented regulations. The International Accounting Education Standards Board developed International Education Standard 7, Compulsory Professional Development (revised), and then the International Federation of Accountants published it in December 2018. This IES further clarifies the principles and methods used by professional accounting organizations to monitor and enforce the continuous professional development of their members (IES 7, 2018). The indicated amendment to IES 7 has been effective since 1 January 2020 (IES, 2020).

There is no top-down requirement for accountants providing accounting services to have an official professional certificate in Poland. Starting on 10 August 2014, the authorities abolished the procedure concerning the issuance of an accounting certificate by the Minister of Finance. This results from the provisions of the Act on facilitating access to the exercise of certain regulated professions, which thus repealed the provisions of the Accounting Act based on which accounting certificates were issued.

In connection with the state regulations in force at present, to be admitted to bookkeeping services, the candidate must have the total legal capacity and not be convicted by a final court judgment for an offence against the credibility of documents, property, business transactions, trading in money

and securities, for a fiscal offence and offences specified in polish accounting law. Moreover, entrepreneurs must conclude a civil liability insurance contract for damage caused in connection with their business. State authorities under the law do not impose any requirements for accountants' education, which is left to their decision. However, this situation may not last long, because the need to redefine the accounting profession is increasingly indicated due to the lack of unification in terms of the requirements for accountants and the discussion that has been taken up in the environment. In addition to the voices from the accounting services market, the MoF also participates in pre-consultations on unifying the requirements for accountants' knowledge, practice, and competence.

Let us also emphasize the role of responsive regulation theory, the essence of which lies in the ability of public authorities to quickly identify emerging problems or dilemmas of public management and respond to them by taking appropriate action.

In the case of providing accounting services in the European Union countries and the United States, there is an obligation to have at least a bachelor's degree in accounting or other related (financial management, banking). However, these requirements should be treated as a minimum because most often graduates complete their education holding the title of Junior Accountants. At this stage, they work under the supervision of experienced accountants or statutory auditors until they obtain an appropriate level of knowledge supported by practice. This is often associated with obtaining accounting certificates, which are perceived in the environment as valued and essential in practice, although not imposed by a top-down obligation.

The diversity in the approach to the profession results from the historical shape of accounting models. The continental model is based on a conservative approach and open to individual solutions: the Anglo-Saxon model. Based on this distinction, the EU countries can be divided into those with top-down regulated access to the accounting professions (Austria, Belgium, France, Portugal, Romania, Serbia, and Italy) and those with certified or environmentally regulated access to the profession (Ireland, England, Scotland, Wales, Sweden, the Netherlands, Lithuania, and Poland). In the first group, it is particularly important to regulate access to the services of the accounting profession, in particular in the context of self-employment or through the accounting service providers. The most common regulations are statutory and environmental (professional) or a combination of both.

Pointing to Poland, the most common is the voluntary certification of accountants under the program offered by the Accountants Association in Poland, currently covering four levels (grades) of education, the completion of which with a positive result is the basis for confirming the qualifications of a specific degree and issuing a document confirming the title: I – accountant (accounting assistant), II – accounting specialist (independent accountant), III – chief accountant, IV – chartered accountant.

For persons operating on international markets or providing services within global corporations, or applying for a managerial position in such a corporation, the strength of tenders may be the possession of international certificates, several of which are indicated below.

The most commonly desired are, among others, the competencies confirmed by the diplomas issued by the Association of Chartered Certified Accountants (ACCA), Chartered Financial Analyst (CFA), Chartered Institute of Management Accountants (CIMA), London Chamber of Commerce & Industry (LCCI). In addition to the qualifications indicated above, numerous postgraduate studies modelled on courses are also gaining popularity, *i.e.* Master of Business Administration (MBA), Executive Study in Finance (ESF)(London.edu/executive-education), or Executive Master in Finance (EMiF).

RESEARCH METHODOLOGY

The starting point of the research was an original model of sustainable development of the accounting profession. The accountants contribute to the efficient allocation and management of resources in both private and public sectors and the operation of financial and capital markets consequently improving living standards and overall wealth. Furthermore, accountants contribute across all sectors of the economy (IFAC, 2007). Therefore, supporting all pillars of sustainable development of the accounting profession belongs to the primary responsibilities of the Professional Accounting Organisation (PAO). In Poland, work is underway to regulate the accounting profession, and the AAP is involved. As

mentioned above, as persons of public trust, accountants play an essential role in shaping sustainable economic development, mainly contributing to reducing the asymmetry of financial and non-financial information between economic entities and their economic environment. However, playing this role requires the sustainable development of the accounting profession. We may frame the sustainable development of accountants as based on three pillars (Figure 1), namely: professional qualifications, rules of professional ethics, and regulation of the profession.

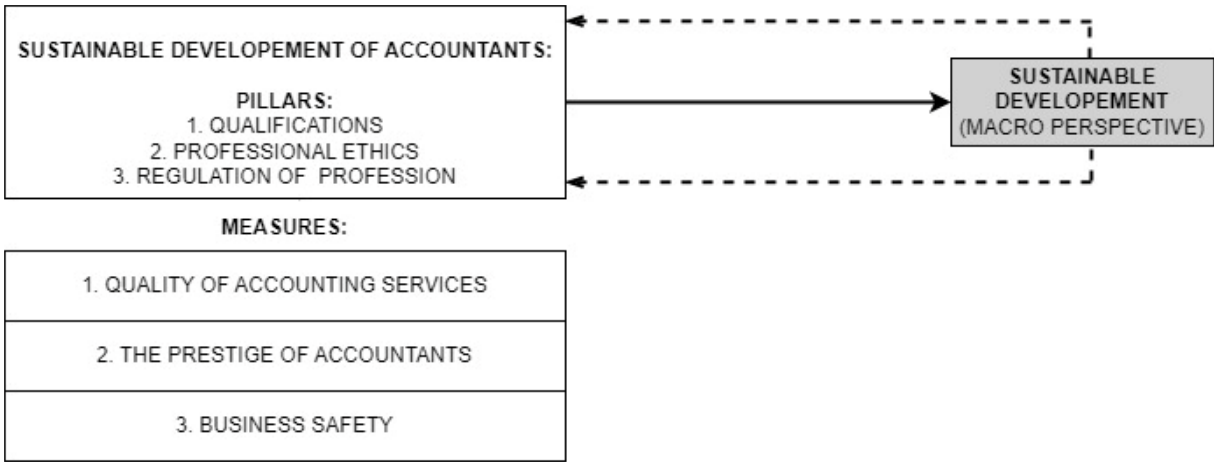

Figure 1. Pillars and measures of sustainable development of accountants
Source: own elaboration of investment results.

The measures of sustainable development of the accounting profession may be (1) the quality of accounting services and (2) the perception of accountants in society. These metrics are interrelated. The higher the level of services provided, the higher the trust and, consequently, the profession's prestige. On the other hand, a prestigious job attracts people with higher qualifications, affecting the level of services provided. As mentioned, the sustainable development of the accounting profession is a fundamental condition for business security, which is one of the elements of sustainable development in macro terms. In this context, we selected the third measure (corresponding to the second pillar) for the sustainable development of the accounting profession, which is (3) business safety. If disruptions in the area of selected measures are identified, changes in the fourth pillar, *i.e.* the need for legal regulation in the accounting profession, should be considered.

Verification of the hypotheses required using an appropriate research procedure, including a description of the conducted survey. In 2022, the Scientific Council of the AAP conducted an online questionnaire (MS Forms) to examine the opinions of the accounting community on the directions of regulating their profession. Information about the survey was sent to 25000 AAP members, posted on social media, and publicized during webinars for accountants, including those organized by MoF. The questionnaire was available from March 15, 2022, to September 15, 2022. Thanks to extensive promotion, 3307 respondents filled it out. The report summarizing the survey results posted on the AAP website provides detailed information about the respondents (www.skwp.pl). Our research sample is the most extensive one concerning the topic of accountants in the Polish literature. Nevertheless, there is no complete certainty that the sample is representative, because we do not know the exact size of the accounting population in Poland. However, it amounts to about 400 000 people. The Survey Monkey sampling calculator and other similar calculators show that with this population at a 95% confidence level and a 2% margin of error, the representative sample is 2387 people. Most accountants in Poland have access to the Internet, which leads to the conclusion that the research sample is highly likely representative. An inevitable imperfection of the study is the lack of control over the possibility of completing the questionnaire several times. Considering the workload of Polish accountants, especially in 2022, this threat should not affect the presented results.

The questionnaire included 24 questions. This article focuses only on two questions, analysing the answers according to the following criteria: 1) age, 2) position, 3) education, 4) size of the entity with

which the accountant is associated, and 5) certificates/entitlements held. Regarding criteria 1-4, we did not observe any significant differences in responses, which was the reason for eliminating these criteria from further analysis. The dependence of the answers on the possession of certificates/entitlements was so significant that the use of statistical analysis tools was abandoned. The responses regarding the authorizations/certificates held by the respondents are presented in Figure 2.

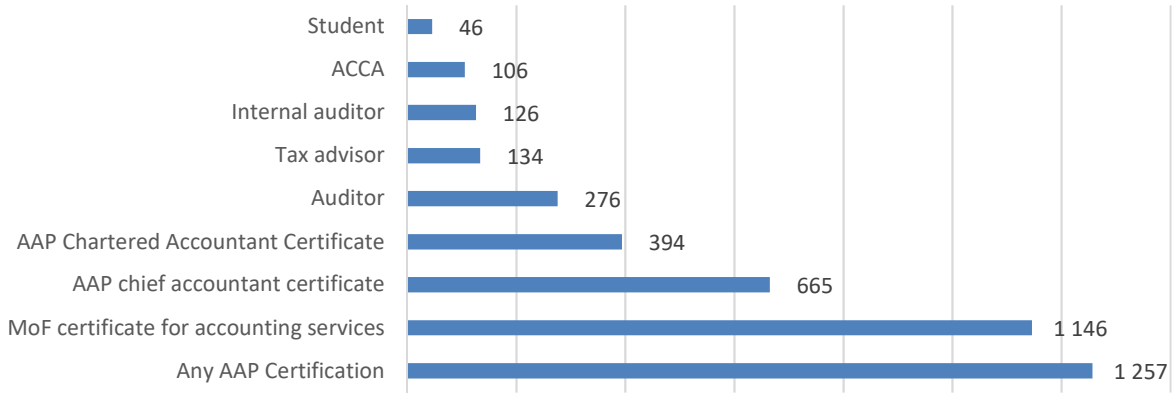

Figure 2. Number of respondents by entitlement/certification
Source: own elaboration of investment results.

Noteworthy, respondents could indicate ownership of several entitlements/certificates. Only 249 people (7.5%) declared they had no certificates.

RESULTS AND DISCUSSION

Verification of hypothesis H1: Accountants with certificates or professional qualifications assess the quality of accounting services in Poland after 2014 as worse than average. The respondents answered the question: 'How has the deregulation of the accounting profession affected the quality of accounting services?' Answer 1 meant definitely negative impact and 5 – definitely positive impact. Figure 3 shows the sum of answers 1 and 2 broken down by the respondents' entitlements/certificates.

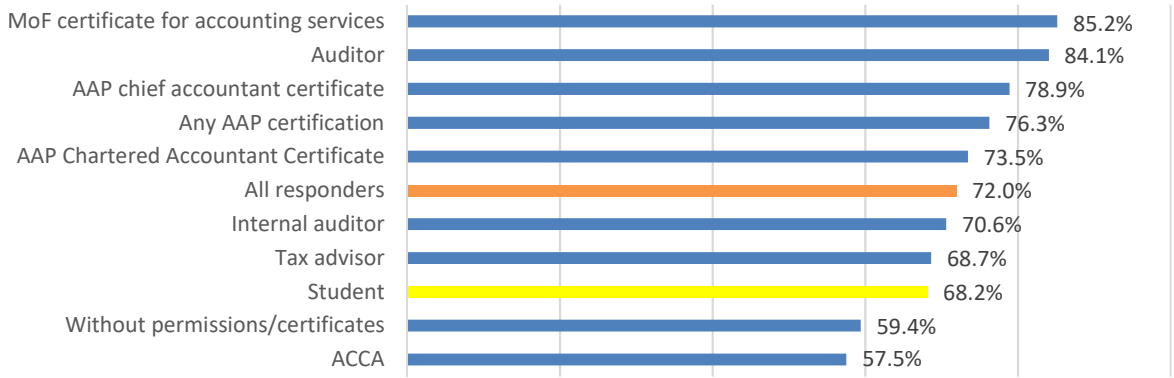

Figure 3. The impact of deregulation on the quality of accounting services by entitlements/certificates (answers 1+2)
Source: own elaboration.

Notably, almost 72% of the respondents negatively assessed the impact of the profession's deregulation on the quality of services provided by accounting offices. According to Figure 3, persons holding certificates in accounting, accounting services, and statutory auditors are even more critical. In the case of holders of ministerial certificates, which can no longer be obtained, a highly negative rating (over 85% of people marking answers 1 or 2) may result from disappointment related to the growing competition. These certificates required the respondents to meet considerable knowledge, experience, and education requirements. Currently, there are no such requirements and a person without any qualifications can

provide accounting services. It is understandable that people who put effort into obtaining certificates expected that there would be a certificate entitling them to provide accounting services.

Statutory auditors represent the second group of respondents who are highly critical of the quality of services provided by accounting offices (84% of negative opinions). These assessments are especially worrying and, simultaneously, the most reliable because statutory auditors cooperate directly with accounting offices in the audit of financial statements. As persons with the highest professional qualifications, statutory auditors can objectively assess changes in the quality of accounting services in recent years.

Another group were the holders of certificates issued by AAP (73.5-78.9% of negative responses). Noteworthy, holding these certificates is not mandatory. However, to obtain it, candidates need to complete long-term training and pass an exam according to the rules set out in the AAP. This group of respondents includes people who voluntarily improve their qualifications in the area of accounting, which, as mentioned, is one of the pillars of sustainable development.

As internal auditors and tax advisors, such respondents are less critical than average (70.6% and 68.7%, respectively) of the impact of deregulation on the quality of accounting services. These entitlements are related to accounting to a lesser extent than previously mentioned, which may affect the respondents' assessments.

Most students negatively assessed changes in the quality of accounting services after deregulation. This may be due to professional experience, including internships during studies. Another reason for such an assessment may be the opinion of academic teachers with whom students have classes.

People without any entitlements/certificates were not a homogeneous group. This group included people entering the profession, people expanding their qualifications but not interested in their certification, and people resigning to broaden their qualifications. The respondents from this group may also benefit from deregulation, because they have the right to provide accounting services and do not have to make an effort to obtain certificates.

The last group consisted of respondents with ACCA entitlements, more than half of whom (57.6%) negatively assessed the impact of the deregulation of the profession on the quality of accounting services. A less critical assessment in comparison to other groups of respondents may have stemmed from the fact that ACCA holders cooperate mainly with large international entities. Accounting offices in Poland primarily serve small and medium-sized entities.

Based on the presented results, the H1 hypothesis was positively verified. The results obtained are similar to the outcomes of research conducted by MoF (MoF report, 2019).

The survey showed that 67% of all groups of respondents were convinced that the deregulation of accounting services was disadvantageous. The vast majority of respondents noted that in the last four years, there was a decrease in the quality of accounting services (52% of responses), of which 43% concerned people from the group 'using accounting services provided by an external company.' The most critical group among the respondents was the one encompassing those providing accounting services (accountants – owners, partners). Of these, 70% assessed negatively the effects of deregulation, including 51% who considered the decision to deregulate as definitely wrong. In the group of accountants who negatively assessed the deregulation, 85% held certificates, including 63% of accounting certificates issued by the MoF, 16% of tax advisors, and 6% of statutory auditors. In the questionnaire, both those providing and using accounting services considered that deregulation had reduced the quality of accounting services. The users of accounting services raised the argument that the qualifications confirmed by a state certificate guarantee a higher quality of the services and a sense of security for entrepreneurs using accounting services.

The second hypothesis (H2) assumed that accountants with certificates or professional qualifications assess the accounting profession's prestige as worse than average following the deregulation of accounting services after 2014. The respondents answered the question: 'Whether and to what extent did the deregulation of accounting services affect the prestige of the accounting profession? Answer 1 meant definitely negative impact and 5 – definitely positive impact. Figure 4 shows the sum of answers 1 and 2 broken down by the respondents' entitlements/certificates.

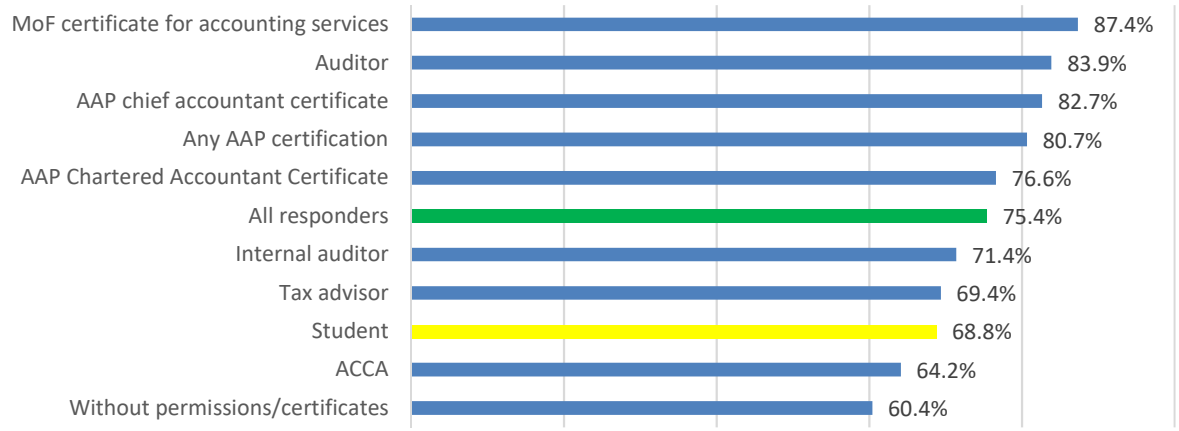

Figure 4. The impact of deregulation on the prestige of the accounting profession according to the qualifications/certificates held (answers 1+2)
Source: own elaboration.

The list of answers is almost identical to the one about the quality of accounting services (Figure 3), which allows for positive verification of hypothesis H2. The similarity of the answers may result from the correlation between the quality of accounting services and the profession's prestige. As in the case of hypothesis H1, we observed that people with accounting certificates and statutory auditor's authorization notice the negative impact of the deregulation of the profession on its prestige to an extent greater than average. Understandably, holders of ministerial certificates feel disappointment related to the depreciation of the previously acquired entitlements. Persons without entitlements assess the deregulation's impact on the profession's prestige less critically than average. Noteworthy, this group covered the most undecided people (28.3%), *i.e.* indicating the answer 3 on a scale of 1-5.

Hypothesis H4 refers to the third pillar of accountants' sustainable development, namely the profession's regulation. It was formulated as follows: 'Accountants with certificates or professional qualifications are more than average in favour of regulating the accounting profession.' The respondents answered the question: 'Which methods of regulating and defining the accounting profession do you prefer?' The first answer option was statutory regulation of the profession. Answer 1 to this point meant 'completely disagree' and 5 – 'completely agree.' Figure 5 shows the sum of responses 1 and 2, and Figure 6 shows the sum of responses 3 and 4.

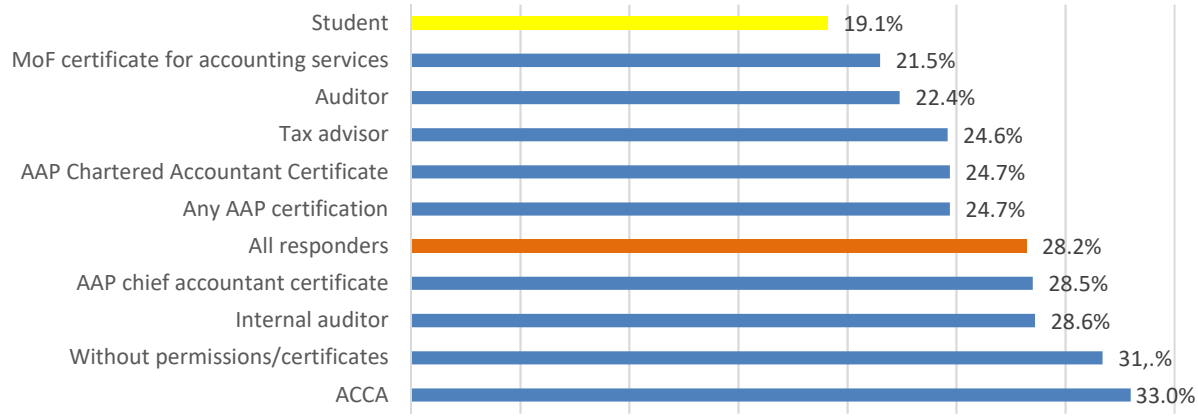

Figure 5. Regulation of the accounting profession (according to certificates/entitlements) on a scale of 1-5 (sum of 1 and 2)
Source: own elaboration.

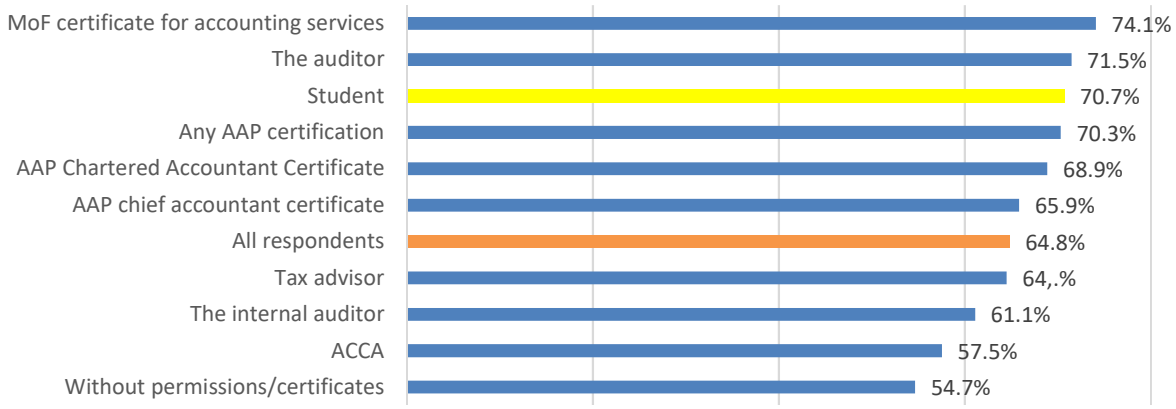

Figure 6. Regulation of the accounting profession (according to certificates/entitlements) on a scale of 1-5 (sum of 4 and 5)
Source: own elaboration.

We may draw the following conclusions from the answers presented in Figure 5 and Figure 6:

- Persons with qualifications or certificates are not afraid of regulating the profession, declaring support for this solution more willingly than average.
- Students constitute the group that disagrees the most with the status quo, *i.e.* with the lack of regulation of the profession. We may assume that the regulation provides them with an opportunity for quick, professional development, and increases the prestige of the accounting profession.
- People without qualifications and certificates are relatively the least in favour of regulating the profession. However, almost 55% of regulation advocates are in this group.

The presented information allows us to verify hypothesis H3.

Another issue concerning the consequence of the sustainable development of the accounting profession is business safety. Hypothesis H3 applies to this topic: 'Accountants with certificates or professional qualifications assess business safety worse than average.' The respondents answered the question: 'How has the deregulation of accounting services affected business safety?' Answer 1 meant definitely negative impact and 5 – definitely positive impact. Figure 7 shows the sum of answers 1 and 2 broken down by the respondents' entitlements/certificates.

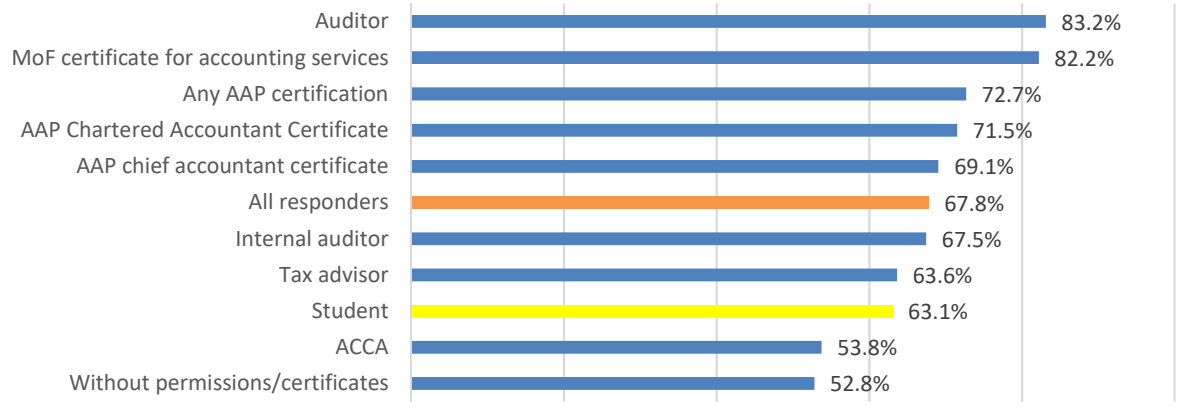

Figure 7. Business safety after deregulation according to certificates/entitlements (answers 1+2)
Source: own elaboration.

As shown in Figure 7, the groups paying particular attention to the negative impact of the deregulation of the accounting profession on the security of economic transactions were statutory auditors and persons with ministerial certificates authorizing them to provide accounting services (over 80% of answers 1 and 2). Another group was AAP certificate holders (69.1-72.7%). As in the case of hypotheses H1 and H2, the respondents with certificates and entitlements were more decisive in

negative assessments than the general respondents. The conclusions concerning other groups of respondents may be analogous to those described earlier.

Deregulating the accounting profession resulted from a broader process of 'freeing' some professions from the existing legal and formal restrictions on employees confirming their competencies. The action aimed to facilitate access to the profession for young people, which the we consider a positive aspect. The goal was also to reduce the cost of accounting services. Such actions may be particularly beneficial in developing countries, where a democratic ideal may consider such actions as 'incorporating notions of deliberative democracy and restorative justice' (Braithwaite, 2006). An important argument for deregulation in the global dimension is counteracting the monopolization of the accounting services market (*e.g.* Caramanis, 2002). Research by the MoF confirmed the positive effect of reducing the cost of accounting services in Poland (Ministry of Finance, 2019).

However, a severe negative side is not taking into account that an accountant is a profession of public trust, requiring specialized, updated knowledge, high competencies, and a relevant ethical attitude. In addition, this profession requires appropriate character predispositions. This means that the accounting profession cannot be open to everyone.

Discussion

The results of our research indicate that the vast majority of respondents negatively assess the effects of the deregulation of the accounting profession from the point of view of the quality of accounting services. The most critical groups were statutory auditors and certified accountants. The results of our study are generally consistent with the results of other research. The users of accounting services argue that the qualifications confirmed by a state certificate guarantee a higher quality of the services provided and a sense of security for entrepreneurs using accounting services.

The outcomes of the study are partially consistent with the results obtained by Ciechan-Kujawa and Szczechowska (2018). Among the respondents, 42.86% indicated a significant decrease in quality, 17.29% stated a slight decrease, and 36.84% found it difficult to assess. Over 70% of the surveyed owners of accounting offices had an accounting certificate, which was necessary to run an accounting office before deregulation. The remaining persons indicated that they had no special powers. Differences in findings may result from a narrow research group in relation to the research conducted by the AAP, extended and deepened in this study. According to OSCBR research (study 1006996, 2022), almost 69% of the representatives of the certified accounting offices surveyed believe that deregulation harmed the quality of accountants' work. In turn, over 67% note that the regulation positively impacts the clients of accounting offices. As many as 66% of the respondents indicated that there are currently no effective certification mechanisms.

Our results indicate that the respondents strongly feel the decline in the profession's prestige due to the accounting profession's deregulation. In the research conducted by the MoF, the respondents providing accounting services (the vast majority of whom have certificates and entitlements) stated that the prestige of the accounting profession has decreased.

The results we obtained regarding the security of economic transactions are a more detailed study in this area carried out by the MoF.

In these articles, both the group providing accounting services and those using accounting services express the opinion that certification and authorization would increase business safety.

CONCLUSIONS

The results obtained in the survey allow for identifying the following regularity: people with accounting certificates and qualifications perceive the risks associated with the lack of regulation of the accounting profession in Poland to a greater extent than average. They also strongly declare their support for regulating this profession in the future. Persons with documented qualifications indicate the specified aspects of sustainable development of the accounting profession, because they are fully aware of its responsibility and economic importance.

According to the respondents, in the period after the introduction of deregulation in Poland, there was a significant disruption in three measures of sustainable development of the accounting profession: the quality of accounting services, the prestige of the profession, and business safety. According to the proposed model of sustainable development of this profession, this means introducing changes in its legal status, *i.e.* return to partial or complete regulation of the profession. Undoubtedly, the orientation of respondents' approach to certification of the profession results directly from the understanding of the impact of their role on the contemporary development of a sustainable economy and the responsibility felt in this area.

Our research was a detailed continuation of earlier research. It expands knowledge on the effects of the deregulation of the accounting profession in Poland and contributes to the discussion on this problem. The results of our research may be useful to the authorities, especially the MoF, in developing new regulations regarding the principles of practising the accounting profession in Poland. Our results not only diagnosed the current state but also indicated the direction of the desired changes.

The study was a supplementary element to diagnose the current state of practice in the accounting profession. We know that a significant limitation of the conducted research was the analysis and assessment of the respondents' opinions, not the actual state of the research problem under examination. One of the significant limitations of our research was the relatively low participation of students in the research sample. It resulted from the insignificant survey involvement of this group of participants (future participants) in the accounting services market. The lack of interest in research on the part of students requires independent research considering the university syllabus and the educational process. Another limitation was the generalized approach to the prestige of the accounting profession. We are aware that the sense of prestige in the profession consists of many factors, which we will analyse in detail in the next research stage.

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The contribution share of authors amounted to 34% for Stanisław Hońko, 33% for Marzena Strojek-Filus, and 33% for Katarzyna Świetla. SH – conceptualisation, methodology, analysis of qualitative data, data interpretation, discussion; MS-F – conceptualisation, analysis of literature, data interpretation, discussion; KŚ – conceptualisation, analysis of literature, data interpretation, discussion.

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Conflict of Interest

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The concept of HR 4.0: A literature review

Magdalena M. Stuss

ABSTRACT

Objective: The article aims to identify the degree of interest and consider HR 4.0 issues in scientific research. This approach enables the analysis of the existing body of work to prepare for future empirical research by gathering relevant resources of knowledge available on this subject, as well as by varying research directions.

Research Design & Methods: The study adopted formal approaches and systematic methods to locate, select, evaluate, summarise, and report the references collected in a literature review. Articles were analysed using the VOSviewer software (version 1.6.19), which is a tool used to construct and visualise bibliometric networks.

Findings: The concept of HR 4.0 forms a separate cluster directly related to the concept of Industry 4.0, and only through this path is it shaped by other semantic determinants. This indicates a lack of detailed analysis of the concept and thus probably of the entire concept itself. In the future, from the perspective of the HR 4.0 concept, the HR function will implement specific tools, such as cybernetic influences, digitalisation of human resource management (HRM), remote HRM, human – machine interface skills, human – strategic organisational links, and human – technology interface competences.

Implications & Recommendations: To date, researchers have focused on technological tools supporting human resource management processes, hence, most references have been identified with the concept of e-HRM. On the other hand, if we take the concept of Industry 4.0 as a starting point, then based on its consequences, it will also be possible in the future to analyse the relationship between the HR function and Industry 5.0.

Contribution & Value Added: There is a wide cognitive gap in the research on the concept of HR 4.0, and the information obtained from research places humans at the centre of Industry 4.0 alongside technology and organisation.

Article type: research article

Keywords: HRM; HR 4.0; Industry 4.0; evolution of the HR; HR function

JEL codes: O15, O32, M 12, M15

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INTRODUCTION

Initially, it was believed that it was not clear as to what effects determined the individual tools used in the HR function or whether success is determined by the overall construction of the human resource management (HRM) process in a particular company (Wright *et al.*, 2003). Because of difficulties in formally assessing HR practices, some researchers even questioned whether they contribute to organizational outcomes or whether organizational success leads to increased investment in strengthening HR activities (Gerhart, 2005).

Contemporary research confirms that practices related to human resource management processes impact organizational outcomes (Armstrong, 2002; Becker & Huselid, 2006; Guthrie, 2001; Huselid, 1995; Oleksyn, 2017; Pocztowski, 2007) and that obtaining and maintaining a competitive advantage depends not only on the quality of human resources but also on having an appropriate human resource management strategy. The proper alignment of the HR strategy with the company's strategy is a critical condition for achieving organizational goals, creating a specific pattern according to which HR decisions

are made, *i.e.* a long-term concept for human resources (Armstrong, 2002; Listwan, 2002; Mahoney-Phillips & Adams, 2009; Muralidhar, 2016; Tabatabaee *et al.,* 2014).

Thus far, researchers have been mainly interested in the subject of e-HRM as part of the issue of implementing IT tools for personnel functions (Obeidat, 2016; Wirtky *et al.*, 2016). Moreover, in the analyses of Industry 4.0 (Arruda *et al.*, 2023), few authors wrote about HR (Makieła *et al.*, 2021; Verma & Venkatesan, 2022). This indicates a significant research gap in the field of HR 4.0.

The main goal of this research process was to identify the degree of interest and take up HR 4.0 issues in scientific research. A systematic review of references to the HR 4.0 concept was used as a research tool. It will make it possible to analyse the existing body of work to then prepare for future empirical research by gathering relevant resources of knowledge available on this subject and by varying research directions. The composition of the article includes a systematic literature review conducted in accordance with the research methodology described, the research results obtained and their limitations. At the end, conclusions and prospects for future research are presented.

LITERATURE REVIEW

Human resource management functions are carried out during the formulation and implementation of the company's overall strategy. This situation requires treating human resources from a long-term perspective, with careful selection of the right staff and emphasis on their development, so that they can support the implementation of the organization's strategy.

The evolution of human resource management begins with the human resources department through the HR business partner and ends with talent management and organizational business strategy (Figure 1), to evolve towards HR 4.0.

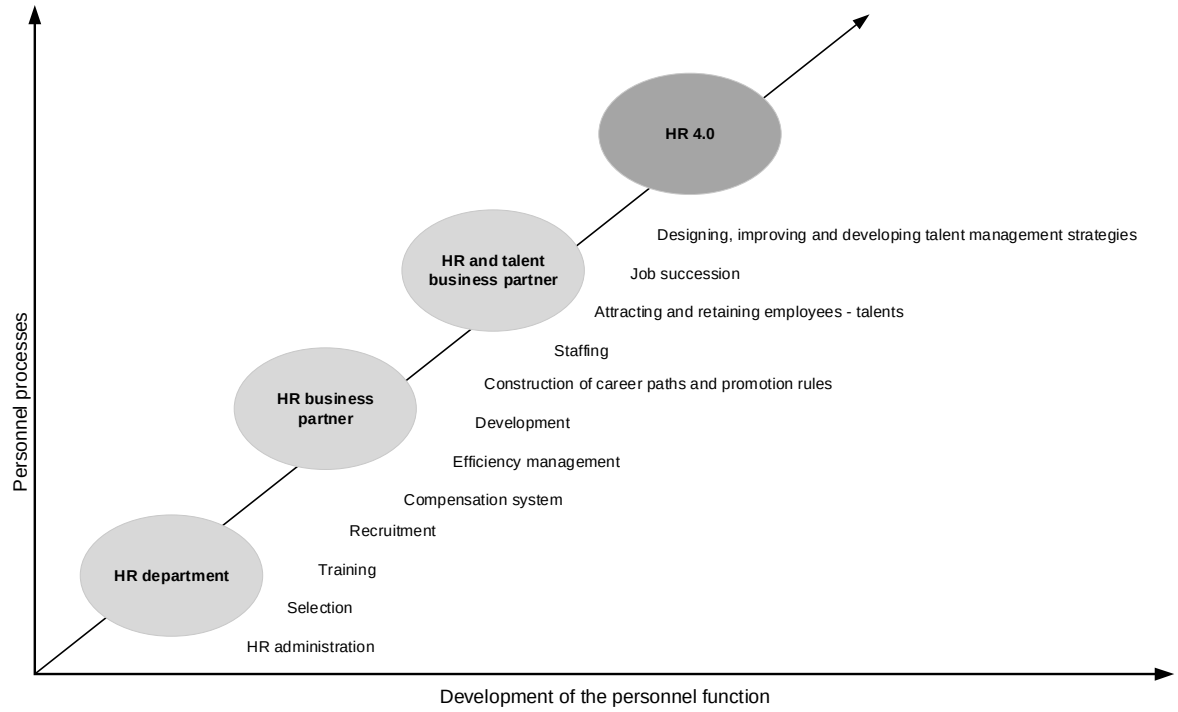

Figure 1. The evolution of the HR function
Source: own elaboration based on (Ganer *et al*., 2022; Nugroho, 2017; Stuss, 2021).

In the 1970s and 1980s, the business function responsible for people was called the 'personnel department.' Their role was to hire people, pay them, and ensure they had the necessary benefits. In this role, the HR department was a well-understood operational function. The primary responsibility of HR departments was payroll and personnel administration, which is now accomplished by outsourcing routine work and implementing technological solutions (Ulrich *et al.*, 2012). In the 1980s and 1990s,

organizations realized that the HR function was more important and the concept of 'HR business partner' emerged. During this time, organizations recognized that the vice president of human resources had a much greater role: recruiting the right people, training them, *helping* with business design and organizational structures (organizational design), developing 'total compensation packages' that included benefits, stock options, and bonuses, serving as a focal point of communication for employee health and wellbeing. The 'personnel manager' became the 'VP of HR' and had a much more significant role in executing the business strategy (Stuss, 2021). The HR strategies focused on linking individual and integrated HR practices to business success through strategic HR. Practices were expanded to include employee assessment and development to integrate them into the organizational culture and leadership in implementing the adopted business strategy (Ulrich *et al.*, 2012).

After the year 2000, the next evolutionary changes in the HR function included the full opening of HR departments to the outside world, combined with the concept of talent management (Stuss, 2021):

- Deliberate use of HR practices to obtain external business conditions and respond to them;
- Extending career aspirations beyond strategy to adapt the HR department's work to business contexts and stakeholders;
- HR becomes a strategic positioner who understands business and can shape and position success-orientated activities;
- HR becomes a credible activist who gains personal credibility and takes a proactive stance on business outcomes;
- HR becomes a capability builder who can find the right combination of personal and organizational development activities;
- efforts are needed to emphasise talent as human capital;
- HR becomes an innovator and integrator of HR activities;
- HR becomes a champion of human resource change that connects the past to the future, which anticipates and manages individual, initiative, and institutional change;
- HR uses technology to seamlessly process administrative work while also generating information for more strategic work.

All the foundations necessary to enable the concept of management through efficient and effective HR functions have four key pillars (Cheese, 2008):

- Harmonized processes and policies – consolidation of processes and policies into consistent formats and approaches, leading to more consistent people management;
- Integrated HR systems and information – a consolidated database containing the 'one truth' for HR information and integrated systems supporting integrated processes;
- Shared services – consolidation of administrative and transactional activities into a common or shared service structure with an integral service management measurement structure. This allows other HR areas, particularly business partners, to focus on their roles and maximize value-added;
- Focus and improved management capabilities – organizing activities in specific areas of the capability to provide focus, improve management, and ensure adequate oversight and proper management of all parts of HR across the organization.

Contemporary research highlights that organizations are slowly becoming cyber-physical systems (Trotta & Garengo, 2019) (Nteboheng *et al.*, 2021; Trotta & Garengo, 2019) and human resource management practices in the context of HR 4.0 are expected to be cyber-based to ensure organizational competitiveness. It is also expected that intelligent systems in HR processes will be used more extensively in the future (Shamim *et al.*, 2016).

RESEARCH METHODOLOGY

In management and quality sciences, a literature review is the first stage of research and is particularly important when considering new research initiatives. This is because it uses formal approaches and systematic methods to locate, select, evaluate, summarize, and report the references collected

(Denyer & Tranfield, 2009). Exploring research gaps using a systematic literature review provides important support in presenting efforts to identify challenges facing future research (Amui *et al.*, 2017; Mariano *et al.*, 2015). A systematic review of references on the concept of HR 4.0 (adopted as the main goal of this research process) will make it possible to analyse the existing body of work to then prepare for future empirical research by gathering relevant resources of knowledge available on this subject, as well as by varying research directions (Denyer & Tranfield, 2006; Kitchenham, 2004). Such a theoretical synthesis of the division of the topic studied into key and ancillary terms increases methodological discipline and helps to create a credible knowledge base by collecting information from a range of studies on HR processes.

To minimize potential errors and biases in this study, data extraction methods were used for the systematic review, which required documentation of all diagnostic stages. Data extraction included general information such as the title, author or authors, and publication details (Jabbour, 2013).

The searched terms were checked in the Scopus database due to its significance as a subscription-based online service for indexing scientific citations. Only scientific articles, monographs, chapters from monographs, and review articles were retained. The following keywords were used: HR 4.0, HRM 4.0, Digital HR, and e-HRM (Table 1). The adopted research process allowed for the identification and analysis of the references obtained based on the coding system, leading to the identification of research gaps in the literature, as well as opportunities and challenges for future studies. In the study based on a systematic review of the literature, a data extraction process was used that included individual analyses of the collected references according to the adopted coding system. All research results from this search were then narrowed down by applying refinement mechanisms by field to business, management and accounting, economics, econometrics and finance, and social sciences. Furthermore, the search was narrowed down to texts in English, as it was the dominant language in all the literature items.

Table 1. Results of the search process and articles remaining after analysis

According to the SCOPUS database	HR 4.0	HRM 4.0	Digital HR	e-HRM
All documents	416	161	133	1365
Subject area, including: Business, Management and Accounting Economics, Econometrics and Finance Social Sciences.	116	117	79	1,162
In English	114	117	75	1151
Content-verified based on abstracts	91	92	63	322

Source: own elaboration.

After collecting the relevant articles, an analysis was conducted to verify whether they all addressed the topic of the HR function from the perspective of implementing tools specific to the HR 4.0 concept, such as:

- cybernetic influences (Trotta & Garengo, 2018),
- digitalization of HRM (Doshi *et al.*, 2021; LUMI, 2020),
- remote HRM (Dlamini & Ndzinisa, 2020),
- human – machine interface skills (Trotta & Garengo, 2019),
- human – strategic organizational links (Gan & Yusof, 2019),
- human – technology interface competencies (Shamim *et al.*, 2016).

RESULTS AND DISCUSSION

Systematic reviews utilize a set of explicit selection criteria to assess the significance of each identified study (Tranfield *et al.*, 2003). Before meticulous codification, articles were analysed using the VOSviewer software (version 1.6.19), a tool for constructing and visualizing bibliometric networks. These networks, made possible through text mining functionality, were used to construct and visualize the co-occurrence of important terms appearing in the literature, representing a way to identify main research topics and

future research opportunities. The terms from the abstracts that appeared most frequently in the networks were initially used to develop analysis categories, as presented in the figures below. Classification frameworks were developed using numerical and alphabetical codes to classify the articles.

As can be seen in Figure 2, the concept of HR 4.0 forms a separate cluster directly related to the concept of Industry 4.0, and only through this path is it shaped by other semantic determinants. This indicates a lack of detailed analysis of the concept, and thus probably of the entire concept itself.

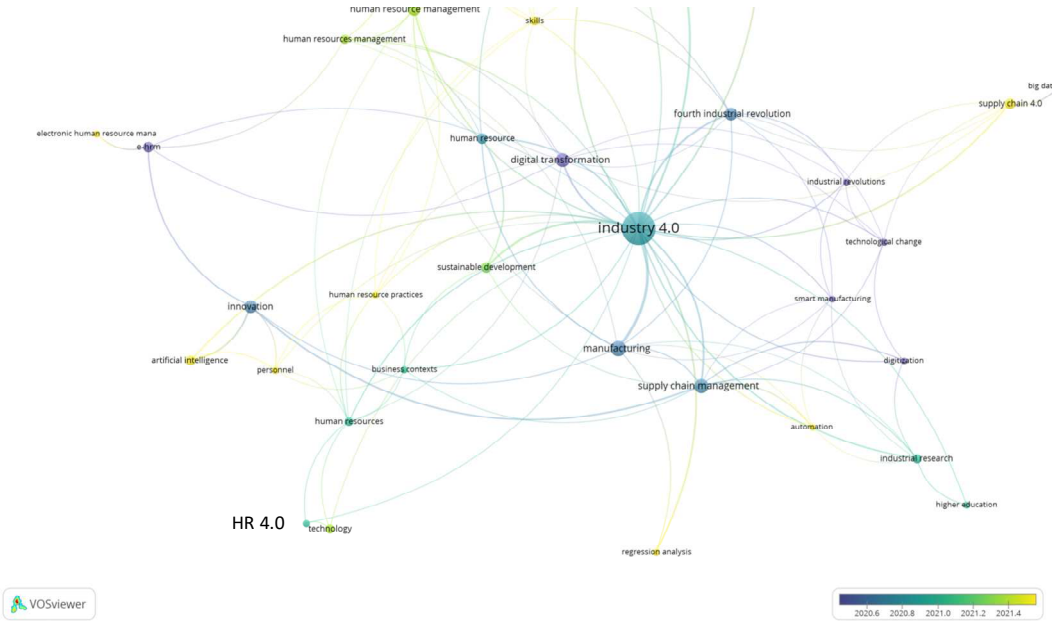

Figure 2. Keyword mapping for the concept of HR 4.0: Network for category development
Source: own elaboration based on systematic literature review.

Although the number of references found is almost identical to that of HR 4.0, in the case of the concept of HRM 4.0, more turning points were identified from the keywords. As shown in Figure 3, among the clusters, there emerged a general concept of human resources, as well as Industry 4.0 and technology. However, similar to the previous case, these are only symptoms of interest in the issue of HRM 4.0.

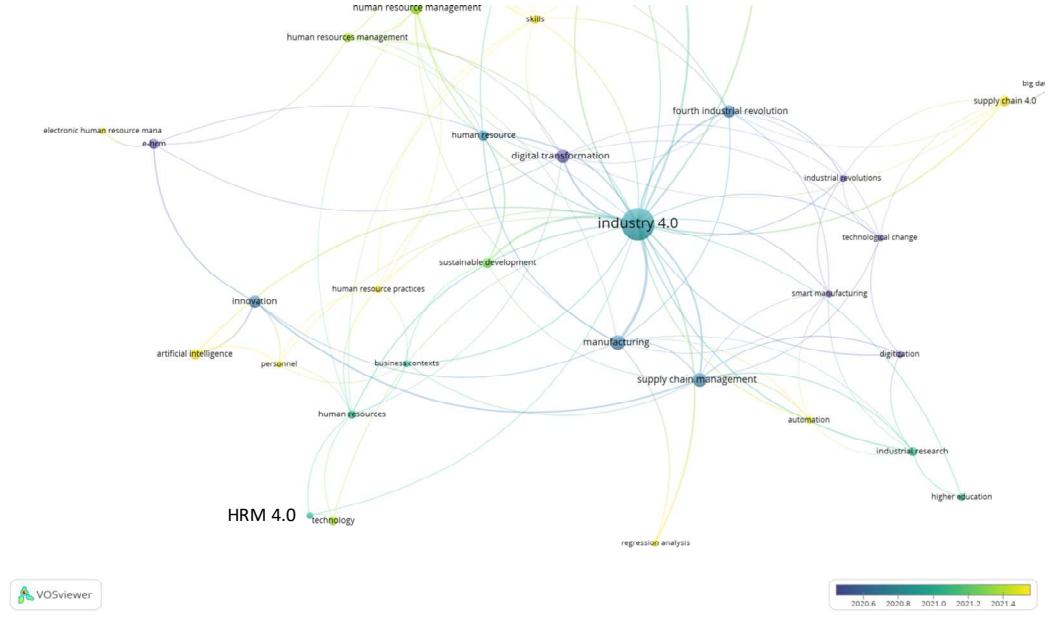

Figure 3. Keyword mapping for the concept of HRM 4.0: Network for category development
Source: own elaboration based on systematic literature review.

However, the analysis conducted for the concept of digital HR (as shown in Figure 4) highlighted more keywords related to the studied term: employees, technology sensibility development, HRM, digitalisation, mergers, and technology transfer.

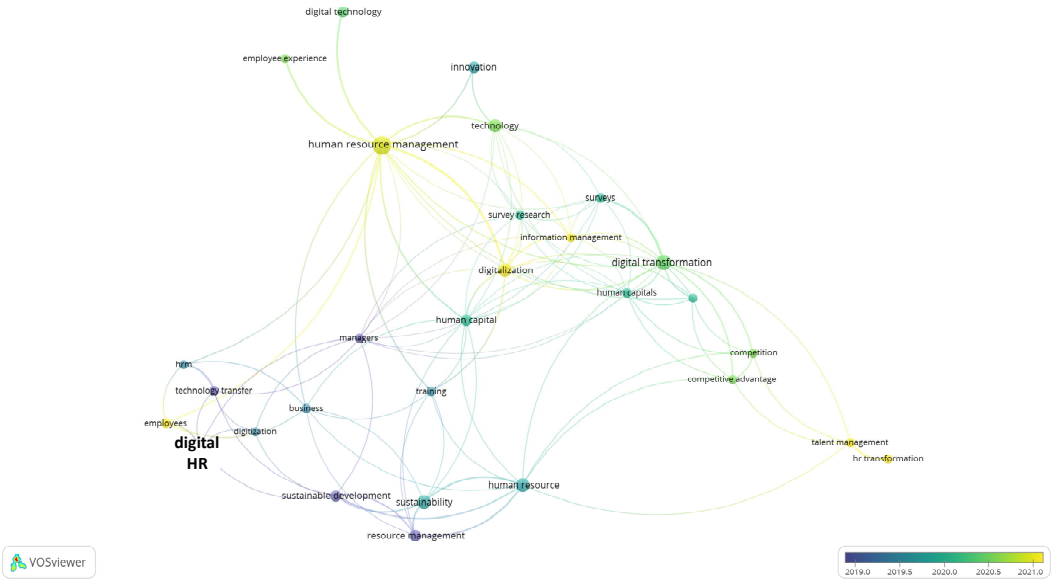

Figure 4. Keyword mapping for the term digital HR: Network for category development
Source: own elaboration based on systematic literature review.

However, there is a lack of direct connection with Industry 4.0, which was emphasized in previous analyses. Therefore, the question should be asked whether this term should be further analysed in the context of the HR 4.0 concept. Therefore, digital HR is not analysed in the context of Industry 4.0.

In the case of the last concept, e-HRM (Figure 5), it is clear that research has been conducted extensively in this area. Numerous connections have been identified, but as before, there is no connection with Industry 4.0. The E-HRM cluster is central alongside human resource management.

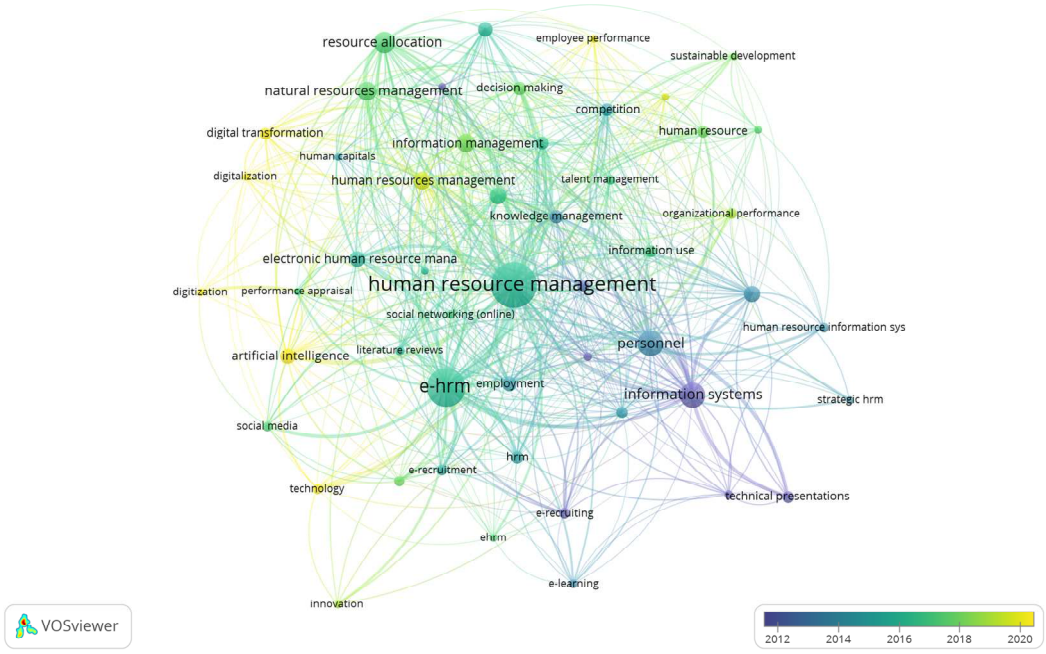

Figure 5. Keyword mapping for the concept of e-HRM: Network for category development
Source: own elaboration based on systematic literature review.

The following graphs present analyses conducted from the point of view of publication date, author affiliations, and funding of publications and/or research from research projects.

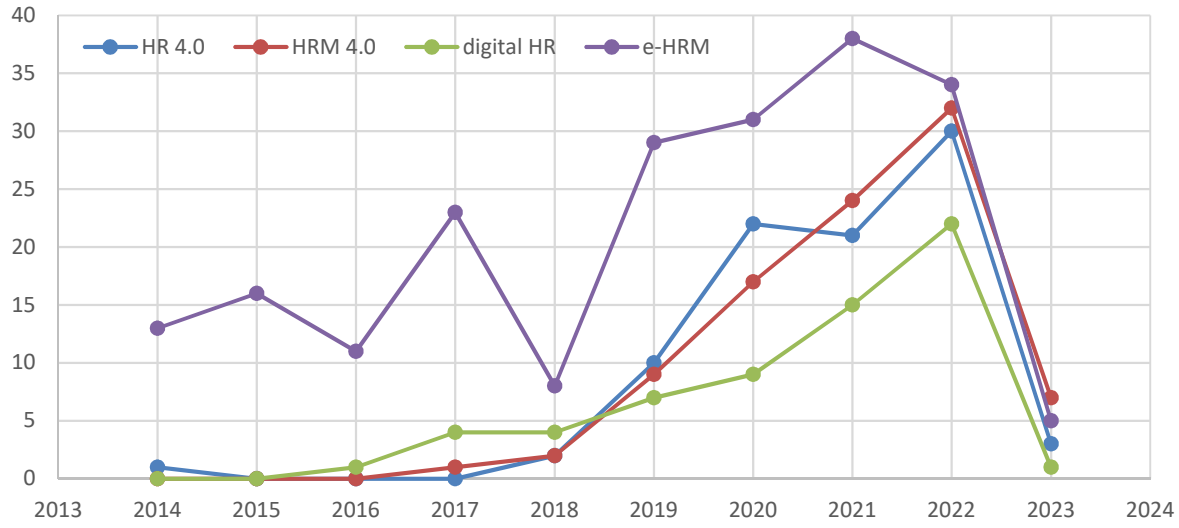

Figure 6. Number of published articles selected per year
Source: own elaboration based on systematic literature review.

Figure 6 shows the distribution of research articles from 2013 to 2023(Q1) and indicates that the number of studies on the analysed issues has been steadily increasing, with a sharp rise after 2019. In conclusion, human resource issues (indexed by the four analysed keywords) are becoming increasingly important and research has been accelerated due to the change in the entire business context after 2019 and the outbreak of the Covid-19 pandemic, often requiring the adoption of digital technology in human resource management. As a result, more and more researchers are focusing on this field and conducting both theoretical and empirical projects.

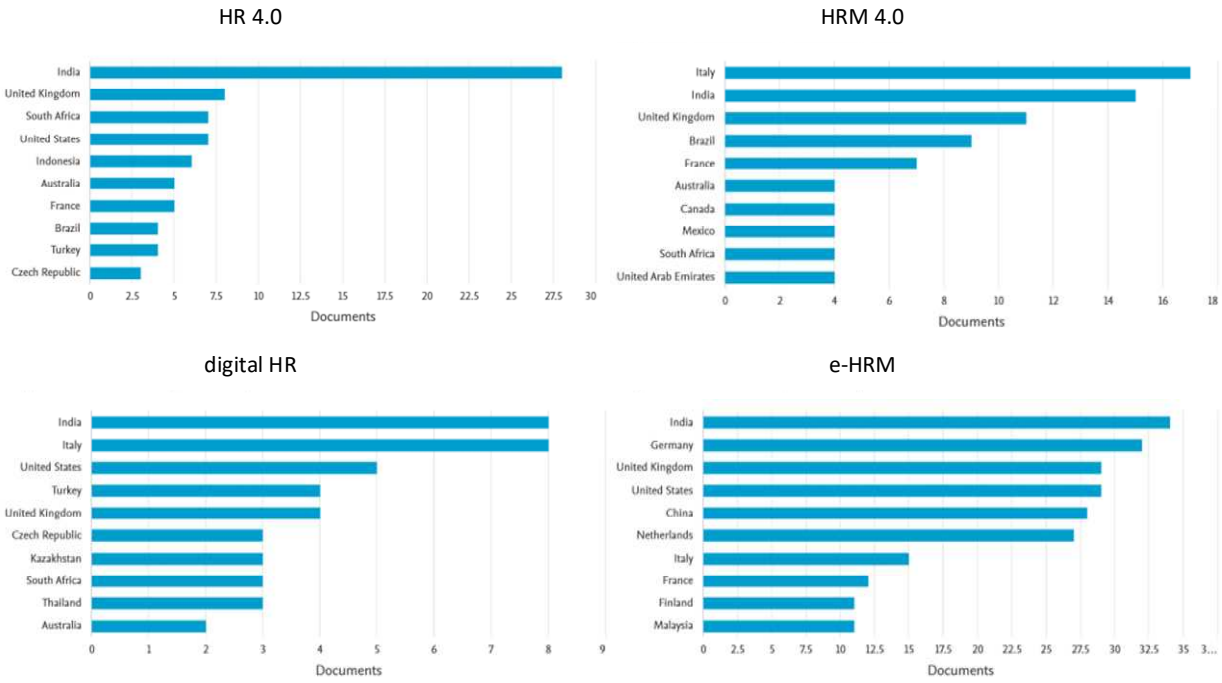

Figure 7. Number of published articles selected by countries
Source: own elaboration based on systematic literature review.

On the other hand, the number of publications based on information on the affiliation of each article showed (Figure 7) that the dominant group of researchers in the case of all analysed concepts comes from India. However, scholars from all over the world are paying attention to this topic, as most articles were written by international research teams.

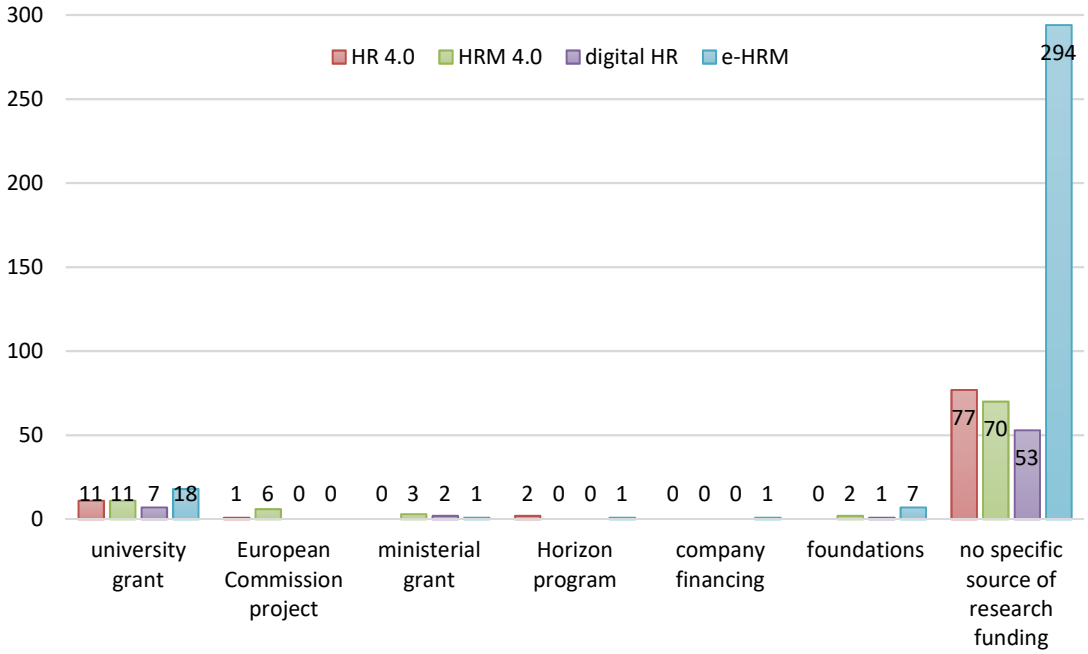

Figure 8. Number of published articles selected, by source of funding
Source: own elaboration based on systematic literature review.

In Figure 8, it is clear that the issues described in the collected references were funded from unknown sources or were not conducted as part of the funded research projects. In the case of the stated sources of funding, university grants were predominant.

In the second stage of the research, a content analysis was conducted based on the distinctive tools that are characteristic of the HR 4.0 concept. All articles were analysed to better understand whether they addressed the identified topics. However, those that were not available for download were removed from the study. The next step after collecting the relevant articles was the analysis of the implementation of tools specific to the HR 4.0 concept, which were adopted in the research methodology. The analysis indicated:

Cybernetic Influences

Challenges facing the HR function in Industry 4.0 include: handling vast amounts of data, adapting to the rapid pace of change, embracing new business models, and leveraging intelligent services enabled by digital tools (Schultz, 2021a). Achieving these objectives requires addressing several challenges. To adopt a particular technology and improve software processes, ethical considerations need to be identified and carefully considered (Rahanu *et al.*, 2021).

Digitalization of HRM

In the literature reviewed, it was emphasized that the digitalization of HRM will continue to play a crucial role in building competitiveness. Human resources management processes such as staffing, compensation, employee relations, and development, driven by information and communication technologies, will rely heavily on data analytics and metrics. Devices and technological infrastructure such as the internet, data analytics, robotics, and artificial intelligence are expected to facilitate digitalization (Nteboheng *et al.*, 2021).

Remote HRM

The demand for workspace is driven by employment trends. The nature of work is becoming increasingly flexible and virtual (Chernyak-Hai & Rabenu, 2018), which may have an impact on future relationships between HR and employees. Digitization and smart communication technology are factors enabling the execution of HR tasks remotely (Kämpf-Dern & Konkol, 2017; Schultz, 2021b). It is essential to provide the proper balance between office, home office, and third space, along with the appropriate information technology (IT) tools and behavioural aspects, to make remote work effective (De Bruyne & Gerritse, 2018).

Human-Machine Interface Skills

The changes brought about by Industry 4.0 are happening quickly and human-machine interface solutions are not always obvious, reaching into organizationally, socially, and culturally ambiguous paths. Qualifications, skills, and appropriate learning frameworks are important issues that support organisation's future agenda. The impact of HRM is based on the natural and inseparable relationships between human issues and the adoption of IT practices and trends (Liboni *et al.*, 2019).

Human: Strategic Organizational Links

Despite automation, digitalization, and the electronic nature of future HRM, it has been observed that human resources will continue to be of crucial importance in building organizational strategy. In the future, human resource management practices will have to focus on stronger talent management. The importance of talent management processes is growing, as evidenced by both the many concerns of researchers and the talent management programs implemented in business practice (Stuss, 2021). In the Industry 4.0 era, it is necessary to adapt the education system to the new developmental requirements of society. In these new conditions, only the acquired knowledge will contribute to the development of Industry 4.0. Depending on the industrial sector, specific skills and tasks of humans may differ from others due to the diversity of processes. Therefore, human capital will have a significant role in work and will alter the course of jobs and education (Sima *et al.*, 2020).

Human: Technology Interface Competences

There is an increased need for technology proficiency among HRM operations due to increased virtuality. In particular, the increased use of technology means that everyone is proficient in information technology (IT) to ensure that the required fluidity of network services, connectivity infrastructure, and other technological accessories is maintained. Technology is also an important element that is expected to impact both the processes and outcomes of the entire HRM system (Nteboheng *et al.*, 2021).

The conducted systematic literature review was based solely on one Scopus publication database. It is necessary to conduct a broader analysis of the degree of interest in HR 4.0 based on other databases, such as ProQuest, Emerald, or Web of Science. It is also necessary to analyse sources among Polish-language publications, which are mostly not included in the above-mentioned scientific databases. Irrespective of the indicated organizations, the conducted research confirmed a research gap, namely the growing interest in the issues of HR 4.0 only since 2018. Therefore, modern building of the personnel function is a challenge and necessity today not only for scientists but also for management practitioners.

CONCLUSIONS

The information obtained from research places humans at the centre of Industry 4.0 alongside technology and organization. If the significant variable is human beings, it is clear that investing in human capital and measuring it on an ongoing basis are essential to have insight into the value of human capital and its potential. There is a wide cognitive gap for research on the concept of HR 4.0, or perhaps HRM 4.0 would be more appropriate.

Regardless of which keyword is used, it embodies the industry strategy of bridging gaps around dynamic opportunities to adapt and survive in the 4.0 market by combining real and virtual global information and IT management expertise (Amui *et al.*, 2017; Liboni *et al.*, 2019). All of these terms

are used to describe the management and market revolution brought by the reality of Industry 4.0 and their analysis has the potential to help familiarize researchers and practitioners with the upcoming changes that Industry 4.0 brings and that are currently being discussed in various fields of knowledge.

With the increasing pace of automation, the required number of employees performing redundant, process-based tasks decreases, both in production and office environments (Dhanpat *et al.*, 2020; Baldassari & Roux, 2017). Industry 4.0 is supported by technology and production development, but HR remains a significant factor in changing all of this (El-Khoury, 2017; Liboni *et al.*, 2019), and the HR area includes how people relate to each other, how they relate to technology and inventions developing in the industry, and how they relate to the new concept of Industry 4.0 (DiRomualdo *et al.*, 2018). It is imperative that organizations adapt their HR practices and plans to Industry 4.0 in areas such as skills development and workforce employment (Sivathanu & Pillai, 2018). The digital transformation process that companies must face to be competitive and play a leading role in the markets is not only a technological issue but also a matter of competencies and skills.

To date, researchers have focused on technological tools supporting human resource management processes, and thus, most references have been identified with the concept of e-HRM. On the other hand, if we take the concept of Industry 4.0 as a starting point, then based on its consequences, it will also be possible in the future to analyse the relationship between the HR function and Industry 5.0.

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