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The effects of monetary policy response to the Covid-19 crisis on dynamic connectedness across financial markets in Central and Eastern Europe

Wojciech Grabowski, Jakub Janus, Ewa Stawasz-Grabowska

ABSTRACT

Objective: This study investigates the effects of monetary policy interventions in Central and Eastern European (CEE) economies on shifts in financial market linkages during the Covid-19-induced crisis. We explore the market reaction to both standard and non-standard (e.g., quantitative easing) monetary policy announcements by central banks in Czechia, Hungary, Poland, and Romania, and analyse the way they affected sovereign bond and stock market linkages. The analysis is further extended to include international spill-over effects.

Research Design & Methods: We first quantify a set of time-varying asset correlations using asymmetric generalised DCC-GARCH models and daily data on financial asset returns. Going beyond the domestic stock-bond interdependencies, we explore cross-border connectedness between CEE economies, Germany, and the US. Next, we investigate the effects of detailed central bank announcements, as they unfolded during the Covid-19 crisis.

Findings: We find that, by and large, the CEE central bank interventions conducted in 2020 alleviated domestic and cross-border pressures in financial market linkages triggered by the global risk shock, such as contagion and flight-to-safety effects. However, monetary policies had largest impact at the height of the crisis when central banks in the region introduced substantial interest-rate cuts and unconventional measures, which were used by those banks for the first time or on such a wide scale.

Implications & Recommendations: Our results imply that monetary authorities may partly mitigate the transmission of global shocks to domestic financial markets, even when it comes to small open economies. However, the effects of monetary policies proved strongest at the onset of the crisis and seem to have been related to unconventional policy tools and aggressive interest rate cuts.

Contribution & Value Added: We examinee linkages across the two largest asset classes, sovereign bonds and equities, both within CEE economies and between each of them and Germany and the US (traditionally perceived as safe havens), while controlling for potential structural breaks, global risk measures, and Covid-19-related indicators, such as the number of Covid-19 cases and the government-response stringency indices. Event studies conducted in the article are based on a comprehensive dataset on policy interventions launched during 2020.

Article type: research article

Keywords: Covid-19 pandemic; financial markets; financial linkages; monetary policy; quantitative easing; Central and Eastern Europe

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INTRODUCTION

One of the trademarks of the financial turmoil induced by the Covid-19 pandemic in 2020 was a deep uncertainty that quickly spread worldwide. Faced with deteriorating economic outlooks, market participants shifted their portfolios, both with respect to particular segments of financial markets and

geographical locations. Consequently, linkages across various asset classes strengthened, indicating an increase in the transmission of adverse shocks during the pandemic (Belaid, Ben Amar, Goutte, & Guesmi, 2021; Bouri, Gabauer, & Gupta, 2021; Halmai, 2022; Youssef, Mokni, & Ajmi, 2021). Those tendencies reflected both herding behaviour and contagion in financial markets, as well as capital flights from riskier to safer assets and countries. Such phenomena are increasingly well documented, both for domestic equity-bond flows and cross-border financial flows among economies (Chari, Dilts Stedman, & Lundblad, 2020; Papadamou, Fassas, Kenourgios, & Dimitriou, 2021). Additionally, recent studies such as Beirne Renzhi, Sugandi, and Volz (2021) show that the disrupting effects of the Covid-19 pandemic were not distributed equally and emerging economies (EMEs) were affected more heavily than advanced economies (AEs).

At the same time, the Covid-19 crisis created a serious challenge for central banks. Responding to adverse financial shocks and the freezing of economic activity, monetary authorities worldwide launched a broad set of measures, including unconventional monetary policies (Fratto, Harnoys Vannier, Mircheva, De Padua, & Poirson Ward, 2021; Rebucci, Hartley, & Jiménez, 2021; Grabowski, Janus, & Stawasz-Grabowska, 2023; Żak & Garncarz, 2020). Interestingly, before the 2020 crisis, non-standard monetary policy tools had not been widely used by central banks outside of the major AEs. It was the case for Central and Eastern European (CEE) countries, in particular Czechia, Hungary, Poland, and Romania, which we investigate in this article. In the first quarter of 2020, central banks in CEE economies initiated bold monetary policy interventions, going into the uncharted territory of the zero-lower bound, liquidity-providing operations, and quantitative easing (QE). This shift in monetary policies raises pressing questions about the effects of those actions. What makes empirical studies on the effects of monetary policies in CEE countries additionally worthwhile is that they are an important example of small, open economies that follow an inflation-targeting framework with floating exchange-rate regimes and occasional foreign-exchange interventions. Despite some differences in their level of economic and financial development, those post-transition countries are also financially integrated with the eurozone and global markets, which makes them susceptible to external shocks and policies.

The intersection of those observations leads us to the problem of the potential role of monetary policies in CEE in mitigating adverse shifts in financial market linkages triggered by the Covid-19 shock. Hence, in this article, we aim to capture the effects of monetary policy actions in the region through the lens of financial market connectedness. This approach contrasts with most studies in the area, which investigate the impact of central bank interventions during the Covid-19 crisis on asset returns, prices, or risk premia (Angosto-Fernández & Ferrández-Serrano, 2022; Sever, Goel, Drkopoulos, & Papageorgiou, 2020; Wei & Han, 2021). The empirical evidence on the potential role of CEE central banks in stabilising markets during the global turmoil will inform us about the effectiveness of their domestic monetary policy frameworks in maintaining or restoring financial stability. The asymmetric generalised DCC-GARCH models were estimated on daily data to retrieve time-varying correlations in the financial markets in Czechia, Hungary, Poland, and Romania. We examined linkages across the two largest asset classes, sovereign bonds and equities, both within CEE economies and between each of them and Germany and the US (traditionally perceived as safe havens), while controlling for potential structural breaks, global risk measures, and Covid-19-related indicators, such as the number of Covid-19 cases, and the government-response stringency indices (see, e.g., Dempere, 2021; Koca, 2022). The event studies were based on an original, comprehensive dataset on policy interventions launched in 2020.

The central finding of this article is that monetary policies undertaken in CEE economies during the Covid-19-induced crisis played a role in mitigating pressures that stemmed from changing financial market linkages. They alleviated flight-to-safety effects and provided a cushion against domestic stock-bond flights. They were also able – at least to some extent – to decrease tensions in the cross-border transmission of shocks in bond markets and contagion effects in equity markets. Our results imply that monetary authorities may partly mitigate the transmission of global shocks to domestic financial markets, even when it comes to small open economies. However, the effects of monetary policies proved strongest at the onset of the crisis, when CEE central banks deployed unconventional monetary measures and aggressively cut interest rates. Those effects seem to have run into diminishing returns and subsequent central bank actions proved to have smaller effects on financial market linkages.

The article contributes to the ongoing discussions in financial and international economics in two noteworthy ways. Firstly, it adds to the growing literature on the pandemic and connectedness among various asset classes. By investigating the influence of monetary policies, including unconventional ones, on the evolution of market correlations, it documents important sources of changes in those linkages during the Covid-19 crisis in CEE economies. The empirical strategy used in this study allowed us to demonstrate how the effects of monetary policies evolved as the pandemic progressed and further decisions were made by central banks. Secondly, the article explores the effects of central bank policies in the region for which the empirical evidence remains limited, namely in post-transition Europe, which is characterised by relatively low levels of financial development and a shorter history of the market economy. The results are chiefly relevant for European financial integration and policymaking but the study also carries more general implications of financial and monetary integration on the effects of global shocks on financial markets in post-transition economies.

The next section of the article reviews the recent literature on changes in financial market linkages that occurred during the Covid-19 turmoil and the monetary policy responses to this crisis. The third section introduces datasets used in the study and lays down our empirical methodology. The fourth section presents and discusses the empirical results, broken down into country-level analyses. Conclusions and policy recommendations are presented in the final section.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Our article can be linked to two main strands of recent research. Firstly, this article adds to the ample literature on the effects of the monetary policy response to the Covid-19-induced crisis. Within this framework, our research is closest to studies that employ event study methodology. In general, these studies suggest that the easing of monetary conditions and the launch of asset purchase programmes (APPs) in particular proved to be effective in calming the financial markets, especially in the sovereign bond segment. For example, Sever, Goel, Drakopoulos, and Papageorgiou (2020) investigate the impact of APP announcements on sovereign bond yields, exchange rates, and equity markets in 10 EMEs. They provide evidence that these announcements significantly reduced the long-term sovereign bond yields. At the same time, their effects on the US dollar exchange rates and equity markets were less pronounced, which the authors view in the context of the large role of global risk factors in shaping these markets. Comparable results were obtained by Arslan, Drehmann, and Hofmann (2020), who also find that domestic APP announcements strongly affected local currency bonds in 13 EMEs, while the response of the foreign exchange markets was ambiguous. In a related study, Rebucci *et al.* (2021) find that APP announcements successfully compressed sovereign bond yields in both AEs and EMEs. However, the effect was stronger in the latter group of countries, which the authors attribute to the surprise effect, as some of them had never resorted to a quantitative easing (QE) policy before the onset of the Covid-19 pandemic. Their results also point to a more divergent reaction of the foreign exchange markets in EMEs. Further, Klose and Tillmann (2021) investigate the response of the sovereign bond yields and stock prices to the monetary, fiscal, and European fiscal events of 29 European countries between 17 February and 24 April 2020. They conclude that monetary policy was effective in supporting the stock market and easing the pressure on public finances and point to a particular role of APP announcements in raising stock returns and lowering bond yields.

Studies devoted to the activities of the European Central Bank (ECB) account for a large share of the empirical literature in the area. They constitute a continuation of the frequently undertaken research trend in times of the sovereign debt crisis and the first unconventional actions of the ECB (Afonso, Jalles, & Kazemi, 2020; Altavilla, Carboni, & Motto, 2021; Falagiarda & Reitz, 2015). For example, Delatte and Guillaume (2020) provide an investigation into the determinants of sovereign bond spreads (vis-à-vis German yields) of 13 euro area countries for the period 2 January – 26 May 2020. Their results indicate that the ECB's announcement of the pandemic emergency purchase programme (PEPP) in March 2020 significantly reduced the spreads. Moreover, the easing of collateral requirements turned out to be effective in lowering the Greek, Italian, and Portuguese spreads. In a related study, Moessner and de Haan (2021) emphasise the role of the announcement effect channel via which

central bank APPs affect financial markets. They show that the 10-year sovereign bond term premia in 11 euro area countries were negatively affected by the ECB's announcement of PEPP. The strongest reactions (between 37 and 173 basis points) were observed in countries with higher sovereign risk (Spain, Portugal, Greece, and Italy). Interestingly, the authors identify a reverse reaction to the press conference of 12 March 2020, when Christine Lagarde declared that the ECB was 'not here to close the spreads.' However, in contrast to the literature dealing with the global financial crisis (GFC) period, such as Grabowski and Stawasz-Grabowska (2021), the problem of cross-border spillover effects of the ECB's monetary policy has not been readily undertaken in Covid-19-related studies.

Some studies attempt to identify the factors that improved or limited the effectiveness of monetary policy in mitigating financial distress during the pandemic shock. Notably, Fratto *et al.* (2021) carry out a study for EMEs and small AEs and show that APPs were generally effective in lowering sovereign bond yields. At the same time, they demonstrate that the magnitude of these effects depended not only on the characteristics of individual programs but also on the central bank's credibility and a share of (non-)resident holdings of government securities. The authors also find that the transmission of non-standard policy announcements across the sovereign yield curve was stronger than the effects of conventional interest-rate policy. Benmelech and Tzur-Ilan (2020) show that higher-income countries relied to a greater extent on unconventional monetary policy actions and lowered their interest rates less in comparison with low-income countries, while Yilmazkuday (2021) demonstrate that non-standard monetary (as well as fiscal) policies were more effective in countries with a zero lower bound on their interest rates. In a study devoted to the effect of the Covid-19 pandemic on global stock market volatility, Uddin, Chowdhury, Anderson, and Chaudhuri (2021) show that the policy interest rate cuts work only in EMEs, while in developed economies, these central bank measures resulted in an increase in the variance of returns and uncertainty. Finally, Elgin, Yalaman, Yasar, and Basbug (2021) find that countries with more independent central banks were less likely to resort to large cuts in the policy rate and the reserve requirement ratio. Instead, their response to the crisis relied on larger fiscal and macro-financial policy packages.

Finally, despite the fact that the majority of studies point to an important role of monetary policy response in curbing financial stress during the pandemic, a handful shows that its impact was negligible. For example, using an event-study methodology, Wei and Han (2021) investigate the effect of the Covid-19 shock on the transmission of monetary policy on government bonds, stocks, exchange rates, and CDS markets in 37 countries. Their results indicate that, in general, since the outbreak of the pandemic, the monetary policy measures, both within conventional and unconventional realms, have had no significant impact on all four financial markets.

The second major strand of the literature that the article is related to investigates various forms of shifts in financial market connectedness that occurred during the Covid-19 pandemic. There seems to be a general agreement that the uncertainty related to the outbreak of the pandemic was a source of the global financial shock that occurred in the first quarter of 2020, as reviewed by Yarovaya *et al.* (2022). This uncertainty concerned the potential impact of the pandemic on economic activity, job markets, international trade, and the future openness of economies (see Altig *et al.*, 2020). Dependencies between the returns on equity indices and government bond returns are examined extensively using various empirical frameworks. In one of the earlier studies, Zhang *et al.* (2020) demonstrate a change in the pattern of linkages among global stock markets in the first quarter of 2020 and a sudden jump in the intensity of cross-border market correlations. Youssef *et al.* (2021) show that the connectedness of stock markets in eight large economies responded to uncertainty regarding global economic policy. Pessimistic news about the virus was amplified by social media, which stimulated trading and caused extreme price movements. Interestingly, Wang, Li, and Huang (2022) indicate that volatility spillovers among large financial markets reached a historic peak in March 2020 and declined in the following months, possibly due to stabilising monetary and fiscal policies.

Numerous studies define and analyse international contagion effects during the 2020 crisis, mostly for stock markets. Belaid *et al.* (2021) document an increase in the transmission of uncertainty across stock markets using spillover indices. They emphasise the structural change in interlinkages that occurred around the pandemic outbreak and the role of the highly integrated European market as transmitters of volatility to the rest of the world. The study shows that financial markets in AEs and EMEs

reacted similarly to the Covid-19 shock, even though the pre-crisis connectedness was much smaller in the latter group of countries. This finding is confirmed by Beirne *et al.* (2021), who report that both Asian and European EMEs experienced the most substantial financial outflows directly linked to the Covid-19 shock. Those outflows were stronger in sovereign bond markets than in stock and exchange rate markets. On the other hand, Akhtaruzzaman, Boubaker, and Sensoy (2021) indicate that financial contagion between G7 economies and China, as approximated by an increase in the conditional correlation of respective stock returns, was driven chiefly by financial firms. Bouri *et al.* (2021) provide an extended investigation of contagion across various asset classes, including bonds. While equity and foreign exchange markets dominated global financial connectedness before the pandemic outbreak, the role of bond indices increased in the first quarter of 2020. Moreover, the article demonstrated that the events that triggered the contagion effects in this period were not country-specific, as they may have been linked to a global news-based index of uncertainty.

Additionally, the Covid-19 crisis triggered global flight-to-safety tendencies and raised questions about the safety properties of various assets, *i.e*., the relative stability of their prices during market crashes. In this context, Papadamou *et al.* (2021) explore domestic stock-bond correlations during the outbreak of the Covid-19 pandemic for ten large AEs and EMEs. They demonstrate that this event put in motion a move from stock to bond markets when stock markets around the world collapsed. Moreover, the flights occurred simultaneously and were not country-specific. Chari *et al.* (2020) focus on capital outflows from EMEs, defining the Covid-19 event as a risk-off shock. They point out that equities and foreign-currency bonds are more susceptible to such shocks than local-currency bonds. Exploring dynamic relationships between EME and the US bond returns, Umar, Manel, Riaz, and Gubareva (2021) find that EME bond markets were more sensitive to Covid-19-related news, and their connectedness to US bonds significantly increased during the pandemic meltdown. Janus (2021), in turn, shows that heterogeneous effects observed in sovereign bond markets in the first quarter of 2020 can be explained by differences in macroeconomic fundamentals and their past sensitivity to global shocks, which may be related to a country's reputation among international investors.

There are but a few attempts to deal directly with financial market linkages in CEE economies during the pandemic. Aslam, Nougeiro, Brasil, Ferreira, Mughal, Bashir, and Latif (2021) narrow down their investigation to three CEE stock markets, the Czech, Hungarian, and Polish, during the onset of the 2020 crisis. They find that high-frequency data revealed strong multifractal patterns in CEE stock markets, which indicated substantial changes in market sentiments, pessimism among investors, and growing inefficiencies. However, those patterns appeared in CEE later than in the euro area countries, possibly due to the relatively lower development of financial markets in the former group. Covering the Covid-19 period and focusing on cross-border linkages in sovereign bond markets, Karkowska and Urjasz (2021) document strong volatility transmission to the region from the US and Germany, which catalysed systemic risk for the region during the crisis period. They also indicate that CEE bond markets are generally less integrated with global markets than corresponding markets in the euro area EU member states but strongly related to each other. It must be noted that the importance of the German market in the transmission of shocks to CEE may also be found in previous studies on dependencies across capital markets (see Grabowski, 2019; Pietrzak, Fałdziński, Balcerzak, Meluzin, & Zinecker, 2017).

Notwithstanding the fact that the number of studies representing both strands of research is vast and growing, as documented above, we believe that we can add to the existing literature in at least two ways. Firstly, in contrast to the previous studies, which primarily concentrated on the impact of Covid-19-related monetary policies on asset prices, returns, premia, and volatilities, we investigate the responsiveness of financial linkages among different asset classes (*i.e.* equities and sovereign bonds). We conduct our analysis at the national level, and later expand it to include international spill-over effects, *i.e.* changes in the magnitude and/or direction of financial market linkages between individual CEE countries and the US and Germany (perceived as traditional safe havens). To the best of our knowledge, such kind of global transmission of shocks during the Covid-19 pandemic has not been studied so far, and hence constitutes our second contribution.

Building on the literature devoted to the effects of the monetary policy response to the Covid-19 shock and the body of work related to shifts in financial market connectedness that occurred since the outbreak of the pandemic, we test the following hypotheses:

H1: Domestic monetary policy measures conducted in response to the Covid-19 pandemic significantly affected linkages among stock and sovereign bond markets of CEE countries.

More specifically,

H2: Domestic central banks were able to alleviate financial market tensions, thus reducing flows from domestic stock to bond markets.

H3: Domestic central banks were able to mitigate international flight to safety effects from CEE countries to safe havens.

DATA AND EMPIRICAL STRATEGY

This section describes the dataset used in the article, along with details on monetary policy events in the CEE economies investigated in this study. Next, the section maps out our empirical strategy based on conditional correlations derived from multivariate DCC-GARCH models.

Dataset Description

In this study, we aim to identify linkages between the stock and sovereign bond markets in four countries from the CEE region, *i.e.* Czechia, Hungary, Poland, and Romania, as well as two major economies, *i.e.* the United States and the euro area (represented by Germany, the most important economic counterpart to all of the analysed CEE countries) during the Covid-19 crisis. In particular, we are interested in checking whether contagion and flight-to-safety (or: flight-to-quality) effects were observed in this period, both between the two segments of the financial market as well as between the two groups of countries (the CEE economies, representing countries prone to capital outflows, and the US and Germany, perceived as traditional safe havens). Given that such phenomena were identified during earlier periods of global financial turbulence, like the GFC, we aim to investigate whether they were also present during the Covid-19 crisis.

In particular, we focus on the following linkages.

1. Linkages between the stock market and the sovereign bond market in individual CEE countries.
2. Linkages between the stock markets of individual CEE countries and the US or German stock market.
3. Linkages between the sovereign bond markets of individual CEE countries and the US or German sovereign bond market.
4. Linkages between the stock markets of individual CEE countries and the US or German sovereign bond market.

The data cover the leading stock market indices in the analysed countries. These include the Prague Stock Exchange Index (PX), the Budapest Stock Exchange Index (BUX), the Warsaw Stock Exchange Index (WIG20), the Bucharest Exchange Trading Index (BET), the German Stock Index (DAX), and the US Standard and Poor's 500 (S&P 500). The dataset also includes the 10-year local-currency sovereign bond yields of all countries considered in this study. The respective time series were sourced from the Refinitiv database.

Our main question of interest is whether the monetary policy measures introduced in the four CEE economies played a significant role in shaping financial market linkages during the Covid-19 crisis. The important consideration is that during the pandemic a broad-based monetary policy response, including unconventional monetary policy measures, was undertaken not only by the major central banks (the Fed and the ECB), but also by many central banks from the EMEs, including the Czech National Bank (CNB), the National Bank of Hungary (MNB), the National Bank of Poland (NBP), and the National Bank of Romania (NBR). Hence, to determine the impact of domestic monetary policy on financial linkages phenomena in the analysed countries, we gathered a comprehensive dataset on their central

banks' policy announcements. The monetary policy expansion of the CEE central banks during the pandemic comprised interest rate cuts, liquidity-enhancing measures, macroprudential tools, and the asset purchase programmes. Most of the anti-crisis measures were introduced in the first half of 2020, with the first important central bank announcements in March of 2020. During this month only, the NBP, and the NBR communicated substantial reductions in their interest rates while launching the first non-standard measures. However, the announcements of additional non-standard monetary policy measures continued well into 2020, with notable examples of the broadening of eligible collateral, new rounds of QE operations, further interest rate cuts, and repo lines to provide liquidity in the euro. A detailed description of monetary policy events used in the study is provided in Tables 1 through 4.

Table 1. Major Czech National Bank announcements in 2020

Date	Event
16 March 2020	CNB cuts its key interest rates (2W repo rate by 50 bps to 1.75%, the Lombard rate to 2.75%, and the discount rate to 0.75%), increases the number of liquidity-providing operations, and revises its earlier decision to increase the countercyclical capital buffer rate for exposures located in Czechia.
26 March 2020	CNB further cuts its key interest rates (2W repo rate by 75 bps to 1.00%, the Lombard rate to 2.00%, and the discount rate to 0.05%) and lowers the countercyclical capital buffer rate.
7 May 2020	CNB further cuts its key interest rates (2W rate by 75 bps to 0.25% and the Lombard rate to 1.00%), announces the broadening of the range of eligible collateral used in liquidity-providing operations, and introduces operations with 3-month maturity.
18 June 2020	CNB partially relaxes mortgage limits and lowers the countercyclical capital buffer rate.

Source: own elaboration based on the CNB's press releases.

Table 2. Major Hungarian National Bank announcements in 2020

Date	Event
16 March 2020	MNB expands the range of eligible collateral to include corporate loans.
18 March 2020	MNB considers restarting the mortgage bond purchase program, announces relief from maintenance of the systemic risk buffer, and suspends capital adequacy assessment.
24 March 2020	MNB expands the scope of collateral coverage and introduces additional one-week FX swap tenders.
30 March 2020	MNB maintains the zero per cent countercyclical capital buffer 'for longer'.
7 April 2020	MNB extends the interest rates corridor and launches QE, which involves purchases of government securities (in the secondary market) and mortgage bonds. It also launches two lending programs: Funding for Growth Scheme Go! and Bond Funding for Growth Scheme (FGS).
28 April 2020	MNB announces details on the long-term assets purchase program. One trillion HUF government bonds; 300 billion HUF mortgage (corporate) bonds. Focus on securities with at least three years to maturity.
4 May 2020	QE operations are launched at the weekly level of HUF 100 bn.
23 June 2020	MPC reduces the base rate by 15 bps to 0.75%.
21 July 2020	MPC reduces the base rate by 15 bps to 0.60%.
8 September 2020	Swap facility is added to the MNB's toolbox.
22 September 2020	The scale of BGS is increased to HUF 750 bn.
6 October 2020	MNB extends its QE program by increasing the maximum amount of purchased securities from 33% to 50% of available securities.
3 November 2020	MNB extends the maturity range of assets purchased under its QE program, prepares for green QE, and raises the total amount of FGS Go! by HUF 1000 bn.
8 December 2020	MNB announces FX swap tenders providing euro liquidity.

Source: own elaboration based on the MNB's press releases.

Table 3. Major National Bank of Poland announcements in 2020

Date	Event
16 March 2020	NBP introduces operations to supply banks with liquidity, large-scale purchase of Treasury bonds in the secondary market and discount credit for banks. The FSC[1] recommends an immediate repeal of the 3% systemic risk buffer for bank capital requirements.
17 March 2020	NBP cuts the reference rate by 0.5 pp to 1.00%, decreases the required reserve ratio from 3.5% to 0.5%, and increases the remuneration of the required reserves from 0.5% to the reference rate level.
8 April 2020	NBP cuts interest rates by 0.50 pp (the reference rate to 0.50%, Lombard rate to 1.00%, deposit rate to 0.00%, rediscount rate to 0.55%, discount rate to 0.60%). It expands the list of securities eligible for purchases in the secondary market to include government securities and government-guaranteed debt securities.
28 May 2020	NBP cuts interest rates (the reference rate to 0.10%, Lombard rate to 0.50%, rediscount rate to 0.11%, discount rate to 0.12%).
15 June 2020	FSC agrees with the request of the Chairman of the PFSA on postponing the implementation of Recommendation S on good practices with regard to managing mortgage-secured credit exposures until 30 June 2021.
13 July 2020	FSC recommends a reduction from 100% to 50% in the risk weights for exposures arising from loans secured on commercial property used for the borrower's own business and not generating rental income or profit on the sale.

Source: own elaboration based on the NBP's press releases.

Table 4. Major National Bank of Romania announcements in 2020

Date	Event
20 March 2020	NBR cuts the monetary policy rate (from 2.5% to 2.0%) and the lending facility rate (from 3.5% to 2.5%). It announces liquidity-providing repo transactions to support credit institutions and purchases of leu-denominated government securities on the secondary markets.
25 March 2020	NBR encourages banks, on an individual basis, to ease the rates on current loans and to facilitate access to new financing lines. Some relaxation in NPL treatment is announced.
27 March 2020	NBR postpones the deadline for collecting the annual contributions to the bank resolution fund for 2020 by three months, with the possibility of an extension of up to 6 months.
29 May 2020	NBR cuts the monetary policy rate (from 2.0% to 1.75%), the lending facility rate (from 2.5% to 2.25%), and the deposit facility rate (from 1.5% to 1.25%).
5 June 2020	ECB and NBR establish a repo line agreement to provide euro liquidity.
5 August 2020	NBR cuts the monetary policy rate (from 1.75% to 1.50%), the deposit facility rate (from 1.25% to 1.0%) and the lending facility rate (from 2.25% to 2.0%).
28 August 2020	ECB and NBR extend the framework arrangement to supply NBR with euro liquidity via a repo line.
12 November 2020	NBR cuts the minimum reserve requirement ratio on FX-denominated liabilities of credit institutions (from 6% to 5%).

Source: own elaboration based on the NBR's press releases.

Finally, a set of control variables was included in the empirical models. To take into account the impact of global financial shocks, we introduced the VIX index, based on the option prices of the S&P500 stock market index. Additionally, we added three control variables directly linked to the Covid-19 pandemic: the official daily counts of Covid-19 cases, the number of virus-related deaths in each of the countries, and the stringency index, all based on the Oxford Coronavirus Government Response Tracker. Those controls were introduced to disentangle the impact of the monetary policy response from the effects of the pandemic and elevated global risk aversion. The respective time series were derived from the Refinitiv database.

[1] FSC stands for Financial Stability Committee, which is the Polish macroprudential authority. The FSC comprises NBP, the Polish Financial Supervision Authority (PFSA), the Ministry of Finance, and the Bank Guarantee Fund.

Conditional Correlations

We start the description of empirical models used in the study by writing down the vector demeaned rates of return on stock markets and changes in 10-year sovereign bond yields for six countries (Czechia, Hungary, Poland, Romania, Germany, the United States). Therefore, vector $\boldsymbol{y}_t$ consists of 12 elements.

In the first step, we calculate time-varying volatilities and correlations based on the estimation of the parameters of the following AGDCC-GARCH model:

$$\boldsymbol{y}_t = \boldsymbol{\varepsilon}_t, \tag{1.a}$$

$$E(\boldsymbol{\varepsilon}_t \boldsymbol{\varepsilon}_t^T) = \boldsymbol{H}_t, \tag{1.b}$$

$$\boldsymbol{H}_t = \boldsymbol{D}_t \boldsymbol{R}_t \boldsymbol{D}_t, \tag{1.c}$$

Matrix $\boldsymbol{D}_t$ is defined as follows:

$$\boldsymbol{D}_t = diag\{[\sqrt{h_{1,t}} \quad \dots \quad \sqrt{h_{12,t}}]\}, \tag{1.d}$$

These variances are modelled using the GJR-GARCH(1,1) model:

$$h_{n,t} = \alpha_{0n} + \alpha_{1n}\varepsilon_{n,t-1}^2 + \gamma_{1n}\varepsilon_{n,t-1}^2 I\{\varepsilon_{n,t-1} < 0\} + \beta_{1n}h_{n,t-1}, \tag{1.e}$$

for each $n = 1,2, \dots ,12$. The correlations between shocks are time-varying and depend on both positive and negative shocks:

$$\boldsymbol{R}_t = \big(diag(\boldsymbol{Q}_t)\big)^{(-1/2)} \boldsymbol{Q}_t \big(diag(\boldsymbol{Q}_t)\big)^{(-1/2)}, \tag{1.f}$$

$$\boldsymbol{Q}_t = \Big(1 - \underline{\alpha}_1 - \underline{\beta}_1\Big)\boldsymbol{Q} + \underline{\boldsymbol{\gamma}}_1(Q - Q^-) + \underline{\alpha}_1 \boldsymbol{u}_{t-1}\boldsymbol{u}_{t-1}^T + \underline{\beta}_1 \boldsymbol{Q}_{t-1} + \underline{\gamma}_1 \boldsymbol{u}_{t-1}^- \, (\boldsymbol{u}_{t-1}^-)^T \tag{1.g}$$

The elements of vector $\boldsymbol{u}_t$ are defined as follows:

$$u_{n,t} = \frac{\varepsilon_{n,t}}{\sqrt{h_{n,t}}}. \tag{1.h}$$

The time-varying correlations retrieved from the estimated AGDCC-GARCH model illustrate changes in connectedness across financial markets. After calculating dynamic correlations between shocks of the stock and bond markets, the dates of structural changes in these series are identified using the Bai and Perron (2003) method. This method seems to be appropriate since it addresses the problem of estimation of the break dates and uses an efficient algorithm to obtain global minimizers of the sum of squared residuals.

Next, we apply the event study methodology based on MacKinlay (1997) to capture the impact of conventional and unconventional monetary policy measures on financial market correlations. It is assumed that financial market correlations depended on regimes and variables reflecting the course of the Covid-19 pandemic and approximating global risk aversion. The set of control variables ($\boldsymbol{cv}_t$) consists of categories tracking the course of the Covid-19 pandemic (change in the level of epidemic restrictions adopted by the country, change in the number of Covid-19 confirmed cases, change in the number of Covid-19 related deaths) and approximating global risk aversion (VIX). The binary dummies for sub-periods ($U_{l,t}$) are based on the previously identified structural changes, while the abnormal correlations are calculated using the following linear regression model:

$$r_{mn,t} = \sum_{l=2}^{L} \kappa_l U_{l,t} + \boldsymbol{cv}_t \boldsymbol{\theta} + \xi_t, \tag{2}$$

where $L - 1$ is the number of detected structural changes, $U_{2,t}, \dots, U_{L,t}$ are binary variables that take the value of 1 in sub-periods of 'constant' correlations and 0 otherwise. $\kappa_2, \dots, \kappa_L$ denote parameters for binary variables, $\boldsymbol{\theta}$ is the vector of appropriate parameters, and ξ_t is the error term.

After estimating the parameters of the model (2), the abnormal correlations are calculated analogously to the abnormal returns (Campbell, 1991):

$$AC_{mn,t} = r_{mn,t} - \sum_{l=2}^{L} \hat{\kappa}_l U_{l,t} + \boldsymbol{cv}_t \widehat{\boldsymbol{\theta}}. \tag{3}$$

It can be seen that the variable defined by the formula (3) is the difference between the observed and theoretical correlations and can be interpreted as residual from the model (2).

Suppose now that an intervention is conducted on day s. Then the average cumulative abnormal correlations h days after the intervention are calculated according to the following formula:

$$CAC_s^+(h) = \frac{\sum_{\tau=0}^{h} AC_{mn,t+\tau}}{h+1}. \quad (4)$$

On the other hand, the average cumulative abnormal correlations h days before the intervention are calculated according to the following formula:

$$CAC_s^-(h) = \frac{\sum_{\tau=1}^{h} AC_{mn,t-\tau}}{h}. \quad (5)$$

Changes in the conditional correlations were investigated in event windows equal to six trading days before and six days after a given policy announcement. Estimation was based on daily data running from January 2019 to June 2021, and the events were introduced subsequently based on the database on monetary policy interventions.

RESULTS AND DISCUSSION

This section presents and discusses our empirical results. We start by exploring the behaviour of bond and stock market correlations and breakpoints. We then proceed to country-level analysis and discuss the impact of monetary policy measures on shifts in financial market linkages in the analysed CEE economies.

Shifts in the Bond and Stock Market Conditional Correlations

After estimating the parameters of the AGDCC-GARCH model, the time-varying correlations were obtained. As indicated, we focused on four types of series: domestic correlation between major stock indices and sovereign bond yields, as well as three international correlations in bond and stock markets between the four CEE economies and Germany/the US. We next ran the Bai-Perron breakpoint tests on the retrieved series and obtain break dates. The resulting series of conditional correlations, along with estimated breakpoints, are depicted in Figures 1 through 4.

In the majority of the retrieved correlation series, the Bai-Perron tests indicated three to five breaks. Usually, one of them fell around the beginning of the Covid-19-induced crisis and one in the summer of 2020 when the markets gradually became more tranquil. Most of the correlation series sharply increased in the run-up to the crisis, in the first quarter of 2020, when there was growing uncertainty concerning the social ramifications of the then-novel coronavirus. This indicates that the Covid-19 crisis did indeed bring about serious distortions in interdependencies across the main financial market segments, as discussed in the literature review (*e.g.*, Belaid *et al.*, 2021). Subsequent breaks were typically detected at the beginning of the third quarter of 2020, when the acute phase of the crisis was coming to an end, and the market participants were rebuilding confidence.

However, both the typical values of the correlations and their shifts were not uniform across series. For example, an increase in correlation at the beginning of the pandemic was strongest for the stock-bond series. Relatively large changes were observed in international correlations in bond yields, but they tended to quickly bounce back to the average value. Those observations align with the recent literature on bond and stock market volatility during the Covid-19 crisis (see, *e.g.*, Sever *et al*., 2020). The results also point to a feature typical for the crisis period, when conditional volatilities evolve rapidly due to the flight-to-safety effects when investors quickly re-balance their portfolios and shed assets perceived as riskier.

Additionally, all four types of series differed across the CEE economies, both in terms of their average values and changes during the period under consideration. In general, Poland, the largest country in the region, was characterised by the strongest domestic stock-bond conditional correlations, with a mean value of 0.165. In February and March 2020, this value rose close to 0.3. The corresponding values for Czechia, Hungary, and Romania were 0.131, 0.024 and -0.064, respectively. Polish bond and stock markets were also more connected to the German and US markets, which was visible both in the values of correlations and their absolute changes in the first part of 2020.

Czechia

Turning to the results of the policy event studies, we start by reporting the regression results for the first of the four CEE economies, Czechia (Table 5). Domestic and international linkages in the Czech financial market were largely influenced by the anti-crisis monetary policy measures undertaken by the CNB. In particular, its first decision on 16 March 2020, which encompassed cuts in the key interest rates, an increase in the number of liquidity-providing operations, along with macroprudential policy easing, had a negative impact on the correlations between the Czech bond and stock markets, the Czech and German bond and stock markets, as well as the Czech stock and US bond markets. This might imply that the flight to safety observed between the two segments of the Czech financial market at the beginning of the Covid-19-induced crisis might have been mitigated by the introduction of the accommodative stance in Czech monetary policy. When it comes to cross-country correlations, the dependence between the Czech and German stock markets decreased significantly. Moreover, a significant decline in the two countries' cross-market linkages was recorded. Regarding the relationship between the Czech and US financial markets, we identified a significant impact only on the stock-bond correlation. Moreover, the effects of the CNB's subsequent measures were stronger for German than US cross-country dependencies, which seems to reflect a stronger integration of the Czech economy with the European financial markets.

The results for Czechia lead to another important conclusion. All monetary policy tools implemented by the Czech monetary authorities proved to play an important role in determining the correlation between the domestic stock and bond markets. With the exception of the decision from 26 March 2020, all announcements exerted a negative impact on the stock-bond correlation. This might indicate that the CNB was effective in mitigating the typical flight to safety effect, *i.e.* an escape from equities to sovereign bonds, which are regarded as a safer type of investment in times of heightened financial stress.

Hungary

The event-study results for the Hungarian central bank are presented in Table 6. Similarly to the Czech case, there was a clear pattern that the first monetary policy interventions turned out to have the most noticeable impact on the conditional correlations. The non-standard measures introduced by the MNB at the onset of the crisis (a series of actions between 16 March and 7 April 2020) were effective in lowering almost all the correlations, as shown by the negative estimates on the policy dummies for these periods. This indicates that strong, non-standard measures, such as QE, together with sharp interest-rate cuts, reduced the volatile market reaction to the Covid-19 shock and the flight-to-safety tendencies in Hungary.

The effects of the MNB announcements on the domestic stock-bond correlations turned out to be concentrated between March and June 2020, with a visibly stronger reaction of markets at the onset of the crisis. Apart from the decision made on 3 November 2020, the effects of interventions undertaken later, seem to be more ambiguous. The estimates are often insignificant or even have positive signs. The effects on international Hungarian bond correlations, both with Germany and the US, also subsided in the second part of 2020. Compared to more clear-cut results from the height of the crisis, this may be interpreted in two, nonexclusive ways. Firstly, the initial monetary policy could have been bolder than anticipated, and the financial markets were surprised by the swift reaction of the MNB, which calmed down the adverse reaction to the Covid-19 shock. Secondly, the market participants could have been more responsive to the central bank's actions when they came under the strain of the Covid-19 ramifications, *i.e.*, in the period of elevated uncertainty of March and April 2020.

Poland

The event study results for Poland are presented in Table 7. Much like in Czechia and Hungary, the policy measures adopted by the NBP had a considerable impact on the investigated conditional correlations. One should draw particular attention to the measures undertaken on 16 March 2020, as they affected linkages both at the country and international levels. This indicates that the NBP was able to effectively influence the market sentiment in this period. The subsequent measures proved to be somewhat less effective but non-negligible. The only exception is the last anti-crisis announcement

from 13 July 2020. This comes as no surprise given that it came in the form of a recommendation to further loosen macroprudential policy, for which NBP is only partially responsible. Moreover, the last measure was introduced in the summer of 2020, after the first wave of the Covid-19 shock, when it was largely believed that the most acute phase of the pandemic was over, and Poland had done relatively better in terms of protecting both its health sector and the economy when compared with its counterparties from the Western part of the EU.

More specifically, we found that the decisions from 16 March 2020 exerted a negative impact on the conditional correlation between Polish stock and bond markets, which might indicate the reduction in financial market tensions following this specific announcement. On this date, the NBP not only took decisive conventional monetary policy measures in the form of lowering its key policy interest rates, but it also launched its asset purchase program, *i.e.* a policy that had never been practised by Polish monetary authorities before. However, compared to Czechia and Hungary, Poland revealed weaker effects of monetary measures on domestic stock-bond correlations.

Regarding cross-country relationships, the negative impact of the NBP's first measures on correlations was observed between the Polish and German stock and sovereign bond markets, the Polish stock and US bond markets, and the Polish and US bond markets. Taking into account the previous literature, which provides considerable evidence of the positive effect of central banks' monetary policies on domestic asset prices (cf. Rebucci *et al.*, 2021; Tillmann, 2020), we may interpret the reduced correlations in the context of investors' returning trust to the Polish financial market (or at least a lower scale of capital withdrawal from Poland). Hence, the introduction of monetary measures helped mitigate flight-to-safety behaviour by boosting the confidence of bondholders and restoring the proper functioning of financial markets.

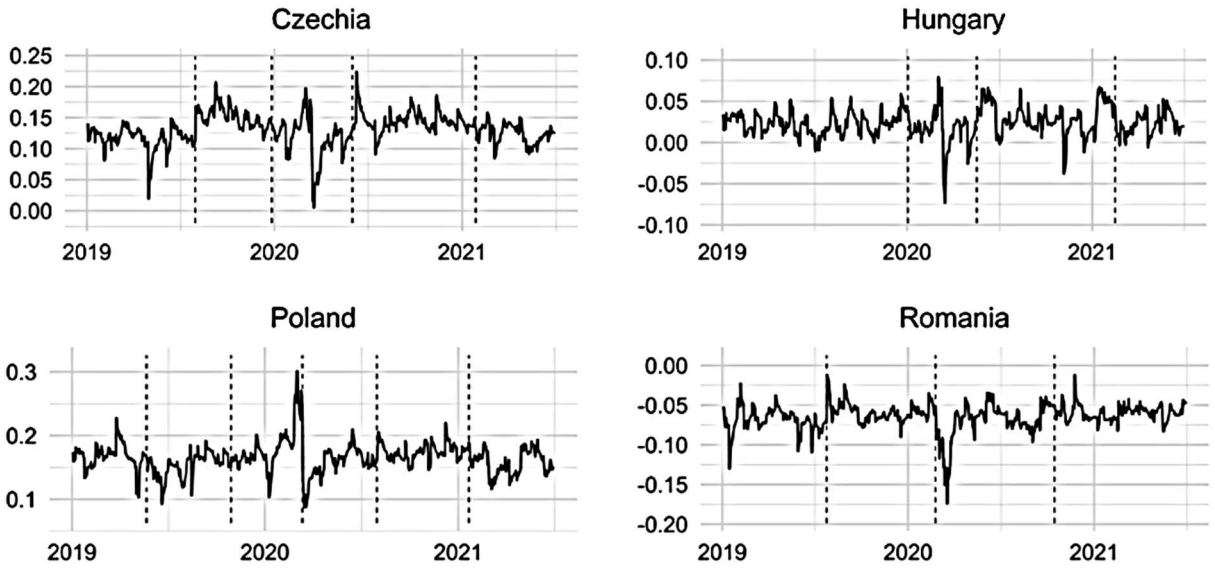

Figure 1. Stock-bond conditional correlations in CEE economies

Notes: solid lines depict conditional correlations estimated in the AGDCC-GARCH models. Dashed lines show breakpoint dates indicated by the Bai-Perron test.

Source: own elaboration.

Romania

Table 8 summarizes the event studies performed for Romania. Similarly to the other countries under consideration, the Romanian central bank began its monetary policy easing in March 2020 by announcing a series of anti-crisis measures. As in the previous cases, the first decision exerted the strongest impact on the financial market linkages, both at the domestic and international levels, in a series of policy interventions between 20 and 27 March, 2020. During this week, the NBR substantially cut its main interest rate and launched liquidity-providing operations. It also introduced an asset purchase programme, although of a smaller scale than Hungary and Poland. However, in the Romanian case, the effects of the

initial monetary easing on the conditional correlations were ambiguous when it comes to the direction of influence. Notably, we identified a positive impact of the NBR's monetary policy easing on correlations between the Romanian stock and bond markets, and the Romanian bond market and both German and US bond markets. In turn, negative signs of parameter estimates were obtained for the Romanian stock and German/US stock markets as well as the Romanian stock and German bond markets.

Moreover, we could not point to any clear pattern for subsequent policy actions in Romania. In contrast to the results for the other CEE countries, we found no further regularities with regard to either the individual measures or the cross-market or cross-country dependencies for Romania. In fact, most of the NBR's subsequently introduced policy measures proved to be insignificant in the event studies. This may be the effect of Romanian bond yields remaining at higher absolute levels than in other CEE economies. All of this points to a relatively smaller effectiveness of the transmission of the Romanian central bank interventions to the longer-end of the sovereign yield curve.

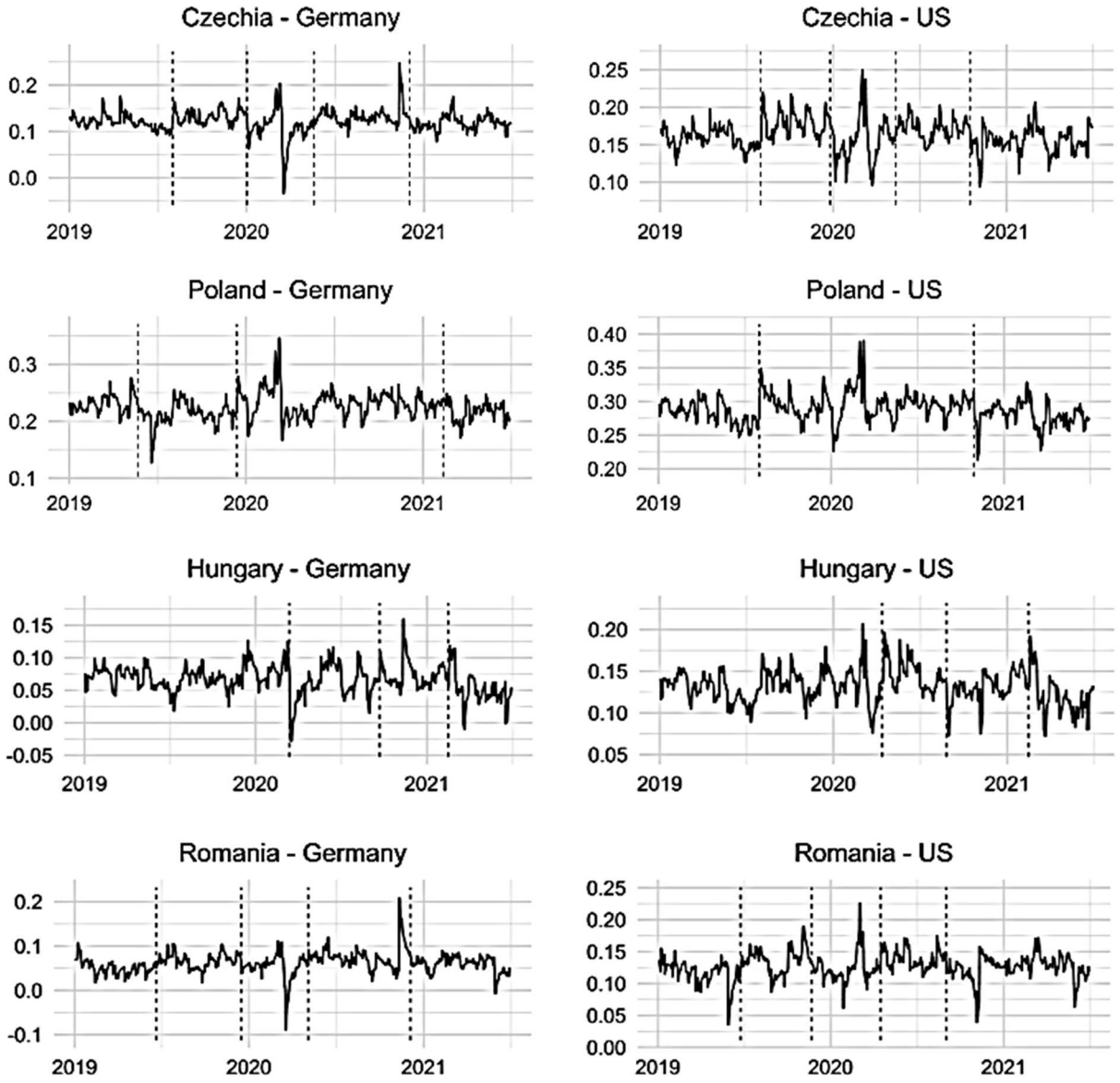

Figure 2. Bond-bond conditional correlations between CEE economies and Germany and the US

Notes: see Figure 1.

Source: own elaboration.

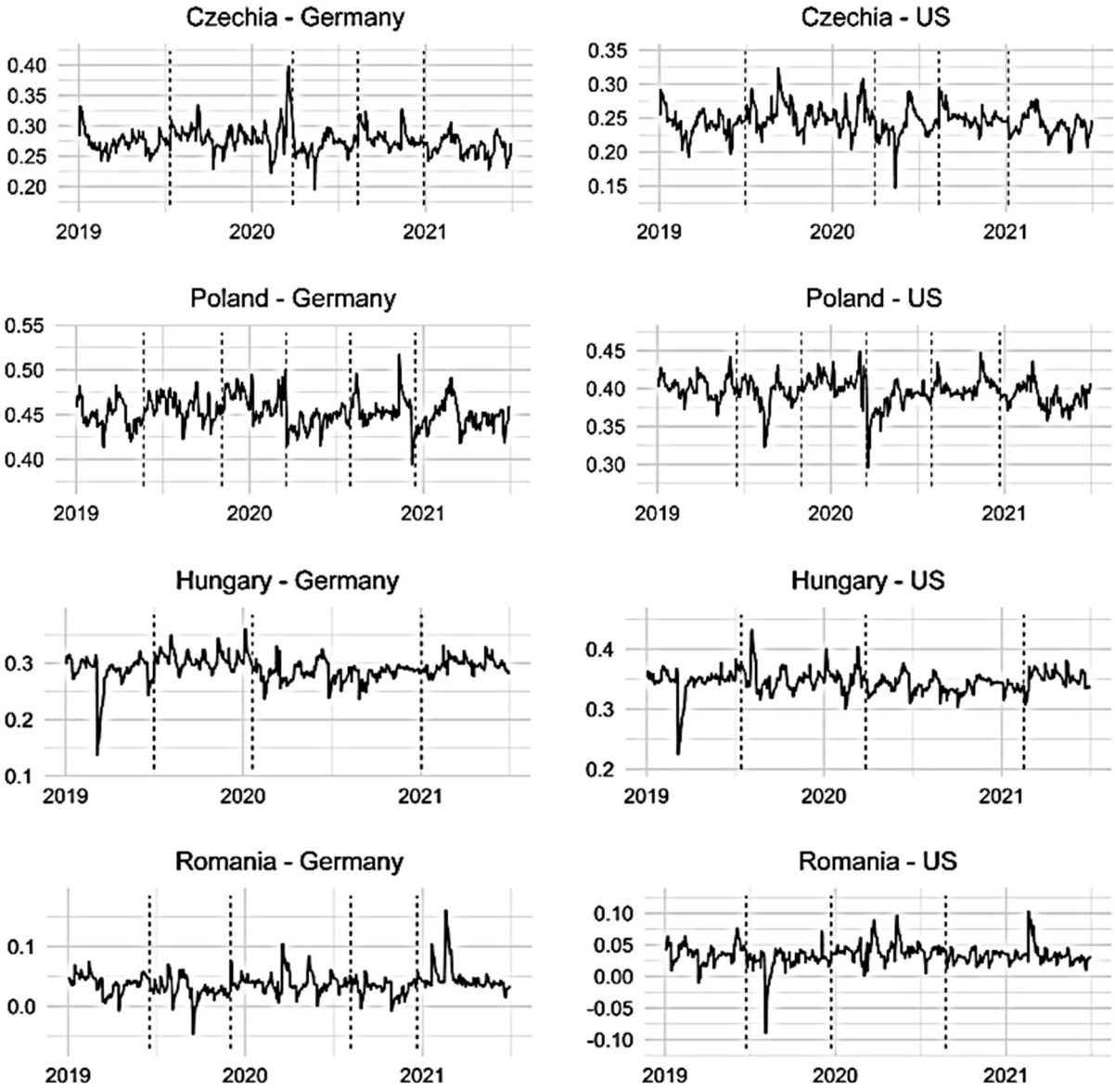

Figure 3. Stock-bond conditional correlations between CEE economies and Germany and the US

Notes: see Figure 1.

Source: own elaboration.

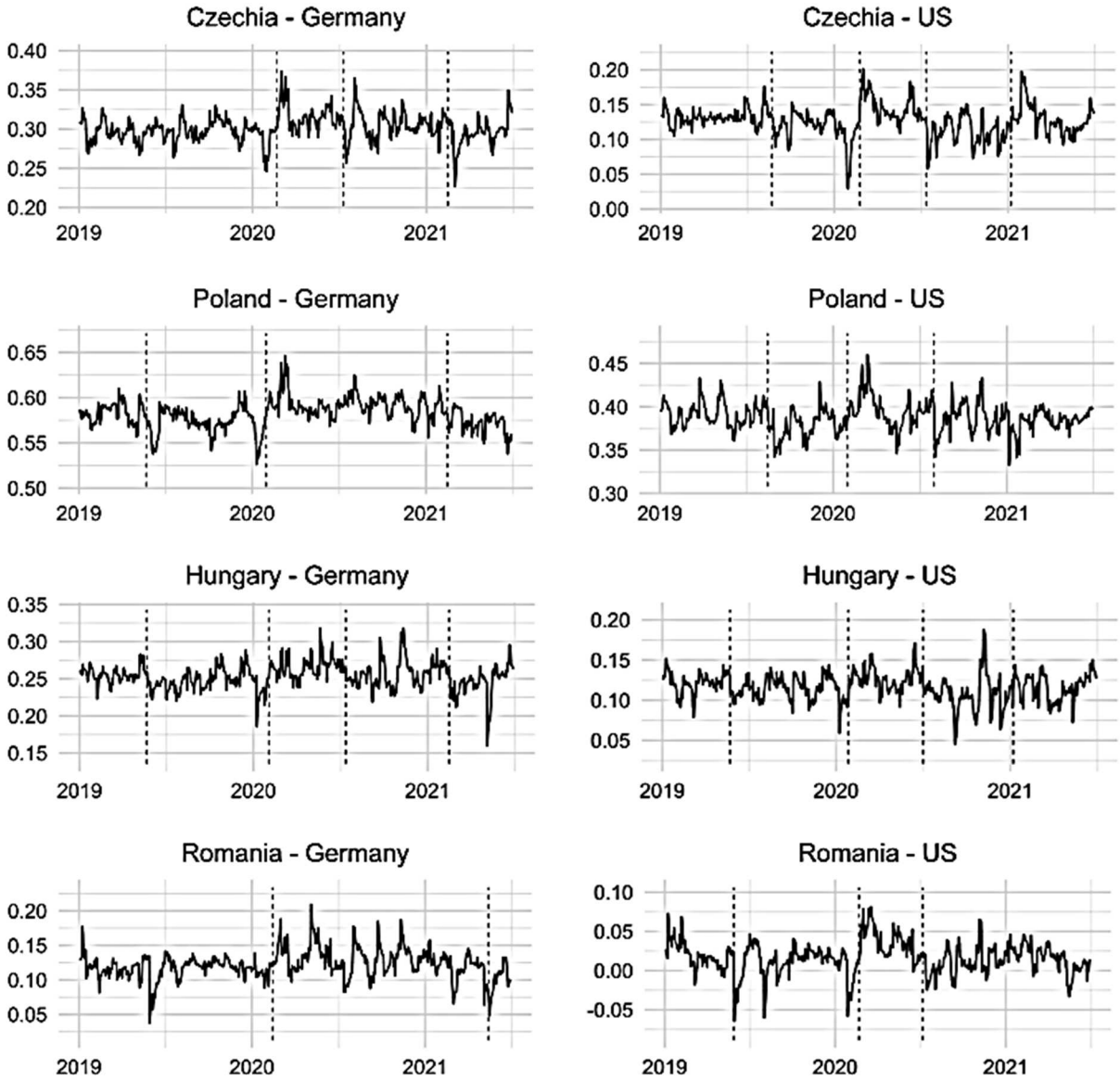

Figure 4. Stock-stock conditional correlations between CEE economies and Germany and the US

Notes: see Figure 1.

Source: own elaboration.

Table 5. Event study estimates for monetary policy responses to the Covid-19 crisis – Czechia

#	Dates	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
		Stock_CZ – Bond_CZ		Bond_CZ – Bond_DE		Bond_CZ – Bond_US		Stock_CZ – Bond_DE		Stock_CZ – Bond_US		Stock_CZ – Stock_DE		Stock_CZ – Stock_US	
		Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
1	16.03.2020	**-0.05005**	**0.000**	**0.05010**	**0.000**	0.00360	0.483	**-0.06378**	**0.000**	**-0.01995**	**0.001**	**-0.00903**	**0.089**	-0.00016	0.979
2	26.03.2020	**0.00917**	**0.081**	**-0.01558**	**0.001**	0.00136	0.751	**0.02246**	**0.000**	0.00585	0.215	-0.00256	0.569	-0.00059	0.234
3	07.05.2020	**-0.01173**	**0.051**	**-0.01436**	**0.008**	**-0.01899**	**0.000**	0.00353	0.589	0.00369	0.494	-0.00262	0.614	-0.00196	0.732
4	18.06.2020	**-0.01269**	**0.035**	-0.00463	0.392	**-0.00810**	**0.094**	-0.00717	0.271	**-0.00931**	**0.082**	**-0.01110**	**0.032**	**-0.01206**	**0.034**

Notes: the Table reports point estimates and p-values on monetary policy intervention dummies introduced to testing regressions. Full regression results that include control variables (global financial measures and pandemic-related indicators) are available upon request.
Source: own study.

Table 6. Event study estimates for monetary policy responses to the Covid-19 crisis – Hungary

#	Dates	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
		Stock_HU – Bond_HU		Bond_HU – Bond_DE		Bond_HU – Bond_US		Stock_HU – Bond_DE		Stock_HU – Bond_US		Stock_HU – Stock_DE		Stock_HU – Stock_US	
		Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
1	16.03 – 07.04.2020*	**-0.00684**	**0.093**	**-0.02240**	**0.000**	**-0.02160**	**0.000**	**-0.02002**	**0.001**	**-0.03315**	**0.000**	**-0.01028**	**0.011**	**-0.01028**	**0.011**
2	28.04 – 04.05.2020*	**-0.01731**	**0.000**	-0.00398	0.263	0.00499	0.143	**-0.00971**	**0.087**	**-0.01361**	**0.013**	-0.00365	0.442	-0.00365	0.442
3	23.06.2020	**-0.01405**	**0.010**	**-0.00190**	**0.000**	**-0.01488**	**0.000**	0.00288	0.661	-0.00050	0.937	-0.00252	0.644	-0.00252	0.644
4	21.07.2020	-0.00155	0.777	**-0.01285**	**0.002**	-0.00589	0.137	-0.00195	0.766	-0.00427	0.501	-0.00194	0.722	-0.00194	0.722
5	08.09.2020	-0.00157	0.774	-0.00156	0.705	-0.00385	0.333	0.00886	0.178	**0.01326**	**0.037**	-0.00721	0.186	-0.00721	0.186
6	22.09.2020	-0.00322	0.555	-0.00364	0.377	-0.00159	0.689	**0.01356**	**0.044**	0.00463	0.466	**0.02004**	**0.000**	**0.02004**	**0.000**
7	06.10.2020	-0.00700	0.200	0.00427	0.301	-0.00112	0.777	-0.00696	0.290	-0.00456	0.473	**-0.01404**	**0.010**	**-0.01403**	**0.010**
8	03.11.2020	**-0.02161**	**0.000**	-0.00486	0.243	-0.00026	0.949	**-0.01374**	**0.040**	**-0.01864**	**0.003**	**0.01972**	**0.000**	**0.01972**	**0.000**
9	08.12.2020	-0.00668	0.221	-0.00034	0.935	-0.00161	0.686	-0.00643	0.329	0.00336	0.597	0.00066	0.904	0.00066	0.904

Notes: see Table 5; * the time interval is due to the fact that monetary interventions were carried out frequently and their individual analysis would be impossible within the framework used in the study.
Source: own study.

Table 7. Event study estimates for monetary policy responses to the Covid-19 crisis – Poland

#	Dates	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
		Stock_PL – Bond_PL		Bond_PL – Bond_DE		Bond_PL – Bond_US		Stock_PL – Bond_DE		Stock_PL – Bond_US		Stock_PL – Stock_DE		Stock_PL – Stock_US	
		Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
1	16.03 - 17.03.2020*	**-0.01606**	**0.005**	0.00152	0.741	**-0.01079**	**0.031**	**-0.05219**	**0.000**	**-0.03268**	**0.000**	**-0.01286**	**0.000**	0.00204	0.656
2	08.04.2020	-0.00622	0.204	-0.00336	0.435	-0.00670	0.116	0.00727	0.216	**0.01089**	**0.045**	**0.00584**	**0.089**	**0.00880**	**0.047**
3	28.05.2020	0.00107	0.827	**-0.00989**	**0.021**	**-0.00903**	**0.034**	0.00241	0.682	-0.00526	0.334	-0.00544	0.113	0.00448	0.313
4	15.06.2020	**0.00875**	**0.073**	0.00092	0.830	0.00119	0.780	0.00207	0.725	-0.00558	0.304	**-0.00611**	**0.074**	**-0.01172**	**0.008**
5	13.07.2020	0.00156	0.750	0.00601	0.162	0.00414	0.330	-0.000	0.999	0.04919	0.366	0.00134	0.695	0.00223	0.616

Notes: see Tables 5 and 6.
Source: own study.

Table 8. Event study estimates for monetary policy responses to the Covid-19 crisis – Romania

#	Dates	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
		Stock_RO – Bond_RO		Bond_RO – Bond_DE		Bond_RO – Bond_US		Stock_RO – Bond_DE		Stock_RO – Bond_US		Stock_RO – Stock_DE		Stock_RO – Stock_US	
		Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
1	20.03 - 27.03.2020*	**0.00885**	**0.012**	**0.00840**	**0.073**	**0.00869**	**0.012**	**-0.01001**	**0.093**	-0.00756	0.121	**-0.01849**	**0.005**	**-0.00835**	**0.045**
2	29.05 - 05.06.2020*	**0.00847**	**0.016**	-0.00735	0.113	0.00124	0.717	**0.01127**	**0.052**	**0.01115**	**0.017**	-0.00026	0.961	0.00076	0.855
3	05.08.2020	-0.00385	0.354	0.00218	0.700	0.00047	0.908	-0.00063	0.928	-0.00361	0.517	**0.01109**	**0.079**	0.00260	0.595
4	28.08.2020	-0.00179	0.666	0.00084	0.879	-0.00025	0.951	0.00485	0.485	0.00424	0.454	-0.00774	0.221	0.00385	0.432
5	12.11.2020	-0.00137	0.743	0.00019	0.973	0.00153	0.709	**0.03863**	**0.000**	**0.03414**	**0.000**	0.00344	0.588	**-0.02289**	**0.000**

Notes: see Tables 5 and 6.
Source: own study.

CONCLUSIONS

This article investigated the impact of monetary policies in four CEE countries on shifts in financial market connectedness during the Covid-19-induced crisis. Firstly, using the DCC-GARCH models, we estimated the time-varying conditional correlations for CEE economies based on stock market returns and sovereign bond yields. Next, we performed a series of event studies based on the daily dataset of standard and unconventional monetary interventions. We found that policies introduced by the central banks of CEE countries contributed to stabilizing or reducing tensions that stemmed from an increase in financial market dependencies during the turmoil, in particular when it comes to the domestic stock-bond and cross-border bond market linkages. Hence, using a different empirical framework, our results support evidence from recent studies that anti-crisis policy measures, including non-standard ones, significantly affected market returns (Arslan *et al.*, 2020; Rebucci *et al.*, 2021). This seems to be the case also when such measures were implemented not only by the major central banks, such as the Fed or the ECB, but also by monetary authorities in small and emerging market economies.

The empirical results substantiate the main hypothesis of the study, which states that the domestic Covid-19 monetary policy response significantly affected linkages among stock and sovereign bond markets in the countries under consideration. More specifically, our findings allow us to claim that, in general, the anti-crisis policy measures announced by domestic central banks in CEE economies in 2020 exerted mitigating effects on an increase in the financial market connectedness triggered by the Covid-19 turmoil. The important caveat, however, is that these effects were not uniform across financial market segments and CEE countries. They turned out to be notably stronger for correlations that involved bond markets and relatively smaller in Romania compared to the remaining CEEs.

The validity of the second hypothesis, which concerned the ability of the central banks in CEEs to reduce flows from domestic stock to bond markets, was partly confirmed by the obtained results. In some cases, due to monetary interventions, the central banks of Czechia, Hungary, Poland, and Romania were able to alleviate financial market tensions, thus reducing flows from domestic stock to bond markets. However, a detailed analysis reveals differences across the CEE countries. While, in the case of Czechia, all monetary interventions turned out to have a statistically significant impact on the level of correlation between stock market returns and changes in sovereign bond yields, in the case of Hungary, Poland, and Romania, the measures launched at the beginning of the Covid-19 pandemic turned out to be much more effective than the interventions introduced in the third and fourth quarter of 2020. Similarly, the validity of the third hypothesis, which stated that the CEE central banks were able to mitigate international flight-to-safety effects from CEE countries, was only partially confirmed. More specifically, we found that such effects were contained by the first monetary interventions. The impact of the subsequent measures differed with regard to its direction and magnitude across the CEE countries.

Our results may be additionally interpreted in the context of the effectiveness of monetary policy interventions under uncertainty in financial markets. This theoretical debate on whether monetary policy is more or less effective during a crisis than in 'normal' times is still not settled (Jannsen, Potjagailo, & Wolters, 2019; see also Wei & Han, 2021). On the one hand, one could argue that the high market volatility and substantial balance-sheet adjustments of the market participants impair the monetary transmission mechanism, and central bank interventions may be expected to generate muted reactions. On the other hand, one may posit that financial constraints, which are binding during crises, increase a central bank's chances of influencing market premia and stabilizing expectations. Our results lean towards the latter theoretical prediction and support recent empirical findings of studies which show that non-standard monetary policies had significant effects on the financial market even at the height of the pandemic shock (Fratto *et al*., 2021; Sever *et al*., 2020).

The relative effectiveness of monetary policies in CEE countries in 2020 may be ascribed to a speedy reaction of the central banks to the pandemic shock, but also the fact that anti-crisis monetary measures were introduced worldwide, easing the adverse effects of the global shock. Special times call for special measures, and the CEE central banks, much like the monetary authorities in major AEs, significantly departed from their regular practice of conducting monetary policies. A close-to-zero policy rate, QE, and

other unconventional measures increased their chances of reducing market risk premia and boosting investor confidence. In this respect, our results are supportive of recent studies by Moessner and de Haan (2021) for the euro area, who highlight the role of the announcement effect and communication in the way that central banks affect financial markets, but also of previous studies that document the announcement effects, for example in sovereign bond markets (Afonso *et al*., 2020). At the same time, the empirical results obtained in the study evoke the problem of the weakening in effects of successive monetary policy actions. The pattern we found shows that the first series of central bank decisions had the strongest market impact. When it comes to policy implications, our results provide a rationale to utilize stabilization tools, including unconventional ones, during periods of financial instability generated by external shocks. Given the connection of CEE countries' financial markets with the euro area and the US and its susceptibility to external shocks, central banks in the region should be prepared to react to potential natural and man-made disasters that may periodically reappear in the global economy. However, it must be noted that efforts to preserve financial stability may come at the long-term cost of undesirable complications when the reversal from extraordinary policies is postponed for too long. In CEE economies, those problems may include the central bank's institutional standing, political economy issues and relationship with the government, and a build-up of inflationary expectations.

There are at least three important limitations to this study that should motivate further work in the area. Firstly, the article leaves aside an important but controversial policy measure used during the Covid-19 crisis, namely the foreign-exchange interventions. Considering the active efforts of some CEE countries to influence the value of their currencies in 2020 and 2021, the issue of the 'second instrument' of central banks (Ghosh, Ostry, & Chamon, 2016) in open economies seems worth exploring in this context. In particular, studies could explore the impact of interventions on CEE economies' exchange rates vis-à-vis major currencies, the US dollar and the euro. The second limitation of the article is related to its empirical approach, based on the DCC-GARCH model and event studies of monetary policy announcements. Specifically, it would be advisable to look more closely into the differences between the effects of standard and non-standard monetary policy tools implemented in CEEs in 2020. The original database of monetary policy interventions in CEE economies prepared for this study may serve as a starting point for further research in this direction. Moreover, as new methods are developed in this active field, one could complement the results presented here with alternative empirical approaches, such as the time-varying parameter VAR models. Thirdly, this study focused on the effects of anti-crisis policy measures implemented at the onset of the Covid-19 crisis in CEE countries. However, increasing inflation rates in 2022 bring about new challenges for central banking in the region. Domestic and international effects of exiting the monetary stimulus in 2022, including their impact on inflation rates in CEE economies, also warrant further investigation.

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Explaining the international opportunity recognition with the qualitative comparative analysis: The role of dynamic capabilities self-efficacy and global mindset

Omar Heredia-Portillo, Enrique Armas-Arévalos

ABSTRACT

Objective: The objective of the article is to explore the configurations of dynamic capability activities and the global mindset attributes of managers that lead to international opportunity recognition. Particularly, sensing capability, seizing capability, transforming capability, networking capability, cognition, knowledge, and behaviour.

Research Design & Methods: This was a quantitative study that uses a fuzzy set qualitative comparative analysis (fsQCA) to analyse how different combinations of sensing capability, seizing capability, transforming capability, networking capability, cognition, knowledge and behaviour are related to the international opportunity recognition (IOR). The sample was made up of a manager from 21 Mexican micro and small companies in the information technology (IT) sector. All the analyses were performed in the QCA package in R.

Findings: The findings suggest that without seizing capability, international opportunity recognitions cannot occur, and other conditions cannot compensate for their absences. There are three causal paths derived from dynamic capabilities and a global mindset that explain when managers of firms recognize opportunities abroad. Findings also show that the seizing and networking conditions are present in the three causal paths that lead to IOR. There are no paths that lead to international opportunity recognitions without the presence of seizing and networking, reflecting their relative importance in guaranteeing IOR. On the other hand, the results show the asymmetric causality of the IOR, in which different sets of conditions are observable for the occurrence and non-occurrence of the IOR, which does not constitute a reversal of the same conditions.

Implications & Recommendations: The results confirm that managers seeking to recognize international opportunities can benefit from a high level of dynamic capabilities, self-efficacy, and a global mindset. These factors can be reinforced by investing in training, education, or experiential learning; or by recruiting a manager with high levels of these factors. In the same way, policymakers can establish programs that allow the reinforcement of these factors. Finally, given the smaller sample size, future research can test this framework across larger datasets, contexts, and time to test the model's reliability.

Contribution & Value Added: The results of this study reinforce the existing literature on the effect of manager dynamic capabilities and global mindset on IOR. It helps to verify the assumptions of Andersson and Evers (2015) and Tabares *et al*. (2021) about manager-level factors that influence IOR, by showing that the combination of explanatory conditions derived from dynamic capabilities and a global mindset explains when a manager recognizes opportunities abroad.

Article type: research article

Keywords: international entrepreneurship; international opportunity recognition; fuzzy-set qualitative comparative analysis (fsQCA); dynamic capabilities; global mindset; self-efficacy

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INTRODUCTION

International opportunity recognitions are the beginning of the internationalisation process (Johanson & Vahlne, 2009; Kraus *et al.,* 2017). Knowing opportunities allows for advancing in the internationalisation process through commitments in relationships and determines the place where managers will expand the operations of their firms (Johanson & Vahlne, 1977; 2009). Although existing theories explicitly assume that internationalisation is preceded by opportunity recognition (OR) (Chandra *et al.,* 2009), current research offers a limited explanation of international OR, or simply pays limited attention to it (Ellis, 2011; Mainela *et al.,* 2014; Teran-Yepez *et al.,* 2020). Opportunity recognition is so important that some international business scholars have called for more research to understand how individuals recognize and exploit international opportunities (Teran-Yepez *et al.,* 2020; Torkkeli *et al.,* 2018; Zahra *et al.,* 2011; Zucchella, 2021).

A growing literature confirms that managers are able to recognize opportunities due to their high levels of: (1) prior knowledge about the markets, the ways of serving the markets and the client problems (Mostafiz *et al.,* 2019; Shane, 2000; Tabares *et al.,* 2021); (2) social and business net-works that allow them to see and hear from a distance, and give them access to new and different types of information and ideas that are not otherwise obtainable (Chandra *et al.,* 2009; Faroque *et al.,* 2021; Tabares *et al.,* 2021); (3) alertness to notice and be sensitive to information about objects, incidents, and behaviour patterns in the environment, with particular sensitivity to manufacturer and user problems, unmet needs and interests, and novel combinations of resources (Ardichvili *et al.,* 2003; Tabares *et al.,* 2021); and (4) international entrepreneurial orientation to emphasizes innovation, risk taking, and a generally proactive approach to business in foreign markets (Knight, 2001; Slevin & Terjesen, 2011; Tabares *et al.,* 2021; Wach, 2015). These factors can be important in several cases, but there is more to the international OR that needs to be looked at (Zucchella, 2021). Recently, dynamic capabilities (DC) and global mindset (GM) have found increasing acceptance among researchers seeking to explain accelerated internationalisation and international OR, arguing that managers possess high levels of these factors to recognize opportunities and capture value by exploiting them (Andersson & Evers, 2015; Ardichvili *et al.,* 2003; Knight & Cavusgil, 2004; Mainela *et al.,* 2014; Mathews & Zander, 2007; Nummela *et al.,* 2004; Schweizer *et al.,* 2010; Teece, 2016; Weerawardena *et al.,* 2007). Therefore, it is crucial to focus on the entrepreneurial processes of opportunity recognition and exploitation while studying business internationalisation (Wach, 2015). Teece (2018) calls for studies that focus on specific aspects of dynamic capabilities and opportunity recognition. However, there is still a paucity of empirical evidence on the effect of dynamic capabilities (Andersson & Evers, 2015; Buccieri *et al.,* 2020; Faroque *et al.,* 2021; Feng *et al.,* 2023; Helfat & Peteraf, 2015; Jones *et al.,* 2011; Mostafiz *et al.,* 2019) and the global mindset of entrepreneurs in the international OR (He *et al.,* 2020; Jones *et al.,* 2011; Torkkeli *et al.,* 2018). Even though the international OR is an important factor in the individual's decision to start the internationalisation process (Johanson & Vahlne, 2009; Kraus *et al.,* 2017). This has resulted in 'the opportunity side of the internationalisation process not being very well developed' (Johanson & Vahlne, 2015, p. 167), and many doubts about how managers discover and exploit international opportunities (Zahra *et al.,* 2011; Zucchella, 2021).

International OR is the trigger for the internationalisation process and deserves more attention than has been obtained so far (Chandra *et al.,* 2009). Therefore, this article studies how the different combinations of the dynamic capability activities and the global mindset attributes of the manager influence the international OR, based on the perspective of dynamic capabilities (Al-Aali & Teece, 2014), global mindset (Felicio *et al.,* 2016a; Nummela *et al.,* 2004), self-efficacy (Bandura, 2006), networking (Johanson & Vahlne, 2015) and fuzzy sets (Dusa, 2019; Ragin, 2008). The analysis was carried out at the level of the manager, because it is considered fundamental and less restrictive than at the level of the firm when seeking to understand internationalisation as a process that involves recognizing and exploiting international opportunities (Chandra, 2007; Ellis, 2011; Jones *et al.,* 2011; Muzychenko & Liesch, 2015; Zahra *et al.,* 2011). However, the studies that relate dynamic capabilities to international OR mostly maintain a theoretical approach (Al-Aali & Teece, 2014; Andersson & Evers, 2015; Bai & Johanson, 2018; Weerawar-

dena *et al.,* 2007; Zahra *et al.,* 2022), making it difficult to operationalize the concepts (Correa *et al.,* 2019). For this reason, this article uses, for analytical purposes, a direct analogy of dynamic capabilities through Bandura (2006) self-efficacy. Dynamic capabilities self-efficacy (DCS) is an attempt to capture the levels of the dynamic capabilities of the manager, allowing the intangible concepts involved to be measured and analysed more reliably (Barney *et al.,* 2011; Kevill *et al.,* 2017). On the other hand, since many international business (IB) phenomena are inherently configurational, fuzzy set qualitative comparative analysis (fsQCA) was adopted to address these patterns (Fainshmidt, 2020; Fainshmidt *et al.,* 2020). Fuzzy-set QCA has been accepted by the international business and entrepreneurship field, evidenced by the increasing number of publications using this method in indexed and high-impact journals (Ciravegna *et al.,* 2018; Dul, 2016; Felicio *et al.,* 2016; Fiss, 2011; Kusa *et al.,* 2021, 2022; Mostafiz *et al.,* 2021; Roig-Tierno *et al.,* 2017; Suder *et al.,* 2022; Tóth *et al.,* 2015). The fuzzy-set QCA was the ideal set theory technique to demonstrate how the membership of the cases in the causal conditions (dynamic capability activities and the global mindset attribute) relate to their membership in the outcome of interest (international OR), allowing to examine the causal conditions together to find equifinality where more than one path leads to the international OR (Fainshmidt, 2020).

The article aims to explore the configurations of dynamic capability activities and the global mindset attributes that lead to international opportunity recognition, particularly, sensing capability, seizing capability, transforming capability, networking capability, cognition, knowledge, and behaviour. Therefore, the following research question was addressed: what configurations of dynamic capability activities and the global mindset attributes lead to international opportunity recognition? The originality of this study lies in reinforcing the existing literature on the effect of manager dynamic capabilities and global mindset on international OR and reducing the paucity of empirical evidence on the subject (Andersson & Evers, 2015; Buccieri *et al.,* 2020; Faroque *et al.,* 2021; Feng *et al.,* 2023; He *et al.,* 2020; Helfat & Peteraf, 2015; Jones *et al.,* 2011; Mostafiz *et al.,* 2019; Torkkeli *et al.,* 2018). Furthermore, it seeks to verify the assumptions of Andersson and Evers (2015) and Tabares *et al.* (2021) about the manager-level factors that influence the international OR. It also provides valuable information to managers, owners, and entrepreneurs, who can benefit from a high level of dynamic capabilities self-efficacy and a global mindset. These factors can be reinforced in two ways. The first is an investment in training programs such as design thinking (Liedtka & Ogilvie, 2011), value proposition design (Osterwalder *et al.,* 2014), customer development (Blank & Dorf, 2012), business model design (Osterwalder & Pigneur, 2010), lean start-up (Ries, 2011; Teece, 2016), and lean launchpad (Blank *et al.,* 2014). The second is to recruit a manager with high levels of these factors. For policymakers, this study provides guidance for more effective and efficient assistance in the internationalization process. Policymakers can reinforce dynamic capability activities and the global mindset attributes, establishing training programs where managers learn to deeply understand customer needs, design, and validating and innovating business models. In addition, they may conduct business seminars and international trade shows that link managers with foreign buyers, sellers, and intermediaries.

The rest of the document is organized as follows. Section 1 will review the literature on international opportunity recognition, dynamic capabilities, and global mindsets. Section 2 will present the measures applied for data collection and describes the research methodology followed. Section 3 will present the empirical results, and the final section of the document will include the discussion and conclusions of the results highlighting the theoretical and practical implications and demonstrate the limitations of the study and recommends the potential direction of future research.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Theoretical reasoning resides at the level of the individual and in predicting differences in the international OR. Theoretical logic was developed based on how different configurations of dynamic capability activities and the global mindset attributes lead to international OR. For this purpose, it begins with the definition of the dynamic capability activities and the global mindset attributes. Based on this review, hypotheses were developed about how these factors lead to international opportunity recognition.

Dynamic Capabilities Self-efficacy and International OR

While previous studies often conceptualize dynamic capabilities as organization-level capabilities (Di Stefano *et al.,* 2014), recent research in international business (Distel *et al.,* 2019) and international entrepreneurship (Mostafiz *et al.,* 2019) has emphasized the importance of understanding dynamic capabilities from the perspective of the individual. This study argues that dynamic capabilities and self-efficacy are concerned with skills/capabilities and offer potentially valuable synergies at the individual level (Kevill *et al.,* 2017) and thus are inherently difficult to study in terms of firm-level processes (Distel *et al.,* 2019; Helfat & Peteraf, 2015; Teece, 2012). This is consistent with Teece (2012), who suggests that the ability to assess and prescribe asset configuration changes rests on the shoulders of top managers, and the quality of organizations' managers is an important foundation for the strength or weakness of its dynamic capabilities (Teece, 2016). The quality of managers can be linked to their personal characteristics, as Bendig *et al.* (2018) and Durán *et al.* (2022) comment, levels of education, leadership styles, and the degree of self-efficacy of managers are relevant factors for developing dynamic capabilities in companies. In this sense, Helfat and Peteraf (2015) suggest that dynamic capabilities not only encompass the ability to perform physical activities, but also one or more mental activities that comprise cognition that can support dynamic capabilities to explain the strategic change of organizations, and the differences in the levels of cognitive abilities between individuals explain who more accurately detect new opportunities and threats. Thus, dynamic capabilities and self-efficacy may offer valuable synergies to counter the paucity of empirical studies seeking to apply, extend, and test the construct of dynamic capabilities in the context of international business (Zahra *et al.,* 2022).

Based on the above, self-efficacy could accurately reflect the processes and activities that comprise the dynamic capabilities (Bandura, 2006; Kevill *et al.,* 2017), because the perception of self-efficacy reflects people's judgments on their abilities to organize and execute courses of action required to achieve certain goals (Bandura, 1997; 2006). Therefore, the levels of dynamic capabilities of managers can be measured through the level of belief that they maintain about their own dynamic capabilities rather than by the dynamic capabilities that they really possess (Bandura, 2006; Kevill *et al.,* 2017). That is, the perception of dynamic capabilities self-efficacy reflects the degree to which the individual can perform dynamic capability activities. In consequence, the stronger the sense of personal efficacy, the greater the perseverance and the probability that the chosen dynamic capability activities will be carried out successfully (Bandura, 2006; Barney *et al.,* 2011).

Al-Aali and Teece (2014) suggest that in order to operationalize dynamic capabilities in the international context they can be usefully disaggregated into three groups of managerial processes and activities performed within the organization. However, although networking activities have a positive and significant relationship with dynamic capabilities (Abbas *et al.,* 2019), and a prominent role in successful internationalization (Weerawardena *et al.,* 2007) and the detection of international opportunities (Bai & Johanson, 2018), it is not conceptualized as a dynamic capability (Mort & Weerawardena, 2006). To fill this knowledge gap, in the present study, we added networking activities to the operationalization of dynamic capabilities in the international context. Because networking is a dynamic capability that changes throughout the evolution of the internationalization process, managers start with a set of networks which are continually renewed (Mort & Weerawardena, 2006).

In the literature, different self-efficacy scales are used to determine whether a person will try to participate in or avoid a task (Bandura, 1997; 2006): creative self-efficacy (Alvarez-Huerta *et al.,* 2022; Beghetto & Karwowski, 2017); international entrepreneurial self-efficacy (Wasowska, 2019); entrepreneurial self-efficacy (Alvarez-Huerta *et al.,* 2022; Shepherd & Patzelt, 2018); leadership self-efficacy (Dwyer, 2019); and networking self-efficacy (Kregar *et al.,* 2019). However, there is no self-efficacy scale for dynamic capabilities to determine manager's level of belief in their ability to successfully participate in activities involving dynamic capabilities: sensing, seizing, networking, and transforming. Using a self-efficacy scale is an attempt to capture the levels of the dynamic capabilities of managers, allowing the intangible concepts involved to be measured and analysed more reliably (Barney *et al.,* 2011; Kevill *et al.,* 2017). Furthermore, it could help reduce the paucity of empirical studies that focus

on applying, extending, and testing the construct of dynamic capabilities (Zahra *et al.,* 2022). Therefore, there is a need to introduce a new concept in this research that connects self-efficacy with dynamic capabilities. The concept is called dynamic capabilities self-efficacy and can be defined as a characteristic of managers that influences the success of their dynamic capabilities.

Dynamic capabilities provide managers with a wide range of diverse resources and capabilities; however, if managers lack perceived self-efficacy, these capabilities may not exist (Kevill *et al.,* 2017). Thus, dynamic capabilities self-efficacy refers to the manager's belief in his or her ability to successfully perform the activities that comprise the dynamic capabilities. That is, based on the literature review, the dynamic capabilities self-efficacy can be defined as (Al-Aali & Teece, 2014; Bai & Johanson, 2018; Peng & Luo, 2000; Ritter & Gemunden, 2003; Weerawardena *et al.,* 2007): The judgment of the manager about their ability to identify opportunities and latent needs of customers at home or abroad based on the interpretation of information from various sources (sensing), address and take advantage of international opportunities through innovation, investment or the design of a business model (seizing), build, maintain and coordinate relationships with senior executives of other firms and government officials within domestic and international networks (networking), and continually renew resources and organizational routines (transforming).

Dynamic capabilities and self-efficacy are important in the process of identifying domestic and international opportunities (Andersson & Evers, 2015; Drnovsek *et al.,* 2010; Muzychenko & Liesch, 2015; Schweizer *et al.,* 2010; Teece, 2007). As Andersson and Evers (2015) and Schweizer *et al.* (2010) argue, entrepreneurs have high levels of dynamic capabilities to recognize international opportunities and capture value by exploiting them. These capabilities not only drive survival and growth during internationalisation (Sapienza *et al.,* 2006) but are also relevant to improving the performance of companies open to international trade and exposed to a combination of opportunities and threats with rapid technological changes (Teece, 2007). Mostafiz *et al.* (2019) found that there is a positive relationship between the dynamic managerial capabilities of entrepreneurs and the identification of international opportunities. Similarly, Tabares *et al.* (2021) identified that cognition, human capital, and social capital allow managers to identify a wide range of international opportunities and select the best ones. Thus, the dynamic capabilities self-efficacy, as will be seen later, is a vehicle to assign membership levels to dynamic capability sets (full membership, point of indifference, or total exclusion) in the fuzzy-set QCA analysis.

Sensing capability. This capability provides the manager with the information and knowledge necessary to detect opportunities at the local and international levels (Teece, 2007; Al-Aali & Teece, 2014). The activities that comprise this capability are like the activities of the opportunity recognition process developed in the entrepreneurship literature (Teece, 2016). Sensing capability involves exploring all technological possibilities, probing local and foreign markets, listening to customers and scanning the national and international business environment, building and testing hypotheses about the market and technological evolution, including recognition of latent demand at a global scale (Al-Aali & Teece, 2014), like, maximizing expected returns and minimizing risk by testing and adapting ideas (Osterwalder *et al.,* 2020). This is achieved when the manager is capable of interpreting and filtering information in any form and through any available source in order to create a hypothesis about the probable evolution of the technologies, the needs of the clients, and the possible market responses (Teece, 2007). Based on the above evidence, the following is hypothesized:

Proposition* 1*: A high level of sensing capability can lead to an increase in international OR.

Seizing capability. As Shane and Venkataraman (2000) point out, identifying opportunities is a necessary condition for entrepreneurship, but it is not enough. Once opportunities are correctly detected and calibrated, they need to be seized (Al-Aali & Teece, 2014). Exploiting opportunities requires a strong seizing capability to design and refine a business model that allows capturing a part of the value that is created for customers and having the ability to decide which ideas are most viable to mobilize available resources (Teece, 2007). In addition, it requires the ability to mobilize resources globally to address opportunities, build a global supply chain and establish strategic alliances (Al-Aali & Teece, 2014). The business model describes how an organization creates, delivers, and captures

value (Osterwalder *et al.,* 2014) and in most cases, its development begins with a deep understanding of customer needs and familiarity with the different models that already exist (Teece, 2018). Design tools (client input, ideation, visual thinking, prototyping, storytelling and scenarios) are required to complement the insights to design viable business models (Osterwalder & Pigneur, 2010). Based on the above evidence, the following is hypothesised:

Proposition* 2*: A high level of seizing capability can lead to an increase in international OR.

Transforming capability. It is crucial that the manager is prospective enough to make a reasonable prediction about the capabilities needed to deliver a valuable solution to customers at the right time (Al-Aali & Teece, 2014). Transforming capabilities include selective removal of old products; renovating aging facilities both nationally and globally; and changing business models, methods, and organizational culture (Al-Aali & Teece, 2014). It has to do with the ability to change outdated business models to more robust models, this includes scaling emerging business models, renewing those in decline and protecting successful ones, ensuring growth, improving returns, and minimizing risk (Osterwalder *et al.,* 2020). The goal is to continually prevent existing business models from collapsing by protecting, improving, and reinventing them (Osterwalder *et al.,* 2020; Teece, 2018). Based on the above evidence, the following is hypothesised:

Proposition* 3*: A high level of transforming capability can lead to an increase in international OR.

Networking capability. It suggests a superior ability to act in international networks, which is based on the knowledge accumulated by building and maintaining relevant relations (Bai & Johanson, 2018; Weerawardena *et al.,* 2007). It facilitates the development of knowledge-intensive products and improves the performance of firms in the international market (Mort & Weerawardena, 2006). Recognition of the international opportunity will depend on the size and scope of an individual network, which takes time to develop (Ellis, 2011). The networks are not static; they change throughout the evolution of the internationalization process. Managers start with a set of networks which are continually renewed (Mort & Weerawardena, 2006). Managers must have a high level of networking self-efficacy to efficiently obtain and use the resources and capabilities obtained through their networks (Kregar *et al.,* 2019). In other words, the manager needs to trust his own abilities to proactively build and develop contacts and thus be able to detect international opportunities (Wolff & Moser, 2009). Networking has proven to be effective when business ties have not yet developed, so managers need to be actively involved in networking with foreign business partners and customers to gain access to opportunity identification (He *et al.,* 2020). The networking capability allows the identification and exploitation of international opportunities (Mort & Weerawardena, 2006; Bai & Johanson, 2018; Ellis, 2011; Nowiński & Rialp, 2016; Tabares *et al.,* 2021; Weerawardena *et al.,* 2007). Even unexpected meetings with friends and colleagues at events such as parties, business seminars, and international trade fairs can become valuable sources of networking knowledge to discover new opportunities (Nowiński & Rialp, 2016; Tabares *et al.,* 2021). Network relationships trigger and motivate internationalization, influence market selection decisions, and help gain initial credibility in establishing channels and access to additional relationships (Dar, 2019). Based on the above evidence, the following is hypothesised:

Proposition* 4*: A high level of networking capability can lead to an increase in international OR.

Global Mindset and International OR

The development of a global mindset is based on cultural self-awareness and openness to the diffusion of foreign values and practices in management processes (He *et al.,* 2020). It is characterized by an openness and articulation of multiple cultural and strategic realities both globally and locally (Levy *et al.,* 2007; Mostafiz *et al.,* 2019). It is the ability to recognize and adapt to cultural cues to intuitively see international opportunities (Solomon & Schell, 2009). It involves scanning the world from a broad perspective, looking for unexpected trends and opportunities, embracing the complexity and contradictions inherent in global interactions (Earley *et al.,* 2007). People with a high level of global mindset value diversity and multicultural teamwork; they are inclusive rather than exclusive, comfortable with ambiguity, continually seeking to discover new meaning and reshape boundaries to improve their lives (Ear-

ley *et al.,* 2007). Moreover, they are more aware of their cognitive processes and adapt their behaviour according to an integration of personal and cultural values (Clapp-Smith *et al.,* 2007). The global mindset is the body of knowledge, cognitive, and psychological attributes that allow a global leader to influence managers, groups and organizations presenting diverse cultural, political and institutional systems to contribute to the achievement of the goals of the global organization (Beechler & Javidan, 2007).

According to Wach (2017), a global mindset of the entrepreneur stimulates internationalisation, and the level of internationalisation is explained by the level of a global mindset of managers. In the same way, Oviatt and McDougall (1994) suggest; a global vision is the most important characteristic of the directors of companies that are born globally. For this reason, the global mindset is an important antecedent that allows accepting and uniting different cultures and markets in a global approach to observe patterns that lead to recognizing and exploiting international opportunities (Weerawardena *et al.,* 2007; Knight & Cavusgil, 2004; Mathews & Zander, 2007; Nummela *et al.,* 2004; Mainela *et al.,* 2014; Ardichvili *et al.,* 2003; Gupta & Govindarajan, 2002; Mostafiz *et al.,* 2019). From the perspective of dynamic capabilities, managers with a high level of global mindset acquire resources such as contacts with local government officials and knowledge about cultures to explore international opportunities and learn from the experience (Lazaris & Freeman, 2018). This means that there is a relationship between dynamic capabilities and a global mindset that leads to discovering business opportunities across borders. The global mindset is related to the decisions, actions, knowledge and ways of thinking of the individual to establish the strategies to position the firm in the international market (Felicio *et al.,* 2016a). Its main characteristic is the ability to associate different cultures and local markets with global dynamics, that is, the ability to assess reality from a contextual, multicultural or commercial perspective, and understand the common points to identify opportunities (Earley & Peterson, 2004; Felicio *et al.,* 2015; Felicio *et al.,* 2016a; Kedia & Mukherji, 1999; Mostafiz *et al.,* 2019). The concept of a global mindset continues to be important for the successful internationalization and as a determinant of logic in managerial decision-making (Torkkeli *et al.,* 2018). The identification of opportunities stems from a change in the manager's way of thinking, from orientation to the domestic market to see the world as a great market where there are enormous opportunities to discover, and a positive attitude to internationalization to achieve the company's growth objectives (He *et al.,* 2020). Global mindset contributes directly to internationalization, by allowing overcoming the limitations of resources and knowledge necessary to enter and compete in international markets (Lazaris & Freeman, 2018). This emphasizes that leaders need cognition, knowledge, and behaviour to successfully interpret and make sense of the complexities of the global environment (Gupta & Govindarajan, 2002).

Cognition. It relates to how executives process unknown and complex information during the early phases of international expansion (DeGhetto *et al.,* 2021). Similarly, Levy *et al.* (2007) argue that executives with higher cognitive may evaluate information about opportunities abroad from different points of view. In this way, cognition could facilitate the formulation of effective global strategies to take advantage of international opportunities, thus making these opportunities more attractive (DeGhetto *et al.,* 2021). The importance of a global mindset hinges on the proposition that cognitive structures represent and order a domain of information and broadly influence information processing (Levy *et al.,* 2007). The cognitive component describes how managers use the cultural knowledge and information available to attune to their social environment, motivating a person to adapt their behaviours according to a new cultural context (Story *et al.,* 2014). Cognitive characteristics are essential in the process of recognizing international opportunities. According to Tabares *et al.* (2021), people with high intention, perceived desirability, self-efficacy, commitment, alertness, imagination, willingness, flexibility, proactivity, risk-taking, and a global mindset are psychologically equipped to pursue international opportunities successfully. Cognition enables international entrepreneurs to build their expertise by identifying the right international opportunities to achieve non-financial performance (Mostafiz *et al.,* 2019). Consequently, cognitive schemes help managers to acquire and process information that allows them to make decisions that involve capturing international opportunities and growth in foreign markets (Tabares *et al.,* 2021). Cognition shows the non-observable elements directly in the minds of managers, such as knowledge formation, judgment and evaluation, reasoning and problem-solving to detect international opportunities (Zucchella, 2021). Based on the above evidence, the following is hypothesised:

Proposition* 5*: A high level of cognition can lead to an increase in international OR.

Knowledge. Distribution of prior knowledge of markets, ways to serve them, and customer problems in society influences those who discover an opportunity (Shane, 2000). International knowledge is a critical intangible resource for the international OR (Shepherd & Patzelt, 2018). The efficient knowledge structure enriches the entrepreneurial capability in decision-making to understand the needs of the global market (Mostafiz *et al.,* 2019). The more international knowledge of managers (based on previous experience), the greater the amount of opportunity recognitions in foreign markets (Mostafiz *et al.,* 2021; Shepherd & Patzelt, 2018). Knowledge, generic or specific, influences the volume and type of opportunities that are detected (Eckhardt & Shane, 2003). Knowledge acquisition activities positively and significantly affect the international OR (He *et al.,* 2020). Exposure to foreign cultures is the most direct way to gain genuine information about foreign markets, this provides insight into international opportunities. Thus, the more knowledge of foreign markets or cultures, the more likely is to consider expanding into foreign markets (Bao & Yin, 2020). Based on the above evidence, the following is hypothesised:

Proposition* 6*: A high level of knowledge can lead to an increase in international OR.

Behaviour. It refers to the positive attitude that is reflected in the manager's proactive and visionary behaviour to take risks in building cross border relationships (Felicio *et al.,* 2016a; Nummela *et al.,* 2004). Proactivity is based on understanding the market and its requirements, also on the ability to take risks (Nummela *et al.,* 2004). Research has pointed out the importance of export attitudes in explaining the propensity to internationalize (Calof, 1994). It is a key characteristic required in international business; therefore, it is important to develop these skills for the detection of international opportunities (Nummela *et al.,* 2004). Based on the above evidence, the following is hypothesised:

Proposition* 7*: A high level of behaviour can lead to an increase in international OR.

International Opportunity Recognition

Recognizing opportunities take place at the manager level (Kuckertz *et al.,* 2017). For this reason, it is better to conceive of opportunities as a project perceived by a manager that is potentially profitable but so far unexplored (Casson & Wadeson, 2007). That is, they are those situations in which new goods and services can be sold at a cost greater than their cost of production (Eckhardt & Shane, 2003; Shane & Venkataraman, 2000). The manager scans the pool of potential opportunities to select the one that best meets established criteria for success (Casson & Wadeson, 2007). In the international context, people discover international opportunities through a process of intentional and deliberate exploration, use different sources and reliable information channels, previous knowledge and networks to limit the duration of the search (Tabares *et al.,* 2021). According to Tabares *et al.* (2021) and Mostafiz *et al.* (2019), cognition (self-efficacy and global mindset), human capital (education and knowledge), and social capital (networking) psychologically equip and provide managers with knowledge and information to identify a wide range of opportunities and select the best.

The international OR detonates the internationalisation process (Johanson & Vahlne, 2009; Kraus *et al.,* 2017), helps to trace the path to advance through the commitments in the relationships, and determines the place where the managers will expand the operations of their firms (Johanson & Vahlne, 1977; 2009). That is, the decision to go global and the selection of a country is preceded by the business opportunities that individuals detect through information obtained from different sources. An explicit definition of the international OR is not often given in research (Muzychenko & Liesch, 2015), much less a scale for its measurement (Kuckertz *et al.,* 2017). In consequence, this study coincided with Kuckertz *et al.* (2017) and adapted their definition and measurement scale of the opportunity recognition to the international context, therefore, the international OR is a process characterized by being alert to business opportunities in other countries, actively searching for them and gathering information about new ideas on products and services for the foreign market.

RESEARCH METHODOLOGY

Research Model

Based on the previous arguments, Figure 1 shows the research model used to explore the configurations of dynamic capability activities and the global mindset attributes that lead to international OR. In other words, the model explores whether a configuration of dynamic capability activities and the global mindset attributes is present whenever the international OR occurs (necessity) and what configuration of these conditions guarantees that the international OR occurs (sufficiency), since knowing that a configuration of dynamic capability activities and the global mindset attributes is always present is sufficient evidence to know that the international OR will also occur (Dusa, 2019). However, some authors suggest a relationship between the number of explanatory conditions and the number of cases, for example, 5.6 cases for each condition (Ide & Mello, 2022) or a minimum of 4 cases for each explanatory condition (Marx & Dusa, 2011). Berg-Schlosser and De Meur (2009) argue that a good balance, for an analysis of between 10 and 40 cases, is achieved by selecting 4 to 7 explanatory conditions. Similarly, Thiem, and Mkrtchyan (2022) concluded that there is nothing in the theory of causation or in the algorithmic machinery of QCA that puts an upper limit on the number of explanatory conditions given a certain number of cases.

Based on the above, the model uses seven conditions to explain the international opportunity recognitions (IOR), all supported by the literature: sensing (SEN), seizing (SEI), transforming (TRA), networking (NET), cognition (COG), knowledge (KNO), and behaviour (BEH). The focus of the research was on the business manager rather than groups or organizations, because the individual level of analysis is considered fundamental and less restrictive when seeking to understand internationalisation as a process that involves recognizing and exploiting international opportunities (Chandra, 2007; Ellis, 2011; Jones *et al.,* 2011; Muzychenko & Liesch, 2015; Zahra *et al.,* 2011).

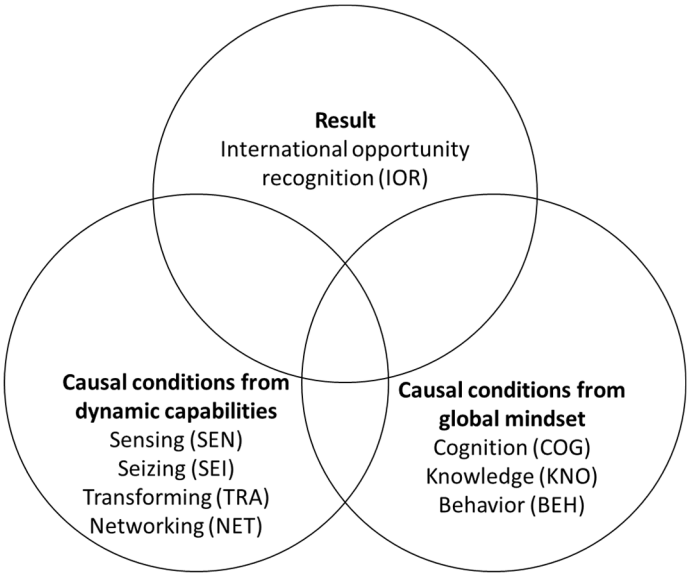

Figure 1. Research model
Source: own elaboration.

Dynamic Capabilities Self-efficacy

The existence of four activities of dynamic capabilities self-efficacy was assumed: sensing (SEN), seizing (SEI), networking (NET), and transforming (TRA). Sensing comprises seven items adapted from Al-Aali and Teece (2014), Andersson and Evers (2015), and Teece (2007, 2016): The manager can (1) explore the opportunities offered by technological developments in other countries; (2) test the feasibility of going to foreign markets; (3) listen to customers from other countries; (4) scan the global business environment; (5) build and test hypotheses about technological evolution and the global market; (6) recognize

latent demands on a global scale; and (7) deeply understand the needs of foreign customers. Seizing comprises five items adapted from Al-Aali and Teece (2014), Andersson and Evers (2015), and Teece (2007, 2016): The manager can (1) build supply chains on a global scale; (2) establish strategic alliances in other countries; (3) design and refine business models with a global vision; (4) discard ideas that do not serve the foreign market; and (5) mobilize resources on a global scale. Networking comprises five items adapted from Al-Aali and Teece (2014), Andersson and Evers (2015), Bai and Johanson (2018), Peng and Luo (2000), Ritter and Gemunden (2003), Teece (2007, 2016), and Weerawardena *et al*. (2007): The manager can build, maintain, and coordinate relationships with (1) foreign buyers; (2) foreign suppliers; (3) foreign competitors; (4) political leaders of other countries; and (5) government officials of other countries. Transforming comprises seven items adapted from Al-Aali and Teece (2014), Andersson and Evers (2015), and Teece (2007, 2016): The manager can (1) replace products and services globally; (2) renovate signature facilities globally; (3) innovate business models with a global vision; (4) renew the structure, methods and cultures of international companies; (5) quickly propagate a strategic vision at all levels of an international firm; (6) match an organization's capabilities to the international opportunity it plans to exploit; and (7) invest in additional capabilities required to enter the foreign market.

Global Mindset

The existence of three attributes of a global mindset was assumed: cognition (COG), knowledge (KNO), and behaviour (BEH). Cognition comprises four items adapted from Felicio *et al.* (2016): the manager (1) encourages interdisciplinary collaboration; (2) listens to others and changes their opinion; (3) believes that he can influence what happens around him; and (4) is an active member when working in a team. Knowledge comprises five items adapted from Felicio *et al.* (2016), Nummela *et al.* (2004), and Shane (2000): The manager (1) is in daily contact with international clients, suppliers, and employees; (2) has international travel experience; (3) has prior knowledge of the international market; (4) has prior knowledge of how to serve the international market; and (5) has prior knowledge of international customer issues. Behaviour comprises five items adapted from Felicio *et al.* (2016), Nummela *et al.* (2004): The manager (1) believes that internationalisation is the only way to achieve the company's growth objectives; (2) is willing to lead the company in the international market; (3) spends considerable time planning international operations; (4) sees the world as a single vast market; and (5) sees the world not only as a paradise but also as a school.

International Opportunity Recognition

International opportunity recognition comprises five items adapted from Kuckertz *et al.* (2017): the manager (1) is alert to business opportunities in other countries; (2) research potential foreign markets to identify business opportunities; (3) systematically looks for business opportunities in other countries; (4) seeks new ideas about products and services for foreign markets; and (5) scan the global environment for business opportunities.

Measurements, Data Collection and Analysis Method

The choice of the fuzzy-set QCA, among the different types of QCA, in this research is due to the following : (1) contemporary configurational thinking and the fuzzy-set QCA can help academics to produce ideas more closely aligned with the complex realities of international business than conventional research approaches (Fainshmidt, 2020); (2) the class of concepts involved and the empirical data at hand allowed them to be captured in fuzzy sets (Schneider & Wagemann, 2012); (3) the fuzzy-set QCA can be used for small (<50 cases) to very large (thousands of cases) sample sizes (Pappas & Woodside, 2021); and (4) it can be used to analyse data series that do not meet the assumptions required by regression analysis (Kusa *et al.,* 2022; Ragin, 2008).

A purposive sampling was used to select a manager of 21 micro and small companies in the information technology (IT) sector from the National Statistical Directory of Economic Units (DENUE) of Mexico. This sampling made it possible to: (1) build a population of cases with the presence and absence of the result of interest (Ragin, 2014); and (2) leave open the possibility of adding and removing cases throughout the investigation process (Rihoux, 2017). Only Mexican-owned

companies that were not part of a multinational, subsidiary, or other international organization were selected (Chandra *et al.,* 2009). A structured online questionnaire with a manager was considered appropriate for data collection (Nummela *et al.,* 2004), which took place between October and November 2020. The informant was the founder, the owner or the manager involved in the strategic decision-making of the firm. The study focused on this type of companies, because they tend to have higher rates of internationalisation in countries with low levels of technology adoption such as Mexico (Chandra *et al.,* 2009; Nummela *et al.,* 2004; Picot *et al.,* 2015; Rönkkö & Peltonen, 2010; WEF & INSEAD, 2016). Once the questionnaire was developed, it was sent to a panel of experts in international business to discard the items considered irrelevant or of little importance (McGee *et al.,* 2009). Subsequently, the questionnaire was administered to a group of 15 managers from IT companies to modify, adjust and improve the reliability indicators, as well as to verify if the instructions and items were understandable to the subjects (García-Cabrero, 2009). The characteristics of the sample are presented in Table 1.

The measurement of all the items was carried out on a seven-point Likert scale, and due to the nature of the fuzzy-set QCA, the summed scales provided the method to calculate the seven explanatory conditions and the result (Felicio *et al.,* 2016). The dynamic capabilities self-efficacy items were phrased in terms of power and ranged from cannot do it (1) to, sure can do it (7) (Bandura, 2006; Beghetto & Karwowski, 2017; Muzychenko & Liesch, 2015). The global mindset and international opportunity recognition items ranged from strongly disagree (1) to strongly agree (7) (Felicio *et al.,* 2016; Kuckertz *et al.,* 2017). The reliability of the model scales was as follows: sensing $\alpha = 0.89$; seizing $\alpha = 0.91$; networking $\alpha = 0.86$; transforming $\alpha = 0.95$; cognition $\alpha = 0.70$; knowledge $\alpha = 0.93$; behaviour $\alpha = 0.82$; international OR $\alpha = 0.96$.

This study used a fuzzy-set QCA, a set theory analysis technique that uses formal logic and Boolean algebra in the analysis of truth tables in order to establish which conditions meet the fit parameters (consistency and coverage) to be considered necessary or sufficient for the outcome of interest (Schneider & Wagemann, 2012). The fuzzy-set QCA analysis consist of creating all combinations of conditions (factors) and establishing which factor configurations imply the expected results (outcome) by applying a logical inference (Suder *et al.,* 2022). Fuzzy-set QCA is an alternative to traditional methods and is as robust as any statistical technique including those that are based on regression analysis (Fainshmidt, 2020; Suder *et al.,* 2022). The most notable advantages of fuzzy-set QCA are: being able to bring together the best of qualitative and quantitative methods and allowing robust analysis of selected small samples through non-probability sampling (Befani, 2013). It was decided to use the QCA package in R, version 3.16 updated to April 08, 2022, with which complex, parsimonious and intermediate solutions were analysed (Dusa, 2019). The parameters to define a condition as necessary were: Inclusion of Necessity inclN >= 0.9 measures the degree to which cases align to a particular rule, the more they fail to comply with this rule, the lower the value (Ragin, 2006); Relevance of Necessity RoN >= 0.6 measures the triviality of the necessity, to which degree a condition is a constant when the result takes different fuzzy values (Dusa, 2019; Oana *et al.,* 2021). The parameters to define a condition, or configuration, as sufficient were: Frequency n >= 1 shows the set of cases that present the same configuration (Ragin, 2006; Suder *et al.,* 2022); Inclusion of Sufficiency inclS >= 0.8 reflects to what extent the presence of the sufficient configuration actually produces the result (Ragin, 2006; Suder *et al.,* 2022); Proportional Reduction in Inconsistency PRI >= 0.7 measures the degree to which a configuration is sufficient for the presence and absence of the result (Flechtner & Heinrich, 2017; Oana *et al.,* 2021); Coverage covS > 0.25 shows how much of the result is explained by each solution term (Dusa, 2019); Unique Coverage covU > 0 measures how much of the explanation can only be attributed to that set and not to another (Dusa, 2019).

Table 1. Sample characteristics

Characteristic	Range	Share	Level
Sex	man	80.95%	Individual
	woman	19.04%	
Age	less than 25	4.76%	
	25–34	23.80%	
	35–44	57.14%	
	45–54	14.28%	
Studies	university studies	47.61%	
	graduate	52.38%	
Position	manager	47.61%	
	owner	52.38%	
Work experience	0–5 years	4.76%	
	6–10 years	4.76%	
	11–15 years	38.09%	
	16–20 years	28.57%	
	above 21 years	23.80%	
English level	basic	33.33%	
	medium	14.28%	
	advanced	52.38%	
Foundation	less than 1 year	9.52%	Firm
	2–5 years	28.57%	
	above 5 years	61.90%	
Size	micro	61.90%	
	small	33.33%	
	medium	4.76%	
Cluster membership	active member	23.80%	
	none	76.19%	

Source: own study.

RESULTS AND DISCUSSION

Results

Rihoux (2017) and Fiss (2011) suggest that the model to be analysed must show some relationships that a high value for a condition leads to a high value for the result. Table 2 presents the descriptive statistics and correlations for all measures. Except for cognition, all the variables present close variation values, which is good according to the recommendations of Rihoux (2017). As expected, all the explanatory conditions show a positive and significant relationship with the international OR, except for cognition, which shows a non-significant negative relationship. That is, high values of sensing capability, seizing capability, transforming capability, networking capability, knowledge, and behaviour lead to high values of international OR, which meets the recommendation of Fiss (2011).

Data Calibration

Table 3 shows calibration thresholds for conditions and outcome. To calibrate the data, a three-valued fuzzy set model was performed using a direct method (Ragin, 2006). With the help of the findTh() function, the optimal values of the three theoretical anchors of the seven conditions and the result were established (Dusa, 2019; Oana *et al.,* 2021). This allowed taking the highest values as the theoretical anchor for complete membership [1.0], an intermediate point on the scale as the qualitative limit that separates being inside or outside the set [0.5], and the lowest possible values as the total exclusion [0.0] (Ciravegna *et al.,* 2018).

Table 2. Descriptive statistics and correlations

Variable	Mean	Median	s. d	1	2	3	4	5	6	7
1. Sensing (SEN)	5.66	5.71	1.01							
2. Seizing (SEI)	5.19	5.40	1.17	0.69*						
3. Networking (NET)	4.91	5.00	1.07	0.45*	0.54*					
4. Transforming (TRA)	4.56	4.57	1.37	0.56*	0.54*	0.5*				
5. Cognition (COG)	6.38	6.50	0.56	0.25	-0.01	0.22	0.34			
6. Knowledge (KNO)	4.36	4.60	1.76	0.7*	0.6*	0.55*	0.65*	0.4		
7. Behaviour (BEH)	5.25	5.60	1.13	0.54*	0.51*	0.41	0.53*	-0.12	0.34	
8. International OR (IOR)	4.70	5.40	1.65	0.53*	0.77*	0.58*	0.61*	-0.17	0.51*	0.62*

Note: * correlations are significant at .05.
Source: own study.

Table 3. Calibration thresholds for conditions and outcome

Condition	Full member	Cross-over point	Full non-member
SEN	6.42	5.28	4.14
SEI	5.80	4.80	3.90
TRA	5.85	4.21	1.71
NET	5.80	4.80	3.60
COG	6.87	6.37	5.75
KNO	5.00	3.20	1.90
BEH	6.20	4.60	3.10
IOR	6.10	5.00	3.00

Note: theoretical anchors obtained with the function findTh() from QCA in R package.
Source: own study.

Analysis of Necessary Conditions

Identifying the necessary conditions is very important for business practice and theory, because without them the result cannot occur, and other conditions cannot compensate for its absence (Dul, 2016). In this sense, the purpose of the analysis of necessary conditions is to identify those conditions whose occurrence is necessary to achieve the international OR (Kusa *et al.,* 2022). According to Felicio *et al.* (2016), the presence of necessary conditions is relevant, but it is difficult to determine which combinations of conditions are necessary or unnecessary for a result. To deal with this problem, some authors propose the superSubset() function from the QCA package in R, to explore all possible combinations of conditions that may be required for the presence or absence of a given result (Dusa, 2019; Oana *et al.,* 2021). But this investigation follows Kusa *et al.* (2022) approach to conducting a classic test of whether individual conditions and their negations lead to the occurrence of high (low) international OR. A condition is necessary if the result is present, and the condition is also present, and it meets the established parameters (Schneider & Wagemann, 2012). Table 4 shows that seizing is a necessary, consistent [inclN = 0.91] and empirically non-trivial [RoN = 0.68] condition for the presence of international OR. In other words, the presence of a high level of seizing capability by the manager is a necessary condition for the occurrences of international OR.

Analysis of Sufficient Conditions

Sufficiency analysis is the main purpose of the QCA methodology, to find the minimum configuration of sufficient conditions for a given result (Dusa, 2019). In this research, a condition or configuration was sufficient if the result of interest occured whenever the condition, or configuration, was present and it met the established parameters (Castillo-Ortiz & Alamos-Concha, 2017). Although the conservative and parsimonious solutions were analysed, the analysis focused on the intermediate solution applying directional expectations (Dusa, 2019; Ragin, 2009; Schneider & Wagemann, 2012), for this first a truth table was built with all the possible causal combinations, then this was reduced to the most significant configurations and later, the logical minimization was done with the Consistency Cubes Algorithm (Dusa, 2018; Tóth *et al*.,

2015). According to the results, the CEMA case, although consistent (inclS = 0.839), shows subset problems (PRI = 0.668), therefore it was eliminated from the minimization process (Table 5).

Table 4. Analysis of necessary conditions

Conditions	International OR (IOR)			International OR (~IOR)		
	inclN	RoN	covN	inclN	RoN	covN
SEN	0.870	0.610	0.684	0.606	0.464	0.429
~SEN	0.274	0.792	0.435	0.553	0.907	0.793
SEI	**0.919**	**0.686**	0.749	0.448	0.450	0.329
~SEI	0.176	0.712	0.262	0.658	0.938	0.880
NET	0.846	0.772	0.778	0.426	0.537	0.353
~NET	0.297	0.678	0.365	0.733	0.876	0.811
TRA	0.806	0.650	0.678	0.573	0.514	0.434
~TRA	0.327	0.755	0.459	0.575	0.859	0.727
COG	0.586	0.598	0.526	0.715	0.626	0.578
~COG	0.530	0.813	0.674	0.413	0.729	0.474
KNO	0.838	0.548	0.635	0.635	0.438	0.434
~KNO	0.254	0.800	0.435	0.467	0.890	0.721
BEH	0.894	0.605	0.692	0.588	0.444	0.410
~BEH	0.232	0.777	0.390	0.558	0.925	0.827
expression	1.000	0.038	0.536	0.989	0.034	0.477

Note: inclN = inclusion of necessity, threshold value >= 0.9 (Ragin, 2006); RoN = Relevance of necessity, threshold value >= 0.6 (Dusa, 2019; Oana *et al*., 2021); covN = coverage of necessity. ~ = negation of a condition; + = logical conjunction.
Source: own study.

Table 5. Truth table for the presence of international OR

SEN	SEI	NET	TRA	COG	KNO	BEH	OUT	n	incl	PRI	cases
0	1	1	1	0	0	1	1	1	0.833	0.732	CPCO
0	1	1	1	0	1	1	1	1	0.927	0.852	MMME
1	1	0	1	0	1	1	1	1	0.839	0.668	CEMA
1	1	1	0	0	0	1	1	1	0.931	0.861	MEIC
1	1	1	0	0	1	0	1	1	0.933	0.872	CEVA
1	1	1	1	0	1	1	1	1	0.890	0.834	JSCE
1	1	1	1	1	1	1	1	5	0.853	0.818	MMGO, MSCI, CSFO, JCST, JSAG
0	0	0	0	0	0	0	0	1	0.296	0.039	NSSU
0	0	0	0	0	1	0	0	1	0.567	0.059	MSDI
0	0	0	0	1	0	1	0	1	0.442	0.132	MSIS
0	0	1	0	1	0	0	0	1	0.319	0.058	CSHM
1	0	0	0	1	0	0	0	1	0.373	0.061	NSCO
1	0	1	1	1	1	1	0	1	0.590	0.240	MMTA
1	1	0	0	0	1	1	0	1	0.759	0.330	NSEN
1	1	0	1	1	1	0	0	1	0.593	0.278	JPAL
1	1	0	1	1	1	1	0	2	0.572	0.329	NSQU, JSOC

Note: inclS = inclusion of sufficiency, threshold value >= 0.8 (Ragin, 2006; Suder *et al*., 2022); PRI = proportional reduction in inconsistency, threshold value >= 0.7 (Flechtner & Heinrich, 2017; Oana *et al*., 2021).
Source: own study.

Table 6 shows the three solutions that lead to the international OR. The first solution [SEN* SEI* NET* KNO] indicates that combining a high level of sensing, seizing and networking with knowledge by the manager leads to international OR. This solution explains 87.33% (inclS = 0.8733) of the international OR, includes 67.09% (covS = 0.6709) of the cases with the presence of international OR and is only sufficient for the presence of the result and not for its absence (PRI = 0.8456). The set of cases covered by this solution are (1) CEVA; (2) JSCE; (3) MMGO; (4) MSCI; (5) CSFO; (6) JCST; and (7) JSAG.

The second solution [SEN* SEI* NET* BEH] implies that combining high levels of sensing, seizing, and networking with behaviour guarantees the occurrence of the international OR. This solution explains 88.75% (inclS = 0.8875) of the international OR, includes 71.16% (covS = 0.7116) of the cases with the presence of international OR and is only sufficient for the presence of the result and not for its absence (PRI = 0.8618). The solution covers the following cases: (1) MEIC; (2) JSCE; (3) MMGO; (4) MSCI; (5) CSFO; (6) JCST; and (7) JSAG. The third solution [SEI* NET* TRA* BEH] requires combining high levels of seizing, networking and transforming with behaviour and is an empirically important way to produce the international OR. This solution explains 86.85% (inclS = 0.8685) of the international OR, includes 68.43% (covS = 0.6843) of the cases with the presence of international OR and is only sufficient for the presence of the result and not for its absence (PRI = 0.8434). The solution covers the following cases: (1) CPCO; (2) MMME; (3) JSCE; (4) MMGO; (5) MSCI; (6) CSFO; (7) JCST; and (8) JSAG.

Table 6. Intermediate solution for the presence of international opportunity recognition (IOR)

Configurations	inclS	PRI	covS	covU	Cases
SEN*SEI*NET*KNO	0.8733	0.8456	0.6709	0.0449	CEVA; JSCE; MMGO, MSCI, CSFO, JCST, JSAG
SEN*SEI*NET*BEH	0.8875	0.8618	0.7116	0.0497	MEIC; JSCE; MMGO, MSCI, CSFO, JCST, JSAG
SEI*NET*TRA*BEH	0.8685	0.8434	0.6843	0.0497	CPCO; MMME; JSCE; MMGO, MSCI, CSFO, JCST, JSAG
–	0.8792	0.8557	0.8064	–	–

Note: inclS = inclusion of sufficiency, threshold value >= 0.8 (Ragin, 2006; Suder *et al*., 2022); PRI = proportional reduction in inconsistency, threshold value >= 0.7 (Flechtner & Heinrich, 2017; Oana *et al*., 2021); covS = coverage, threshold value > 0.25 (Dusa, 2019); covU = unique coverage > 0 (Dusa, 2019). ~ = negation of a condition; + = logical conjunction; * = logical disjunction. Source: own study.

Analysis of the absence of international opportunity recognition (~IOR)

The configurations that lead to the presence of the result can be very different from those that lead to its absence; therefore, the non-occurrence of the result and the possibility of causal asymmetry were analysed in this research (Tóth *et al.,* 2015). A new truth table was constructed with the absence of the international OR as the result (~IOR), coded 1 if the manager showed a low level of international OR and 0 in all other cases (Dusa, 2019; Tóth *et al.,* 2015). According to the results, the NSEN case, although consistent (inclS = 0.881), shows subset problems (PRI = 0.670), therefore it was eliminated from the minimization process (Table 7).

Table 8 shows the two solutions that lead to the absence of the international OR (~IOR). The first solution [~SEI] indicates that low levels of seizing capability by the manager are an important path for the absence of the international OR. This solution explains 87.84% (inclS = 0.8784) of the absence of the international OR, includes 69.37% (covS = 0.6837) of the cases with the absence of international OR and is only sufficient for the absence of the result and not for its presence (PRI = 0.8515). The set of cases covered by this solution are (1) NSSU; (2) MSDI; (3) MSIS; (4) CSHM; (5) NSCO; and (6) MMTA. The second solution [NET* BEH] requires a combination of low levels of networking and behaviour by the manager to guarantee the absence of international OR. This solution explains 89.93% (inclS = 0.8993) of the absence of international OR, includes 51.09% (covS = 0.5109) of the cases with absence of international OR and is only sufficient for the absence of the result and not for its presence (PRI = 0.8993). The solution covers the following cases: (1) NSSU; (2) MSDI; (3) NSCOs; and (4) JPAL.

Table 7. True table for the absence of international OR

SEN	SEI	NET	TRA	COG	KNO	BEH	OUT	n	incl	PRI	cases
0	0	0	0	0	0	0	1	1	0.972	0.961	NSSU
0	0	0	0	0	1	0	1	1	0.913	0.941	MSDI
0	0	0	0	1	0	1	1	1	0.915	0.868	MSIS
0	0	1	0	1	0	0	1	1	0.958	0.942	CSHM
1	0	0	0	1	0	0	1	1	0.960	0.939	NSCO
1	0	1	1	1	1	1	1	1	0.870	0.760	MMTA
1	1	0	0	0	1	1	1	1	0.881	0.670	NSEN
1	1	0	1	1	1	0	1	1	0.844	0.722	JPAL
0	1	1	1	0	0	1	0	1	0.542	0.268	CPCO
0	1	1	1	0	1	1	0	1	0.581	0.148	MMME
1	1	0	1	0	1	1	0	1	0.676	0.332	CEMA
1	1	1	0	0	0	1	0	1	0.571	0.139	MEIC
1	1	1	0	0	1	0	0	1	0.545	0.128	CEVA
1	1	1	1	0	1	1	0	1	0.444	0.166	JSCE
1	1	0	1	1	1	1	0	2	0.790	0.671	NSQU, JSOC
1	1	1	1	1	1	1	0	5	0.313	0.150	MMGO, MSCI, CSFO, JCST, JSAG

Note: inclS = inclusion of sufficiency, threshold value >= 0.8 (Ragin, 2006; Suder *et al*., 2022); PRI = proportional reduction in inconsistency, threshold value >= 0.7 (Flechtner & Heinrich, 2017; Oana *et al*., 2021).
Source: own study.

Table 8. Intermediate solution for the absence of international opportunity recognition (~IOR)

Configurations	inclS	PRI	covS	covU	Cases
~SEI	0.8784	0.8515	0.6937	0.2748	NSSU; MSDI; MSIS; CSHM; NSCO; MMTA
~NET*~BEH	0.9239	0.8993	0.5109	0.0920	NSSU; MSDI; NSCO; JPAL
	0.8645	0.8336	0.7858		

Note: inclS = inclusion of sufficiency, threshold value >= 0.8 (Ragin, 2006; Suder *et al*., 2022); PRI = proportional reduction in inconsistency, threshold value >= 0.7 (Flechtner & Heinrich, 2017; Oana *et al*., 2021); covS = coverage, threshold value > 0.25 (Dusa, 2019); covU = unique coverage > 0 (Dusa, 2019). ~ = negation of a condition; + = logical conjunction; * = logical disjunction.
Source: own study.

Discussion

Seizing is a necessary condition for international OR, without this capability international OR cannot occur and other conditions cannot compensate for its absence (Dul, 2016). This makes perfect senses because once opportunities are correctly detected and calibrated; they need to be seized (Al-Aali & Teece, 2014). This suggests that the manager must indispensably trust in his ability to design and refine a business model that allows capturing a part of the value that is created for customers and having the ability to decide which ideas are most viable to mobilize the available resources and to be able to detect international opportunities (Teece, 2007). On the other hand, the results support hypotheses 1, 2, 3, 4, 6 y 7 of this study, by revealing three antecedent configurations to international OR. The three configurations present subtle but important differences in the causal paths that lead to international OR and show that the combination of explanatory conditions, derived from dynamic capabilities and a global mindset, is what really explains when manager recognizes opportunities abroad. Solutions contain a set of INUS conditions [SEI* NET* (SEN* KNO + SEN* BEH + TRA* BEH)], which refer to those conditions that are unnecessary but sufficient to produce a result (Schneider & Wagemann, 2012) and can be obtained by factoring the model of the intermediate solution (Dusa, 2019). These conditions show two very important aspects. Firstly, the seizing and networking conditions are present in all three configurations that lead to international OR. There are no configurations that lead to international OR without the presence of seizing and networking, reflecting their relative importance in guaranteeing international OR. Secondly, these two conditions, either in combination with high levels of sensing and knowledge or sensing and behaviour or transforming and behaviour ensure the presence of international OR (Table 9).

Table 9. Common factors of the intermediate solution model for the presence of international OR

Intermediate solution model	Common factors
SEN***SEI***NET***KNO + SEN***SEI***NET***BEH + ***SEI***NET***TRA*BEH	***SEI*NET****(SEN*KNO + SEN*BEH + TRA*BEH)

Note: ~ = negation of a condition; + = logical conjunction; * = logical disjunction.
Source: own study.

In other words, managers that detected international opportunities believe they are capable of mobilizing resources globally to address opportunities and capture value from doing so, build a global supply chain and establish strategic alliances, craft business models that capture a share of the value that is created for the client using the lean start-up method [SEI]. They also believe that they can build, maintain, and coordinate relationships with top executives of other firms and government officials within domestic and international networks [NET]. The seizing capability equips managers with the necessary and sufficient skills to exploit an opportunity, by designing a business model that allows creating, delivering and capturing a part of the value that is created for customers (Al-Aali & Teece, 2014; Osterwalder *et al.,* 2014; Teece, 2007).

As suggested by previous research, network ties, whether strong or weak, affect the way in which the attractiveness and feasibility of opportunities are perceived and not only facilitate international OR but also have the potential to trigger commitment to developing such opportunities (Nowiński & Rialp, 2016). In line with previous studies (Mostafiz *et al.,* 2019; Oviatt & McDougall, 2005), once the individuals discover an opportunity, they can combine their knowledge of the market and the product and the opportunity with the know-how and networking capability to explore where and how quickly the opportunity in foreign locations can be exploited. Networking allows individuals to establish better credibility and often establish alliances and other corporate strategies (Johanson & Vahlne, 2009), like gathering market intelligence, forging links with key overseas contacts, deepening relationships in current markets, and cultivating new segments of global buyers (Knight & Cavusgil, 2004; Mort & Weerawardena, 2006; Oviatt & McDougall, 2005). The manager needs to trust his own abilities to proactively build and develop contacts in order to efficiently obtain and use resources and capabilities that allow him to detect international opportunities (Kregar *et al.,* 2019; Wolff & Moser, 2009). Even unexpected meetings with friends and colleagues at events such as parties, business seminars, and international trade fairs can become valuable sources of networking knowledge to discover new opportunities (Nowiński & Rialp, 2016; Tabares *et al.,* 2021). Again, networking proves to be effective when business ties have not yet developed, so managers need to be actively involved in networking with foreign business partners and customers for effective access to information leading to identifying opportunities (He *et al.,* 2020).

The study shows also that the seizing and networking self-efficacy of the manager are not enough to guarantee the international OR, and they must be combined with other causal conditions in three different paths. *Firstly*, we combine them with the belief of being able to explore technological possibilities, test markets, listen to customers, scan the business environment, build and test hypotheses about technological and market evolution, and recognize latent demands on a global scale [SEN], and with experience in trips abroad and prior knowledge of the international market, how to serve it and its problems [KNO]. Wach and Głodowska (2021), proved that knowledge is crucial for internationalisation. They found that entrepreneurs with high levels of foreign language skills, previous experience in international business and international work experience has a positive impact on the pace and speed of internationalisation. This agrees with Shane (2000), even if information about a technological change is widely disseminated, only a subset of the population will have prior knowledge of markets, ways of serving markets, and customer problems, to trigger discovery of a particular opportunity. International knowledge is a critical intangible resource for the international OR (Shepherd & Patzelt, 2018). It enriches the entrepreneurial capacity in decision-making to understand the needs of the global market (Mostafiz *et al.,* 2019), positively and significantly influences the volume and type of opportunities that are detected (Eckhardt & Shane, 2003; He *et al.,* 2020). Therefore, the more internationally aware, the greater the amount of opportunity recognitions in foreign markets (Shepherd & Patzelt, 2018) and the more likely to consider going international (Bao & Yin, 2020; Mostafiz *et al.,* 2021).

Secondly, we combine them with sensing and with the positive attitude regard to internationalisation is the only way to achieve the company's objectives, be willing to lead the firm in the international market and see the world as a single and vast market [BEH]. Previous research has pointed out the importance of export attitudes in explaining the propensity to internationalize (Calof, 1994). It is considered a key characteristic of international business; therefore, it is important to develop these skills for the detection of international opportunities (Nummela *et al.,* 2004; Felicio *et al.,* 2016a). *Thirdly,* we combine them with behaviour and the perception of being able to selectively phase out declining products, renovate older facilities both nationally and globally, and innovate business models, methods, and organizational culture, and rapidly propagate a strategic vision throughout all levels of the firm considering the correct adaptation of the organization to the opportunity it plans to exploit [TRA]. This shows that it is crucial that the entrepreneur is proactive enough to make a reasonable prediction about the capabilities needed to deliver a valuable solution to customers at the right time (Al-Aali & Teece, 2014). The manager must be able to prevent existing business models from collapsing by protecting, improving and reinventing them (Osterwalder *et al.,* 2020; Teece, 2018). The results confirm what was stated by Schweizer *et al.* (2010), Andersson and Evers (2015) and Mostafiz *et al.* (2019), managers have high levels of dynamic capabilities with which they supplement learning to recognize opportunities abroad and capture value by exploiting them. And they may help develop innovative, knowledge-intensive products to outperform and overcome resource constraints in the foreign market, assess the quality of ideas, reduce uncertainty and develop the knowledge to act within networks (Bai & Johanson, 2018; Johanson & Vahlne, 2009; Mort & Weerawardena, 2006; Schweizer *et al.,* 2010; Tabares *et al.,* 2021).

CONCLUSIONS

The objective of the article was to explore the configurations of dynamic capability activities and the global mindset attributes that lead to international opportunity recognition, particularly, sensing capability, seizing capability, transforming capability, networking capability, cognition, knowledge and behaviour. The results of this study reinforce the existing literature on the effect of manager dynamic capabilities and global mindset on international OR, reducing the paucity of empirical evidence on the subject (Andersson & Evers, 2015; Buccieri *et al.,* 2020; Faroque *et al.,* 2021; Feng *et al.,* 2023; He *et al.,* 2020; Helfat & Peteraf, 2015; Jones *et al.,* 2011, 2011; Mostafiz *et al.,* 2019; Torkkeli *et al.,* 2018). In addition, it verifies the assumptions of Andersson and Evers (2015) and Tabares *et al.* (2021) about the manager-level factors that influence the international OR. All this by showing that the combination of explanatory conditions derived from dynamic capabilities and a global mindset explains when manager recognizes opportunities abroad. It also provides valuable information to managers, owners or entrepreneurs.

The results confirm that managers who actively seek to recognize international opportunities can benefit from a high level of dynamic capabilities self-efficacy and a global mindset. However, when the manager shows low levels of dynamic capabilities self-efficacy and a global mindset, he has two options to reinforce these factors. The first is to reinforce the factors by investing in training and education (Durán *et al.,* 2022) or experiential learning (Faroque *et al.,* 2021; He *et al.,* 2020; Tabares *et al.,* 2021). For example, since sensing capacity requires a deeper understanding of customer needs, it can be reinforced with design thinking (Liedtka & Ogilvie, 2011), value proposition design (Osterwalder *et al.,* 2014) and customer development (Blank & Dorf, 2012). The seizing capacity can be reinforced with business model design (Osterwalder & Pigneur, 2010), lean start-up (Ries, 2011) and lean launchpad (Blank *et al.,* 2014) programs. These programs equip individuals with the necessary tools to design and validate business models. The transforming capacity can be reinforced with programs like the one proposed by Osterwalder *et al.* (2020). This course teaches managers to manage and innovate their portfolio of business models and to establish a culture of innovation, leadership and entrepreneurship within the organization. Finally, networking capability can be strengthened by attending programs that link managers with international buyers, sellers, and intermediaries (Faroque *et al.,* 2021), even by attending unexpected meetings with friends and colleagues, such as parties, business seminars, and international trade fairs (Nowiński & Rialp, 2016; Tabares *et al.,* 2021). In relation to the global mindset, it is possible to strengthen it through exposure to foreign markets and cultures (Bao & Yin, 2020) and working in multicultural teams

(Earley *et al.,* 2007). That is, working with managers, groups and organizations that present diverse cultural, political and institutional systems (Beechler & Javidan, 2007). The second option to strengthen dynamic capabilities and the global mindset is to recruit a manager with high levels of these factors. Distel *et al.* (2019) and Bendig *et al.* (2018) state that recruiting is a feasible way to develop dynamic capabilities and can set the stage for encouraging other managers to develop new competencies.

In addition, the three different combinations of dynamic capability activities and the global mindset attributes could provide the abilities and confidence managers require to achieve superior performance of firms both in the domestic market and abroad. It allows creating a barrier to imitation, because the rivals will not be able to understand what combinations and levels of the configuration of dynamic capability activities and the global mindset attributes are based on strategies, generating an ambiguity between the causal connection of actions and results (Fiol, 1991; Lippman & Rumelt, 1982). Managers commonly have well-identified sufficient combinations of ordinary capabilities for their firms to operate in the short term (Winter, 2003), achieving technical efficiency by doing things right across core business operational, administrative and governance functions (Teece, 2014). However, while some combinations of ordinary capabilities make it possible to do the right things (Teece, 2014), the combinations of dynamic capability activities and the global mindset attributes from this research make it possible to do the right thing in a timely manner through assessing the business environment and opportunities, the correct management orchestration of resources and capabilities (Teece, 2016; 2018).

For policymakers, this study provides guidance for more effective and efficient assistance in the internationalisation process. Policymakers play a key role in the development of the dynamic capabilities self-efficacy, because individuals who perceive public policies as supportive for some entrepreneurial activities (for example, access to qualified consultants, services and information, or loans, credits and public subsidies) increase their entrepreneurial self-efficacy beliefs (Nowiński *et al.,* 2020). According to Nowiński *et al.* (2020), the support of the public policies improves individuals' perceived desirability and feasibility in terms of starting their own business. In effect, this establishes that policymakers should assist in activities that encompass the different configurations of dynamic capabilities self-efficacy and global mindset to guarantee the international OR. For example, policymakers can establish training programs where managers learn to deeply understand customer needs, design, validate, and innovate business models to reinforce managers' dynamic capabilities self-efficacy. In addition, they can conduct business seminars and international trade fairs that link managers with foreign buyers, sellers, and intermediaries, facilitate business missions abroad, and encourage the study of foreign languages, to reinforce the global mindset attributes of managers.

Beyond studying the characteristics of IT firms, this research focused on the most promising analysis for the study of the international OR, the level of the manager (Chandra, 2007; Jones *et al.,* 2011; Zahra *et al.,* 2011). When the central concern is to learn how individuals recognize international opportunities, the approach at the manager level is more appropriate and less restrictive than the approach at the firm of which the individual may be a part (Ellis, 2011). On the other hand, the results show the asymmetric causality of the international OR, in which different sets of conditions are observable for the occurrence and non-occurrence of the international OR, which does not constitute a reversal of the same conditions (Tóth *et al.,* 2015). The explanation of the presence of international OR did not provide information to infer its absence; both results (IOR, ~IOR) required different configurations for its occurrence.

The focus on dynamic capabilities was also shown to provide a promising theoretical foundation for capturing internationalisation (Mort & Weerawardena, 2006; Mostafiz *et al.,* 2019; Zahra *et al.,* 2022), and this in combination with self-efficacy provides a vehicle for turning intangibles into tangibles for more reliable empirical research and measurement (Barney *et al.,* 2011; Kevill *et al.,* 2017). Thus, there is a substantial promise for international OR research at the nexus between entrepreneurship, internationalisation, dynamic capabilities, global mindset and self-efficacy (Mostafiz *et al.,* 2021; Sapienza *et al.,* 2006; Teece, 2018; Teran-Yepez *et al.,* 2020; Torkkeli *et al.,* 2018; Zahra *et al.,* 2011; 2022; Zucchella, 2021). Fuzzy-set QCA is an alternative to traditional methods and is as robust as any statistical technique including those that are based on regression analysis (Fainshmidt, 2020; Suder *et al.,* 2022). The most

notable advantages of fuzzy-set QCA are being able to bring together the best of qualitative and quantitative methods and allowing robust analysis of selected small samples through non-probability sampling (Befani, 2013). Fuzzy-set QCA did not help identify the effect size of a single factor in isolation. Instead, it allowed us to understand the complex interaction of dynamic capability activities and the global mindset attributes to achieve the international OR (Oana *et al.,* 2021). The results allow us to affirm what Fiss (2011) said, the set theory method used here is very promising to overcome the current challenges because it allows a detailed analysis of the configurations of the necessary and sufficient conditions for the international OR. By analysing dynamic capability activities and the global mindset attributes with fuzzy-set QCA, the current study represents a step towards building a better understanding of the crucial role of cause-and-effect relationships in organizations, a topic that is central to both the strategy literature and the research literature in an organization (Fiss, 2011).

The size of the sample used in this research turned out to be ideal to maintain sufficient knowledge of each of the cases and to meet the objective and scope of the study (Rihoux, 2017). The instrument showed an acceptable level of reliability to record the data that represented the conditions and the outcome of interest. It checked the existence of variation and relationship between all the conditions of the model. Calibration, regardless of the chosen method (direct or indirect) produced a useful and detailed calibration of the degrees of membership of the cases in the sets with values between 0.0 and 1.0 (Ragin, 2008). Due to the lack of information to determine a high or low degree of the conditions and the result, it relied on a statistical technique of cluster analysis with the findTh() function of the QCA package in R to find the optimal theoretical anchors (Dusa, 2019).

This study has several limitations: (1) the study acknowledges that one of the limitations of fuzzy-set QCA with a small sample is the generalization problem. While the results of this research provided complex and detailed solutions, the means to test, refine and validate the theories, it is only possible to generalize to a small number of cases (Befani, 2013). As Mostafiz *et al.* (2021) suggest, the results may or may not show consistency if replicated. Therefore, to achieve a greater consensus, a similar study should be carried out in other economies with different industries and a bigger sample; (2) although fuzzy-set QCA is an adequate method to study causal relationships with numerous interactions, it was necessary to limit the number of explanatory conditions, because the data matrix increases exponentially depending on the number of causal conditions (Felicio *et al.,* 2016a); (3) external factors that affect the context in which the research is carried out, for example, the health contingency and the global economic crisis due to the new SARS-COV2 coronavirus (COVID-19); (4) limited support from public and private organizations; and (5) lack of literature on the operationalisation of dynamic capabilities.

Therefore, we deem it important to delve into the subject in the following way: (1) analyse other sectors and especially family firms, in which it is very certain to find other combinations of dynamic capability activities and the global mindset attributes to produce the international OR; (2) using a bigger sample, contrast the fuzzy-set QCA approach with some statistical method such as structural equations with partial least squares, to study how both methodological approaches complement each other; (3) use a more generalizable sample, which strikes a balance between the sample required for an fuzzy-set QCA study and an inferential study; (4) identify additional conditions, for example, conditions at the firm, industry, or country level, or a mix of all; (5) make additional applications of the fuzzy-set QCA within the field of international business, entrepreneurship and strategic management; (6) address perceptual limitations by developing and employing objective measures for the conditions and outcome of interest; (7) take advantage of the multiple functions offered by the QCA package in R; and (8) to deal with the limitation in the number of explanatory conditions, future research can use Dusa (2018) Consistency Cubes, a fast and efficient method for exact Boolean minimization.

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Conflict of Interest

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The influence of start-up entrepreneurship and disruptive business model on firm performance

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ABSTRACT

Objective: This research aims to develop the constructs and to study the causal relationship between start-up entrepreneurship (SUE), disruptive business models (DBM), and firm performance (FPF) of start-ups in Thailand.

Research Design & Methods: A quantitative research, a total of 186 samples from start-ups in Thailand. Data were collected by using online questionnaires with an entrepreneur/start-up founder/co-founder per company. The data were analysed through structural equation modelling.

Findings: The new dimensions of SUE, DBM, and FPF reach a decent level of structural credibility and are suitable for measurement. SUE and DBM had a positive influence on FPF, while SUE had a positive influence on DBM as well.

Implications & Recommendations: The results could be used to advance the potential of start-up entrepreneurs, strengthen the existing business model, or decide to develop a new business model that could develop brand new products/services in the markets to meet customer needs that change with technology advancements.

Contribution & Value Added: The dimensions of the newly developed SUE, DBM, and FPF could be developed dynamically. These new dimensions have contributed to SUE acting as a mechanism of DBM development. The finding show that the new dimensions could be used to develop start-ups; to begin with, the new business model generation, technology-driven products/services development to meet the customer needs and seeking investors network. Thus, the impact of DBM will be strengthened, and the impact of FPF can gain a competitive advantage and improve profitability, as start-ups introduce a new business model with technological innovation that will redefine industries and restructure the economy.

Article type: research article

Keywords: start-up entrepreneurship; disruptive business model; firm performance; start-up; entrepreneur; structural equation modelling

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INTRODUCTION

Over the past decade, information technology and innovation development as well as digital technology advancement have played an important role in developing and changing business operations completely (Niyawanont, 2022) making them different from the traditional business model that was interrupted by technology (Christensen, 1997). One of the businesses that benefit from this situation is a 'start-up' which is a business founded to seek a business model that can build up the business by leaps and bounds by seeking a repeatable, scalable business model driven by technology or innovation that can generate income (Blank & Dorf, 2012).

The repeatable and scalable business model is attractive to entrepreneurs and investors, especially start-ups that offer products and services over the internet and have a good chance of creating a repeatable business model (Ries, 2011). This allows start-ups to become scalable businesses without expanding the organization. Modern information technology helps companies to be able to serve

millions of customers without employing thousands of people (Blank & Dorf, 2012). For example, if a start-up is primarily internet-based, it can be run internationally with a single office. This leads to excellent cost performance. As the start-up is able to serve a large group of clients while being run by a few engineers, the impact of repeatable capability will be further enhanced if the products/services or a new business model are starting to replace the existing model in the market (Hyrkäs, 2016). Technology is a key factor that enables entrepreneurs to create new ways to seek opportunities from supply and demand. It is particularly well suited to Schumpeter's (1991) entrepreneurship realizing the opportunity not only to create a new company but also to bring technological innovation and a new business model to life, reshaping industries and restructuring the economy (Adler *et al*., 2019) and the idea of how entrepreneurship acts as a mechanism of 'creative destruction' (Schumpeter, 1991), a concept which was initially the concept before being developed as a concept of 'disruption' (Christensen, 1997). However, new innovations which will bring start-ups success will not come easily because innovation will not be needed without the public acceptance. Therefore, the future is uncertain, start-ups are pushed to run under uncertainty as to whether the business will be profitable or not (Cantamessa *et al*., 2018; Aminova, & Marchi, 2021). A start-up could only go on when founders and investors in some cases believe that it can succeed. Interestingly, start-ups are still temporary organizations (Blank, 2020). After being successful with a product or service, a start-up will take some steps to become a more 'serious' company (Hyrkäs, 2016) by being acquired by a large corporation or entering the stock market by offering shares to the public.

When comparing the general economic conditions with the performance of start-ups, many of them in Thailand have been supported quite well. The 2021 investment in start-ups in Thailand was USD 318.54 million (Techsauce, 2022). Start-up investment incurs a very low cost of website/application development. With the founder's investment and minimal cost risk, usually less than USD 1 million, these start-ups are in the early stages of start-up scaling and finding a repeatable and scalable business model is a must for them. Scaling requires external investment to fuel rapid expansion (Blank & Dorf, 2012). The five start-ups with the most investments were business service, fintech, health tech, ed tech, and food/agri tech. In 2020, the investment in start-ups in Thailand amounted to USD 376.71 million, making it the year for Thailand with the highest investment in start-ups in nine years. Overall fundraising in industries that were positively impacted by the COVID-19 pandemic were still doing well, such as Logistics, e-Commerce, especially for business services that offer digital transformation services to organizations, allowing businesses to conduct online transactions. On the other hand, the negatively affected groups have no signs of recovery, especially in tourism, which has been affected by the COVID-19 pandemic. Moreover, people's purchasing power has been declining (Techsauce, 2022). While in Southeast Asia, according to the e-Conomy SEA 2020 report, the investment value has been trending down since 2018 (Google, Temasek, & Bain Company, 2020).

Sometimes, starting a new business by a few individuals with a new economically feasible product could meet market demands in line with rapidly changing technology advancements and vision for business growth and expansion. The vision for growth and expansion is a result of a product component which is innovative, strongly demand-based, and can be quickly scaled (Ries, 2011; Frederiksen, & Brem, 2017; Kim, Kim, & Jeon, 2018). However, the research problems came from the truth that most start-ups fail to realize the success they are aiming for (Aminova, & Marchi 2021; Thanapongporn *et al*., 2021). Furthermore, funded start-ups tend to disappear after five years. Most start-ups survive with their investments while three-quarters of start-ups are unable to gain a return on their investments (Gage, 2012; Cantamessa *et al*., 2018; Aminova, & Marchi, 2021). This may affect the perception of new entrepreneurs and investors. The research focuses on Thailand. Thai government formed the Thailand 4.0 policy with the aim of making Thailand a high-income country and helping it escape the middle-income trap. Thus, the government has policies to drive the economy through innovation, promoting and supporting investment and research to create new start-ups and increase their economic value. This makes start-ups in Thailand even more important (Wisuttisak, 2021; Jeamwittayanukul *et al*., 2022) as the country aims to become the perfect Start-up Nation and readiness to become the Global Start-up Hub (National Innovation Agency, 2022). Hence, this research aims to develop the constructs of start-up entrepreneurship (SUE), disruptive business model (DBM), and firm performance

(FPF) which is suitable for start-up assessment and exploring influence paths. The intention behind it is to obtain useful information on the potential development of start-ups and business models to be competitive and successful in order for start-ups to be able to survive by taking advantage of the disruption in the economy which is constantly changing through technological advancements.

The next section is the literature review to develop the hypothesis. The following is the research method to explain the sampling, data collection, instrument, and data analysis. Then, the results and discussion present the findings. Finally, the conclusions explain the research contribution, research limitations, and suggestions for future research.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Start-up entrepreneurship (SUE)

Start-up is a business founded to seek a business model and build up the business by leaps and bounds by seeking a repeatable, scalable business model (Blank & Dorf, 2012). Rise (2011) describes a start-up as an organization that launches new products and services over uncertainty. Moreover, a start-up is a new venture with a commitment of high income and high potential to change the competition through innovative ideas (Hyrkäs, 2016; Adler *et al*., 2019). This research defined a start-up as a new venture that can change the technology-driven business model to meet the need of customers' behaviours that change according to the technology advancement through products and services introducing the new way of using technology to do things that facilitate and solve the everyday problems. Research on Schumpeterian entrepreneurship states that high-growth start-ups are the key factors in innovative technology and economic growth (Adler *et al*., 2019). Hence, this research investigated entrepreneurs who drive the creation of start-ups.

The SUE refers to people who see an opportunity to start a business and can make it grow by leaps and bounds by seeking a revenue-generating business model which is profitably repeatable and scalable (Blank & Dorf, 2012). In that context, while being an entrepreneur, it is expected to face challenges in driving a business by creating a new business model which is an easy way to expand it. The challenges of market volatility and the fundamentals of start-up development include the challenge of expanding the market from early adopters to the main market. The importance of understanding customers from a business perspective and collecting data and insights from unmet customer needs is also part of it (Osterwalder *et al*., 2014).

In the past research, SUE has been studied in terms of business activities, the usage of information technology innovation, and new ways to use technology to do new things as well as new joint ventures with high income-generating capabilities and high potential to use new innovations to change the way of competition (Hyrkäs, 2016). However, SUE has not been clearly developed as a specific dimension. Therefore, this research will develop new SUE's dimensions from two established traditional concepts of entrepreneurship: (1) entrepreneurial orientation (EO) and (2) entrepreneurial self-efficacy (ESE).

Lumpkin and Dess (1996) presented EO as the processes and practices that lead to a new business establishment from ESE. McGee *et al*. (2009) presented ESE that came up with four entrepreneur's tasks in the new business developing process: searching; planning; marshalling; implementing.

Covin and Slevin (1989) studied three key important components to study EO including two behaviours: innovativeness; pro-activeness; and one attitude which is risk-taking. Innovativeness creates new products and services or new technologies while pro-activeness reflects the attitude towards seeking new opportunities in business continuity, while risk-taking refers to the determination to invest and the acceptance of resource commitments with uncertain returns. Then, there was agreement that the entrepreneurship study goal has multiple dimensions and each component does not necessarily occur at the same time. Two additional factors are presented: competitive aggressiveness; and autonomy (Lampkin & Dess, 1996). Both have the potential to support creative processes that increase the capacity for innovation. However, entrepreneurial activities are all about finding the suitability of products, customers, markets and channels of distribution in order to come up with the best business model (Yang *et al*., 2018). Consequently, the components from these two entrepreneurial education concepts are suitable for the SUE dimensions development to further study the DBM and FPF influence pathways.

Disruptive business model (DBM)

The business model describes the rationale of how an organization creates, delivers, and captures value (Osterwalder & Pigneur, 2010). Meanwhile, DBM arises along with technology and innovation (Christensen, 1997) and it refers to an emerging business model that replaces the existing business. It happens when the existing industry faces business challenges that provide greater value to customers with which the company's existing business models can directly compete (Rogers, 2016). It transforms the existing business model into a new business model delivering an unprecedented product or service (Karimi & Walter, 2016).

An Austrian economist, Joseph Schumpeter, was the first theorist of the business disruption concept, but he did not use the term. His writings regard a phenomenon known as 'creative destruction,' a phenomenon that undermines the old system of industrial capitalism and the economic system in the creation process of new innovations. He uses it to describe the arrival of the train to the Midwestern United States by Illinois Central (Schumpeter, 1991). Later, Clayton Christensen (1997) presented a theory of 'disruption,' and thus, he became the person to use the term to describe the 'disruptive technology' theory which later on was expanded to 'disruptive innovation' in *The Innovator's Dilemma*. Chesbrough and Rosenbloom (2002) state that the new business model exposes the underlying value of technology when technological advances can shape new consumption patterns with new technologies to increase competitiveness, change relationships with customers, and present value. The new business model reveals the hidden value of technology and it can link technical potential and the realization of economic value, thus, creating 'a new business model that affects the old business model to adapt. If it cannot adapt, the new business model will replace them until the old ones quickly disappear' (business disruption) (Chesbrough & Rosenbloom, 2002). Likewise, the business model innovation concept aims to replace the existing business model with a new model for an unprecedented offering of products/services. Such a replacement may be, for example, a gradual transition from the existing business model to the new model (Cavalcante *et al*., 2011; Sabatini, Cucculelli, & Gregori, 2022).

From an entrepreneur's perspective, the business model is the central construct of an organization to represent a strategic framework for defining the concept of a value-based venture, and the business model is expected to emerge and evolve over time (Morris, Schindehutteb, & Allen, 2005). The business model reflects consumer needs, delivery of value, creation of new demands for consumers, the process of holding the value of goods and services and profitability (Teece, 2010). Meanwhile, Rogers (2016) presents the theory of 'disruption' that applies to business models and has different definitions because of its tendency to be used as a strategy tool. Rogers defines a 'business model' as a business model that describes an overall view of a business that creates value, delivers to the market, and then gets the value back.

However, DBM is not for every organization. An organization which is suitable and is important to the success of the disruptive business will need a leader who can maintain or improve profit margins and lead the business to survive in the industry (Sonthiprasat, 2014). As this study focused on DBM with 'start-up,' an established business to find profitable, repeatable and scalable business models (Blank & Dorf, 2012), therefore, this research will develop dimensions of DBM that are suitable for start-ups.

According to the literature review, entrepreneurship is all about business creation and investment in new businesses such as self-employment, new business establishment, business expansion by an individual, a team, or a sub-business establishment. Entrepreneurship is therefore defined as a part of discovering, evaluating, using the opportunity to offer new products and services by effectively managing the organization, marketing, process, and raw materials to gain profits that will enable the business to survive. In this research, SUE will develop new dimensions from two traditional concepts of entrepreneurship: ESE and EO. Both are recognized as the process of decision-making, creating new things, developing and introducing new ideas that promote product and service development (Shan, Song, & Ju, 2016) as they signify a useful path to start a business in order to build business models, strategies and define products/services (Karimi & Walter, 2016). And ESE in doing business is useful

for preparation to start a business, build a business model, determine the company's strategy, and products/services (McGee *et al*., 2009). Hence, the hypothesis will be as follows:

H1: SUE has a positive direct effect on DBM.

Firm performance (FPF)

Performance appraisal is fundamental to achieving organizational success. Performance analysis investigates how to determine and compare the level of achievement of actual objectives (Yang, 2012). When it comes to analysing performance appraisal systems, it is difficult to use qualitative evaluation because it is often vague, however, numerical results alone may not adequately describe the system of performance appraisals. Nowadays, the business environment is rapidly changing, thus making it necessary for companies to continually seek new opportunities in order to increase uncertain profits from existing operations, to promote the performance of companies where they turn time into profit by responding to customer needs immediately or quickly, and to determine industry standards and brand awareness to help create a competitive advantage and help adapt quickly to the market demands in a competitive environment (Shan, Song, & Ju, 2016).

All of the literature regarding entrepreneurship recognizes the importance of OE in order to survive and FPF by Lumpkin and Dess (1996). In short, OE is a process and practice which leads to establishing a new business through ESE. It helps the organizations perform better than competitors, gain a competitive advantage, be able to see innovative opportunities that could get high returns, and determine the target market and be the first to enter the market (Mapalala, 2017).

However, a start-up's FPF evaluation, a financial metric is a factor of start-up success as well as the income and investment received (Phangestu *et al*., 2020). As a 'start-up' is an established business to find profitable, repeatable and scalable business models (Blank & Dorf, 2012), therefore, SUE is the engine of growth that drives DBM in order to develop better products/services. This will allow the start-up performance to gain profit and advantages over competitors as well as the ability to survive in a highly competitive industry. Therefore, this research will develop the FPF dimensions that are suitable for the start-ups study.

In this research, SUE was used to develop new dimensions from ESE and EO, where entrepreneurship was the focus in order to study the success factors in start-ups and the impact of entrepreneurial strategic processes on organizational performance (Shan, Song, & Ju, 2016). Meanwhile, ESE is a reflection of an individual's trust towards the capability in controlling their own motivations and behaviours to get the job done and towards organizing the intellectual resources and strategies which are necessary to an effective operation. Yunusa *et al*. (2022) studied ESE influencing the interaction between entrepreneurship and business performance. The results confirmed that ESE and EO positively affect the performance of small and medium businesses. Hence, the hypothesis will be as follows:

H2: SUE has a positive direct effect on FPF.

At the same time, DBM in this research will develop new dimensions from the overall DBM concept that does not separate components. According to research, DBM is used as an intermediate variable (Karimi & Walter, 2016; Phangestu *et al*., 2020) Between entrepreneurial concepts and FPF in a study of the transition from the existing business model to the new business model in offering unprecedented products and services, it is necessary to be aware of the economic value and to explore and understand different customer needs (Karimi & Walter, 2016). However, the activities of a start-up operation, the entrepreneurs completely take part in seeking a viable business model which leads to a better performance in the final business operation (Yang *et al*., 2018). Hence, the hypothesis will be as follows:

H3: DBM has a positive direct effect on FPF.

Therefore, the research developed the conceptual framework and research hypothesis as shown in Figure 1 to study the causal relation between SUE, DBM, and FPF. The details of the research hypothesis development are as follows.

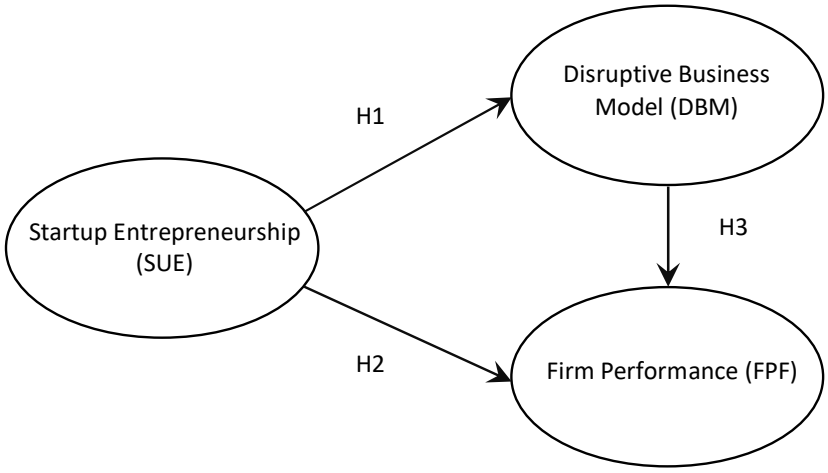

Figure 1. Research frameworks
Source: own elaboration.

RESEARCH METHODOLOGY

Sampling and Data Collection

The population and sample in this research are start-ups in Thailand. The start-ups' name lists were obtained from a publicly accessible database on the website of Startup Thailand, a government agency that supports and inspires start-ups as a new venture that can change the technology-driven business model to meet the need of customers through products and services delivering a new way of using technology to do new things that facilitate and solve the everyday problems. There was a total of 536 start-ups registered in the Thailand start-up ecosystem, whose firms were formed in the pre-seed growth phase (a phase of incubation, that has a good idea emphasis on prototype product/service creation) to the series C growth phase (a phase of the expansion of the company and expanding the customer base to regional and global levels). The data was collected using an online questionnaire with the entire population from February to August 2022. The target group was an entrepreneur, founder/co-founder, one person per start-up. A total of 189 samples was collected (35.26% response rate). Ultimately, 100-200 samples fell under the sample group, which according to the analysis of the structural equation model, was a good level of reliability (Hair *et al*., 2014).

Instruments

The research instruments were a questionnaire based on the knowledge from the review of the literature. The questionnaire consisted of four parts which required respondents' opinions on the following concepts:

Part 1: General information on a start-up. It came in the form of a check-list questionnaire, which were (1) the main industry of the start-up, (2) the growth stage of the start-up, (3) the company's funding source (investment funds or investors), (4) the value from fundraising, and (5) the duration of the incorporation starting from concept test to present.

Part 2 SUE-related questions. A total of thirty-three questions required the respondents' opinion on the start-up's SUE which was elaborated based on McGee *et al*. (2009); Karimi and Walter, (2016); Mapalala (2017); Shan, Song, and Ju (2016).

Part 3 DBM-related questions consisted of nine questions that required the respondents' opinion on the start-up's DBM which was elaborated based on Osiyevskyy and Dewald (2015); Sonthiprasat (2014); Karimi and Walter (2016).

Part 4 FPF-related questions. The respondents were required to comment on six questions about FPF which was elaborated based on Shan, Song and Ju (2016).

The questions required respondents' opinion in the form of a numerical rating using the 7-pointed Likert scale. This required the respondents to rate the variables divided into 7 levels, where 1 means strongly disagree and 7 means strongly agree.

Developing a measurement model which covers the research objectives and conceptual frameworks by selecting questions from research that has been studied before and translating the questions from the original English text into Thai, then adjusting the questions to fit the context of the technology-driven start-up. The translated version then was reviewed and assured content validity by the assistance of four experts on the content and the use of language in communication. The result of the assessment of the IOC = 0.95 (Rovinelli & Hambleton, 1977) which indicates that the questions were considered matching with the content and alignment with the assessment objectives.

The questionnaire reliability validity testing was done by the researcher with the respondents who were similar to a sample in a total of 30 sets using convenience sampling while testing the reliability of the questionnaire was done using Cronbach's Alpha coefficient analysis method. It was found that SUE = 0.934, DBM = 0.961 and FPF = 0.902, all of which were greater than 0.800, indicating that the measurement model was in a very good level of reliability (George & Mallery, 2016).

Data Verification Before Analysis

Multivariate outlier checking is the determination of abnormal highs or lows using the Mahalanobis distance (D^2) statistic (Mahalanobis, 1936). Any data set with a p-value lower than 0.001 (Hair *et al*., 2014) is discarded due to multivariate outliers. According to the examination of the multivariate outlier, it was found that there were three data with the D^2 = 147.103, 91.005, and 183.005, so all of the p-value = 0.000 respectively, which was considered as multivariate outliers, therefore the said data was eliminated. Thus, there was a total of 186 data for the analysis.

The normal distribution and its characteristics have been verified by skewness-kurtosis values for each variable (Tabachnick, Fidell, & Ullman, 2007). According to the analysis, all data had skewness and the kurtosis in the range of -3.00 to +3.00, which indicates a normal distribution (Kline, 2015).

Data Analysis

Structural equation modelling (SEM) with AMOS: exploratory factor analysis (EFA) was used to develop observable variables or questions into an appropriate measurement model of SUE, DBM, and FPF. This aimed to develop constructs and analyze the relationship structure of the components of each such variable.

Confirmatory factor analysis (CFA) was used to confirm observable variables or questions within the measurement model of the SUE, DBM, and FPF. Next, SEM was used to test the influence of SUE, DBM, and FPF. Model fit testing with empirical data was done by testing various statistical values according to the following criteria χ^2/df < 5.00 (Loo & Thorpe, 2000); RMSEA < 0.08; GFI > 0.90; CFI > 0.90; NFI > 0.90 (Hu & Bentler, 1999); IFI > 0.90; TLI > 0.90 (Hair *et al*., 2014). The convergent validity analysis considering the question weights in each indicator's components had a statistical significance of 0.05 and a t-value > 1.96. This means the Lamda (λ) was different from 0, so it could be concluded that the gauge model showed convergent validity. The composite reliability or construct reliability (CR) > 0.7 (Carmines & Zeller, 1980); the average variance extracted (AVE) > 0.5 (Fornell & Larcker, 1981); the factor loading > 0.6 (Hair *et al*., 2014); and discriminant validity analysis when comparing $\sqrt{\mathrm{AVE}}$ of each variable with the correlation between the other variables, $\sqrt{\mathrm{AVE}}$ must be higher than the correlation between the variables (Fornell & Larcker, 1981).

Path analysis aims to analyse the causal relationship between variables. Both magnitude and direction of influence were studied using path coefficient, total effect (TE); direct effect (DE); and indirect effect (IE) (Leech, Barrett, & Morgan, 2005).

RESULTS AND DISCUSSION

General Information on Start-ups in Thailand

According to 186 sampled start-ups in Thailand that answered the questionnaire in this research, it was found that most of the start-up's main industries were business service = 37.1%, followed by fintech = 12.9%, and industry tech = 9.1%. Most of the start-ups were in the series A growth phase (a phase of customer growth distribution where they start earning and have a clear business model) = 41.4%, followed by the seed funding growth phase (a phase of products/services development and improvement to meet the needs of the market as much as possible) = 36%, and the pre-seed growth phase (a phase of incubation that emphasises prototype product/service creation) = 10.8%. Most of the fundraising comes from venture capital = 24.7%, followed by corporate venture capital = 16.9%, and bank loan = 15%. Most of the fundraising valuations ranged from USD 2 to 15 million = 37.1%, followed by USD 15 to 30 million, and USD 10.05 thousand to 2 million. Most start-ups' time required to build their company from concept testing (pre-seed phase) to the present was less than 5 years = 54.8%, followed by 5–10 years = 42.5%. The total mean SUE was 5.47 with the SD = 1.307, meaning the start-up entrepreneurship was at a high level. Next, DBM had a total mean of 5.04 with the SD = 1.282, meaning the disruptive business model was at a high level, FPF had a total average of 5.53, and the SD = 1.106, meaning the firm performance was at a high level.

Constructs Development

Constructs development was conducted using EFA to find the optimal components of SUE, DBM, and FPF variables with common factor analysis using the principal axis factoring method which makes a root mean square residual (RMSR) low. This was suitable for factor analysis for SEM. Hair *et al*. (2014) suggested that oblique rotation is appropriate for small sample numbers and correlating factors are likely. According to the study, the components of the variables of the SUE, DBM, and FPF had a possibility of correlation, therefore oblique rotation with the Promax method was appropriate.

Start-up Entrepreneurship (SUE)

The EFA revealed that the KMO (Kaiser-Meyer-Olkin) = 0.881, meaning that the model was able to describe 88.10% of the SUE variables composition, which was at a good level. According to Barlett's test of sphericity, it was statistically significant at 0.01 level. The communalities were higher than 0.4 (Costello & Osborne, 2005). Furthermore, there was explainable cumulative variance by the components only if the eigenvalues > 1, representing 67.43%. Five SUE dimensions could be redeveloped. Moreover, CFA was consistent with empirical data. The index values were χ^2/df = 2.149; RMSEA = 0.045; GFI = 0.903; CFI = 0.985; NFI = 0.948; IFI = 0.985; and TLI = 0.980. According to the question, weights in each indicator's components had t-value > 1.96. Therefore, it could be concluded that the gauge model shows convergent validity. Meanwhile, CR, AVE, and factor loading had construct reliability. Thus, SUE could be measured with good reliability. Table 1 presents the details.

Observable variable or questions grouped into new five dimensions can define each dimension as follows:

Technology driven products/services development (TPD) refers to the design and development of a product/service that meets customer needs that change as technology advances. Devoting necessary resources and supporting ideas or research to develop new products/services could inspire, encourage, and motivate employees to improve their working methods with technology to seriously develop business innovations.

Innovative ideas (IDE) refer to supporting employees or creative development teams by brainstorming to present ideas, visions, and marketing strategies for new products/services as well as the search for new methods to do things that meet the needs of customers according to the advancement of technology.

Striving for venture (SFV) refers to the company's efforts to keep the entity to survive in a market with intense technological competition. It is to create an advantage over competitors using aggressive

competitive approaches with technology without giving up until entering the market with new products/services that the company can set a competitive price for.

Funding Network (FND) refers to the ability of the company to create a network to contact and exchange information with customers, partner companies, and partners to build confidence with the vision and plans for the new business where the company estimates the initial amount and working capital needed to start the business.

Initiation (INI) refers to investment in new products/services. Although the income and future growth is uncertain, companies are often the first to introduce new products/services, manage, or operate with new technologies.

Table 1. Results of SUE construct with reliability and validity

Dimension	Items	Factor loading	t-value	Sig.	R^2	CR	AVE	Cronbach's Alpha
TPD						**0.937**	**0.682**	**0.935**
	SUE21	0.805	14.526	0.000***	0.649			
	SUE14	0.882	17.180	0.000***	0.778			
	SUE3	0.820	15.227	0.000***	0.673			
	SUE32	0.686	11.067	0.000***	0.470			
	SUE31	0.799	16.153	0.000***	0.639			
	SUE25	0.894	17.617	0.000***	0.799			
	SUE22	0.876	–	–	0.768			
IDE						**0.923**	**0.668**	**0.919**
	SUE33	0.808	12.865	0.000***	0.653			
	SUE2	0.899	15.136	0.000***	0.807			
	SUE20	0.856	14.145	0.000***	0.733			
	SUE7	0.713	10.608	0.000***	0.508			
	SUE1	0.810	12.903	0.000***	0.656			
	SUE19	0.806	–	–	0.649			
SFV						**0.842**	**0.646**	**0.827**
	SUE5	0.865	11.382	0.000***	0.748			
	SUE29	0.601	8.342	0.000***	0.355			
	SUE30	0.911	–	–	0.829			
FDN						**0.873**	**0.703**	**0.854**
	SUE6	0.603	9.377	0.000***	0.355			
	SUE9	0.884	18.226	0.000***	0.782			
	SUE8	0.982	–	–	0.965			
INI						**0.858**	**0.669**	**0.864**
	SUE26	0.817	11.751	0.000***	0.668			
	SUE24	0.839	12.026	0.000***	0.703			
	SUE23	0.797	–	–	0.634			

Note: TPD – technology driven product/service development, IDE – innovative idea, SFV – striving for venture, FND – funding network, INI – Initiation, ***p-value < 0.001.
Source: own study.

Disruptive Business Model (DBM)

The EFA revealed that the KMO = 0.878, meaning that the model was able to describe 87.80% of the DBM variable composition, which was at a good level. According to Barlett's test of sphericity, it was statistically significant at 0.01 level. The communalities values were greater than 0.4 (Costello & Osborne, 2005) and the cumulative explained variances was 78.63%. The three dimensions of the DBM could be redeveloped. Next, CFA was consistent with empirical data. Index values were χ^2/df = 1.978; RMSEA = 0.073; GFI = 0.945; CFI = 0.984; NFI = 0.969; IFI = 0.984; and TLI = 0.975. According to the question, weights in each indicator's components has t-value > 1.96, thus, it could be concluded that the gauge model shows convergent validity. Meanwhile CR, AVE, and factor loading had construct reliability. Thus, DBM could be measured with good reliability. Table 2 provides details.

Table 2. Results of DBM construct with reliability and validity

Dimension	Items	Factor loading	t-value	Sig.	R^2	CR	AVE	Cronbach's Alpha
BMG						**0.932**	**0.819**	**0.931**
	DBM1	0.893	19.575	0.000***	0.798			
	DBM5	0.888	19.565	0.000***	0.789			
	DBM4	0.934	–	–	0.872			
BMV						**0.866**	**0.682**	**0.872**
	DBM6	0.859	11.437	0.000***	0.737			
	DBM3	0.824	12.016	0.000***	0.679			
	DBM2	0.794	–	–	0.631			
TBM						**0.930**	**0.815**	**0.929**
	DBM9	0.868	17.903	0.000***	0.754			
	DBM8	0.909	21.002	0.000***	0.826			
	DBM7	0.930	–	–	0.865			

Note: BMG – business model generation, BMV – business model value, TBM – transformative business model, ***p-value < 0.001.
Source: own study.

Observable variables or questions grouped into new three dimensions can define each dimension as follows:

Business model generation (BMG) means using customer feedback as information to improve business models that meet market demand. It could start with new add-on services according to customer requirements which lead to the development of business models that meet the customer needs according to the advancement of technology.

Business model value (BMV) refers to a business model value that can solve problems and meet customer needs that change with the advancement of technology. Qualitative values such as the ability to solve customer problems and quantitative values such as price and speed of service could increase the cost of production that is not derived from the main product or service.

Transformative business model (TBM) refers to a trend of business model changes arising from the exchange of information about new products/services with both official and unofficial partners where the company's new products/services are interestingly seen as innovations that meet customer needs and can replace existing products/services.

Firm Performance (FPF)

The EFA revealed that the KMO = 0.825, meaning that the model was able to describe 82.50% of the FPF variable composition, which was at a good level. According to Barlett's test of sphericity, it was statistically significant at 0.01 level. The communalities value was greater than 0.4 (Costello & Osborne, 2005). Moreover, there was explainable cumulative variance by the components only if the eigenvalues > 1, representing 76.12%. The two new dimensions of the FPF could be redeveloped. Next, CFA was consistent with empirical data. The index value of χ^2/df = 2.084; RMSEA = 0.077; GFI = 0.971; CFI = 0.989; NFI = 0.980; IFI = 0.989; and TLI = 0.980. According to the question, weights in each indicator's components had t-value > 1.96, thus, it could be concluded that the gauge model showed convergent validity. Meanwhile, CR, AVE, and factor loading had construct reliability. Thus, FPF could be measured with good reliability. Table 3 provides details.

Observable variables or questions grouped into new two dimensions can define each dimension as follows:

Achievement (AMP) refers to the act of achieving goals according to the set objectives such as profitability, sales, etc. Achieving overall profit as specified in the business plan Including return on investment (ROI) that exceeds investors' expectations as stated in the company's business plan.

Relative profitability (RPP) refers to a comparison of competition with other companies on market share, the ability to grow sales, or net profit, etc.

Table 3. Results of FPF construct with reliability and validity

Dimension	Items	Factor loading	t-value	Sig.	R^2	CR	AVE	Cronbach's Alpha
AMP						**0.918**	**0.789**	**0.915**
	FPF1	0.809	15.474	0.000***	0.655			
	FPF3	0.918	20.031	0.000***	0.843			
	FPF2	0.933	–	–	0.870			
RPP						**0.887**	**0.724**	**0.883**
	FPF4	0.780	12.217	0.000***	0.609			
	FPF6	0.935	14.997	0.000***	0.874			
	FPF5	0.830	–	–	0.689			

Note: AMP – achievement, RPP – relative profitability, ***p-value < 0.001
Source: own study.

Structural Model

Prior to analysing the SEM, to study the influence of SUE, DBM and FPF, each observed variable (Manifest) which refers to each question was reduced to composite variables by combining the values of each observed variable or each question of each component together then calculated the average value (Williams & O'Boyle, 2008). After reducing the observed variables or the questions of each component into composite variables, then using CFA, the measurement model, and the structural model were analysed. This process was recommended by Prajogo and Sohal (2003) and it aims to reduce the number of variables and parameters in SEM for a small sample.

Measurement Model

The results of the measurement model CFA analysis revealed that the index values were χ^2/df = 1.962; RMSEA = 0.072; GFI = 0.945; CFI = 0.975; NFI = 0.950; IFI = 0.975; and TLI = 0.959,thus indicating that the measurement model was consistent with the results of the tests of t-value > 1.96. Hence, it could be concluded that the gauge model shows convergent validity. Meanwhile, CR, AVE, and factor loading had composite reliability. Therefore, this measurement model could be measured with good reliability. Table 4 provides details.

Table 4. Results of measurement model with reliability and validity

Constructs	Composite Variables	Factor loading	t-value	Sig.	R^2	CR	AVE	Cronbach's Alpha
SUE						**0.874**	**0.585**	**0.923**
	INI	0.698	10.037	0.000***	0.487			
	FDN	0.731	11.973	0.000***	0.534			
	SFV	0.704	11.315	0.000***	0.496			
	IDE	0.744	12.322	0.000***	0.554			
	TPD	0.924	–	–	0.854			
DBM						**0.853**	**0.660**	**0.921**
	TBM	0.824	11.539	0.000***	0.680			
	BMV	0.732	8.587	0.000***	0.535			
	BMG	0.875	–	–	0.765			
FPF						**0.748**	**0.598**	**0.898**
	RPP	0.717	8.450	0.000***	0.514			
	AMP	0.826	–	–	0.682			

Note: SUE – start-up entrepreneurship; TPD – technology-driven product/service development; IDE – innovative idea; SFV – striving for venture; FND – funding network; INI – Initiation, DBM – disruptive business model; BMG – business model generation; BMV – business model value; TBM – transformative business model, FPF – firm performance; AMP – achievement; RPP – relative profitability, ***p-value < 0.001
Source: own study.

Table 5. Results of discriminant validity

Constructs	CR	AVE	SUE	DBM	FPF
SUE	0.874	0.585	**0.765**	–	–
DBM	0.853	0.660	0.699	**0.812**	–
FPF	0.748	0.598	0.713	0.680	**0.773**

Source: own study.

Table 5 shows the discriminant validity, it was found that $\sqrt{\mathrm{AVE}}$ of SUE = 0.765, DBM = 0.812, and FPF = 0.772 when comparing $\sqrt{\mathrm{AVE}}$ of each variable along with the correlation between those variables and other variables in which $\sqrt{\mathrm{AVE}}$ is higher than the correlation between the variables, which indicated that the measurement model had good discriminative consistency and could clearly distinguish each variable (Fornell & Larcker, 1981).

Structural Model

Figure 2 shows that SEM revealed that the index value of χ^2/df = 1.962; RMSEA = 0.072; GFI = 0.945; CFI = 0.975; NFI = 0.950; IFI = 0.975; and TLI = 0.959. This indicated that the structural equation modelling of SUE and DBM that influenced the FPF was consistent with the statistical criteria. This means that this structural model is valid.

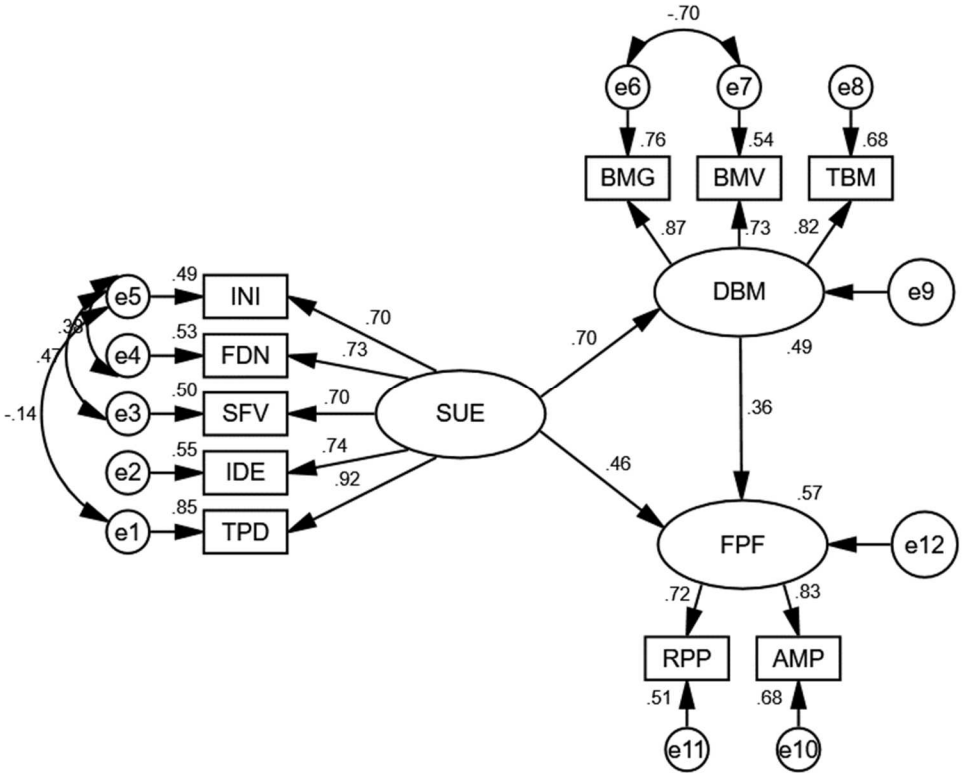

Figure 2. Structural model
Source: own elaboration.

Path Analysis

Table 6 shows that SUE had a positive direct effect on DBM. The path coefficient was very high (DE = 0.699, $p < 0.001$). When considering the indirect effect, it was found that SUE had no indirect effect on DBM. When considering the total effect, it was found that SUE had a total effect on DBM with a very high path coefficient (TE = 0.699, $p < 0.001$). The proportion of the variance could be explained and predicted with the coefficient of determination (R^2) = 0.488, meaning that 48.80% of the DBM variance could be explained and predicted by SUE, which is very high.

Table 6. Results of path coefficients of direct effects (DE); indirect effects (IE); and total effects (TE)

Dependent variables	Independent variables						R^2
	SUE			DBM			
	DE	IE	TE	DE	IE	TE	
DBM	0.699***		0.699***				0.488
FPF	0.464***	0.249***	0.713***	0.356**		0.356**	0.573

Note: **p-value < 0.01, ***p-value < 0.001.
Source: own study.

In the study, SUE had a positive direct effect on FPF. The path coefficient was high (DE = 0.464, $p < 0.001$). When considering the indirect effect, it was found that SUE had a positive indirect effect on FPF via DBM. The path coefficient was moderate (IE = 0.249, $p < 0.001$). When considering the total effect, it was found that SUE had a total effect on the FPF. The path coefficient was very high (TE = 0.713, $p < 0.001$). At the same time, DBM had a positive direct effect on FPF. The path coefficient was high (DE = 0.356, $p < 0.01$). When considering indirect effect, it was found that DBM had no indirect effect. When considering the total effect, it was found that DBM had a total effect on FPF with a path coefficient (TE = 0.356, $p < 0.01$). While the proportion of the variance could be explained and predicted with the coefficient of determination (R^2) = 0.573, meaning that 57.30% of the FPF variance could be explained and predicted by SUE and DBM, which were very high.

Discussion

The newly developed SUE dimensions are as follows: (1) technology-driven products/services development (TPD), (2) innovative ideas (IDE), (3) striving for venture (SFV), (4) funding Network (FND), (5) initiation (INI). The five new SUE dimensions can define SUE as the ability of potential entrepreneurs to change the competition with new innovative ideas; a new way to apply technology to business operations; initiation to design and develop a product/service that meets customers' needs according to the advancement of technology; the ability to create a funding network to contact and exchange information with customers, and partner companies; striving for venture without giving up until entering the market with newly develop products/services. It is consistent with Hyrkäs (2016) that SUE is the ability to adopt new information technology or new ways of using technology to do new things. A new joint venture with high earning potential has great potential to change the way of competition through innovation. However, in this research, SUE is the ability of a start-up that supports the concept of Rise (2011); Blank and Dorf (2012); SUE refers to people who see an opportunity to start a business and can make it grow by leaps and bounds by seeking for a revenue-generating business model which is profitably repeatable and scalable.

The dimensions of the newly developed DBM are as follows: (1) business model generation (BMG), (2) business model value (BMV), (3) transformative business model (TBM). The three new DBM dimensions can define that DMB is a process aiming to create a new business model and replace the existing business model, which occurs when an existing industry faces products/services that provide more value to customers than traditional business models to the point where they cannot compete directly. The trend of changing business models arises from receiving information about new products/services from customers and bringing many suggestions to solve problems, add value, and improve business models, which leads to the development of business models that meet the needs of new markets according to the needs of customers that change according to the advancement of technology. It is consistent with the ideas of Cavalcante *et al*. (2011); Sabatini, Cucculelli, and Gregori (2022). The DBM started with creating a new business model. It is important to discard or delete some processes and then close the old business-related section or unit, which is often attained by expanding new business models and adding activities or expanding new core processes to the existing business model. Expanding a new business model by improving existing business models through exploring new business alternatives. Followed by a gradual removal of processes associated with the existing business model and replacement of them with new processes for the new business model (Karimi & Walter, 2016).

Finally, the company ended its old business model by phasing out current processes and changing the existing business model with the new business model. Moreover, this supports the idea of Blank and Dorf (2012). The business model of a start-up arises from solutions meant to solve problems which leads to a valuable business model that can solve problems and meet customer needs.

The said developed dimensions of the FPF are as follows: (1) achievement (AMP), (2) relative profitability (RPP); both have financial and non-financial performance indicators which is consistent with Mapalala's concept (2017). The performance is the achievement of the ultimate goal. It can also be defined in terms of achieving the goal which is in line with the concept of Shan, Song, and Ju (2016). It focuses on the results of successful business operations which involves entering a new market, introducing new products/services to the market, and comparing profitability with other companies in order to formulate a strategy to create competitive advantages.

The hypothesis H1 was accepted, SUE had a positive direct effect on DBM at the 0.001 statistically significant level, with a very high path coefficient (DE = 0.699), and a standard coefficient (γ) = 0.699 ($p < 0.001$). The research findings support the idea of Blank and Dorf (2012). A start-up entrepreneur is a person who sees an opportunity to start a business and can make the business grow by leaps and bounds by searching for a profitable, repeatable and scalable business model which is in line with the findings of Karimi and Walter (2016). An outstanding attribute of entrepreneurs is the ability to deploy DBM effectively. Entrepreneurs can predict the extent of disruption in the business model beyond the company's original product and transaction characteristics. This makes start-up entrepreneurs have the ability to decide to develop a new business model that can replace the old business model. The results showed that SUE is in line with Schumpeter's (1991) idea of entrepreneurship acting as a mechanism of 'creative destruction' as an original concept before it was developed into a concept of 'disruption' (Christensen, 1997). Hence, SUE is a DBM development mechanism.

The hypothesis H2 was accepted, SUE had a positive direct effect on FPF at the 0.001 statistically significant level with a high path coefficient (DE = 0.464), and a standard coefficient (γ) = 0.464 ($p < 0.001$), supporting the findings of Shan, Song, and Ju (2016). Entrepreneurship is relevant to FPF through the speed of innovation which is consistent with the findings of Mapalala (2017). It was found that the relationship between entrepreneurship and organizational performance is in line with the ideas of Osiyevskyy and Dewald (2015). Entrepreneurs have the greatest effect on successful transformation in high-risk situations. Because of their risk tolerance and self-efficacy, the person is more prone to perceive opportunities. Entrepreneurs are strategic planners, exploiting threats for a competitive advantage.

The hypothesis H3 was accepted, DBM had a positive direct effect on FPF at 0.01 statistically significant level, with a high path coefficient (DE = 0.356), a standard coefficient (β) = 0.356 ($p < 0.01$). This finding is consistent with Osiyevskyy and Dewald (2015). The DBM innovation is related to other profitability and investment that are competitive in terms of the resources of the existing organization. Moreover, the research by Phangestu *et al*. (2020) found that financial metrics are key performance appraisals of a company that could indicate the success of a company, the success of leadership roles of the entrepreneurs, and the success of the company's DBM. This supports Sonthiprasat's concept (2014). Thus, DBM can develop new products/services that provide a competitive advantage and can improve company profits.

CONCLUSIONS

The dimensions of the newly developed SUE, DBM, and FPF meet the first research objective that develops the constructs of SUE, DBM, and FPF. These new dimensions could be developed dynamically, which contributed that SUE acting as the engine of DBM development. Thus, the new dimensions could be used to develop start-ups. To begin with, the new business model generation, technology-driven products/services development to meet the customer needs and seeking investors network. The second research objective was to study the causal relationship between SUE, DBM, and FPF and it was found that SUE and DBM had a positive influence on FPF, while SUE had a positive influence on DBM as well. Hence, the impact of DBM will be strengthened, and impacting FPF can gain a competitive advantage and improve

profitability as start-ups introduce a new business model with technological innovation that will redefine industries and restructure the economy (Schumpeter, 1991; Adler *et al*., 2019).

Start-up entrepreneurs enhance perception skills, combat threat awareness and risks in their industry, and seek opportunities in disruption. It shows a positive impact on the new business model that will replace the old one with strategic planning starting from looking for problems that arise from threats, accepting and strengthening the old business model or deciding to develop a new business model. Therefore, start-ups should seek new customer bases. This is because a new or improved business model could exceed the needs of existing mainstream customers. It could take some time to switch to products/services developed from DBM (Osiyevskyy & Dewald, 2015). For example, DBM in the photography, film, and publishing business is being replaced by digital technology, e-media, and streaming, and the emerging travel business with travel agencies is being replaced by the online format of websites or apps for accommodation reservations, travel, and site visits on your own (e-brokering) or even virtual tours. Although, this research found that most of the start-ups were in the A growth phase (a phase of customer growth distribution where they start earning and have a clear business model) = 41.4%, the fundraising valuations ranged from USD 2 to 15 million = 37.1%, and FPF had a high level (mean = 5.53), while SUE and DBM had a positive influence on FPF with the impact being high. However, funded start-ups are likely to disappear after five years. Most start-ups survive on investment, with three out of four failing to return their investment (Gage, 2012; Cantamessa *et al*., 2018; Aminova & Marchi 2021), and rather might also be viewed as a temporary organization (Blank, 2020). Start-ups should focus on measuring FPF by setting clear goals for success and regularly monitoring and controlling operational strategies that can lead to the intended outcomes. After the success of the proposed business model which means it has been accepted, its product/service has been profitable, the business could be acquired by a large corporation or could enter the stock market through an IPO (initial public offering). Therefore, an FPF measurement clearly demonstrates results in terms of profitability and competitiveness over competitors and strengthens confidence amongst investors very well (Sonthiprasat, 2014).

The limitation of the research is that some start-ups could not provide information due to investor contracts, and some were uncomfortable providing numerical financial information and a financial metric is a factor of start-up success as well as the income and investment received (Phangestu *et al*., 2020). However, numerical results alone may not adequately describe the system of performance appraisals. Consequently, this research developed performance measurement to determine and compare the level of achievement of firm objectives (Yang, 2012). Future research should be applied the new dimensions of SUE and DMB to study and develop start-ups in the industries that tend to grow well from technological advances and are consistent with the country's economic development policy such as agri tech, health tech, property tech and urban tech, and travel tech, etc. Mixed methods with qualitative and quantitative would be required.

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Appendix: Table scale items

Start-up entrepreneurship (McGee *et al*., 2009; Karimi & Walter, 2016; Mapalala, 2017; Shan, Song, & Ju, 2016)
Searching
SUE1: The company can brainstorm new ideas for new products/services.
SUE2: The company can identify the need for new products/services.
SUE3: The company can design new products/services that meet the needs of customers.
Planning
SUE4: The company estimates customer demand for new products/services.
SUE5: The company sets competitive prices for new products/services.
SUE6: The company estimates the initial amount and working capital needed to start the business.
SUE7: The company designs effective marketing strategies for new products/services.

Marshaling
SUE8: The company can build confidence in the vision and plans for new business with customers, partners and partners.
SUE9: The company's network is capable of communicating and exchanging information with customers, business partners, and partners.
SUE10: The company's business concept is clear, guiding employees to operate every day.

Implementation
SUE11: The company has the ability to supervise employees.
SUE12: The company has the ability to recruit and hire employees.
SUE13: The company has the ability to delegate tasks and responsibilities to employees.
SUE14: The company has the ability to inspire, encourage, and motivate employees.
SUE15: The company has the ability to train employees.
SUE16: The company has the ability to organize and maintain financial interests.
SUE17: The company has the ability to manage financial assets.
SUE18: The company has the ability to read and interpret financial statements.

Innovativeness
SUE19: The company is creative in operation.
SUE20: The company seeks new approaches to operate things.
SUE21: The company attentively improves and develops business innovations.

Pro-activeness
SUE22: The company develops products/services based on customer needs arising from technological advancements.
SUE23: The company is often the first in the country to introduce new technology products/services.
SUE24: The company is often the first in the country to offer management or operation by means of technology.

Risk-taking
SUE25: The company supports the idea or research results to develop new products/services in technology.
SUE26: The company is willing to invest in new products/services although the revenue and future growth is uncertain.
SUE27: The company manages business risk with new technologies.

Competitive aggressiveness
SUE28: The company's business environment is highly competitive with technology.
SUE29: The company takes a competitive approach using technology to gain an edge over competitors.
SUE30: The company is trying its best to survive in a market with strong technology competitiveness.

Autonomy

SUE31: The company encourages its employees to create and motivate change in the way they work with technology.
SUE32: The company is dedicated to using the resources necessary for the development of technology products/services.
SUE33: The company encourages employees or teams to present ideas, visions, and implementation using technology.

Disruptive business model (Osiyevskyy & Dewald, 2015; Sonthiprasat, 2014; Karimi & Walter, 2016)

DBM1: The company adds value with new value-added services to meet market demand.
DBM2: The cost of production that is not derived from the core products/services is comparatively higher.
DBM3: The company offers fee discounts to meet market demand.
DBM4: The company takes customer feedback as information to meet market needs.
DBM5: The company will change its business model to add value to its customers.
DBM6: Over the past 1–3 years, the company has introduced value within its products/services that change according to customer needs.
DBM7: Over the past 1–3 years, companies have exchanged information about new products/services with both official and unofficial partners
DBM8: Over the past 1–3 years, the company's new products have gained attention as innovative solutions to meet customer needs.
DBM9: Over the past 1–3 years, the company has introduced new products/services that can replace the existing products/services.

Firm performance (Shan, Song, & Ju, 2016)

FPF1: Return on investment (ROI) exceeds investor expectations as stated in the company's business plan.
FPF2: The company achieves all established goals and objectives of this new business (*e.g.*, profitability, sales, etc.).
FPF3: The company succeeds by its overall profitability (*e.g.*, as stated in the business plan).
FPF4: When compared to the competition, the company has the ability to grow sales at the level of (1=greatly not growing, 7=greatly growing).
FPF5: When compared in terms of competition, the company has a market share at the level of (1=no significant market share, 7=extreme market share).
FPF6: When compared in terms of competition, the company has a net profit of (1=extremely profitable, 7=extremely profitable).

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Conflict of Interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Internationalization and innovation orientation as factors of employee learning and development adaptation during Covid-19: Evidence from Polish SMEs

Agnieszka Żur, Agnieszka Wałęga

ABSTRACT

Objective: The driving aim of this study is to test whether small and medium-sized enterprises (SMEs) with a higher level of internationalization and innovation orientation were able to adapt their training and development activities during Covid-19 quicker and better than others. With no or very few studies investigating employee learning and development adaptation in SMEs, we address an important research gap.

Research Design & Methods: We tested the hypothesized relationships on a sample of 214 Polish SMEs. Data was collected using the computer-assisted telephone interview (CATI) method. The logit model and ordered probit model were employed to analyse the data.

Findings: While the results clearly indicate that innovation orientation had an impact on the adaptation of training and development for Polish SMEs during the first year of the Covid-19 pandemic, internationalization did not exhibit any significant impact on the number of training sessions conducted during the first year of Covid-19. However, the existence of prior experience with online technologies may have moderated the relationship between internationalization and adaptation of learning and development.

Implications & Recommendations: To become quick adapters, SMEs should develop an innovation orientation, implement online learning practices and foster mutual learning within the organization, and take every opportunity to learn from external partners.

Contribution & Value Added: With this study, we contribute to the body of knowledge investigating SME adaptation during Covid-19. This research implies that innovation orientation can positively influence how firms adapt their training and development in times of crisis. This pioneering contribution is an important piece of the puzzle of what might determine the competitive advantage of some SMEs over others in years to come.

Article type: research article
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INTRODUCTION

The years 2020-2022 will be remembered as a shakedown for all organizations, which were put to a test in their adaptability and resilience. The Covid-19 pandemic created an unprecedented, complex, and hyper-challenging environment for managers who needed to ensure the continuity of their companies and help their employees to cope with this extraordinary crisis. The unanticipated and sudden switch to work from home posed huge challenges for HR managers and functions; learning and training programs were oftentimes halted, remote work disconnected people from each other, and increased employee stress and burnout (Gabriel & Aguinis, 2022). As organizations of all sizes and across industry types experienced significant revenue drops and budget cuts, they

faced monumental talent management challenges including hiring freezes and layoffs, salary freezes, cancelled bonuses and pay reductions (Kaur & Shah, 2021).

Training and development in turbulent times are essential, people need additional support and access to both knowledge and skills necessary to function effectively in times of crisis. Upskilling the workforce was oftentimes a matter of survival. In the life-long learning culture, learning cannot cease, which was extremely difficult for many organizations. In total, 46% of organizations halted or reduced their employee development programs in 2020 (Degreed State of Skills Report, 2020).

Businesses have put much effort to modify and adapt business practices to pandemic realities and we know that this process was pursued differently by different companies. Academic literature on Covid-19 within its various management areas displays evidence that it was a highly complex process, differentiated across sectors and firm types (Kwiatkowski & Szymańska, 2022; Arlindo, Nunes, Aires, & Pimenta, 2021; Margherita & Heikkilä, 2021; García-Madurga, Grilló-Méndez, & Morte-Nadal, 2021; Ivanov, 2021; Androniceanu, 2021). Existing studies identified several critical issues for training and development during the pandemic: insufficient employee digital skills, low adoption of e-learning by firms and universities (Głodowska *et al.*, 2022), screen fatigue, stress and burnout (Krugiełka & Kostrzewa-Demczuk, 2021; Aguinis & Burgi-Tian, 2021; Hamouche, 2021; Mihalca *et al*., 2021; Androniceanu & Marton, 2021). Yet, although much has been reported on training and development during Covid-19, these studies focus on larger firms and global corporations. On the other hand, there are several studies assessing the impact of Covid on SMEs, but these do not focus on training and development practices, but rather on broader business-related issues (*e.g.* Juergensen, Guimón, & Narula, 2020; Marcazzan, Campagnolo, & Gianecchini, 2022; Halmai, 2022; Bagh, Khan, Fenyves, & Olah, 2023; Teja Kusuma *et al*., 2022).

Hence, we identify a gap in our growing body of knowledge on Covid-19 adaptation strategies; we do not know much about how and with what success small and medium enterprises adapted their training and development practices during the Covid-19 pandemic. Taking the importance of training and development of the workforce, identified as a key driver of business performance, we need to know more about training and development within this vital sector, during the Covid pandemic. These studies are necessary to develop an effective crisis management framework within human resource management for the future.

This study addresses the broad question, important to reflect on after over two years of Covid reality: which companies were able to adapt their training and development programs better than others to lock-down mode? Existing studies reveal two factors that played a role in SME resilience during Covid-19 – learning from the prior crisis (Haneberg, 2021) and digital transformation (Klein & Todesco, 2021). With this study we intend to address factors that are more nuanced, not so obvious, yet suggested by prior research as potential drivers of positive change - internationalization and innovation orientation. Hence the driving aim of this study is to test whether SMEs with a higher level of internationalization and innovation orientation were able to adapt their training and development activities quicker and better than others. We tested these relationships on a sample of 214 Polish SMEs.

The main contribution of this study lies in broadening our understanding of adaptation and agility of SME learning and training activities in times of crisis and extreme turbulence. It provides evidence that internationalization and innovation performance play a role in the pace and scope of process adaptation to new and unforeseen circumstances. This way, we offer an important contribution to SME organizational learning theory. A better understanding of the full spectrum of factors that impact SME adaptation processes to business viability threats can inform future SME strategies. The article will continue with hypothesis development and then lay out the methodology. Results will be presented and discussed in light of existing literature. We will conclude with closing remarks, research limitations, and suggested future research.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Adaptation of Employee Learning and Development

The need to develop human resources as the most valuable capital possessed by an organization has become prevalent in business management, affecting various performance areas from employee retention (Cascio, 2014; Alrazehi & Amirah, 2020) to firm growth (Kotey & Sheridan, 2004; Lok, Cheng, & Choong, 2021). In this context, continuous professional development of employees that covers formal, nonformal, and informal education, retraining and upskilling through in-company training and self-education is a vital part of any business organization and must be incorporated into a systematic and formal system within the firm (Tan & Antonio, 2022). In times of unexpected and turbulent disruption, such as the Covid19 pandemic, human resources development has become more important than ever; people need to redefine, upgrade and/or modify their skills to meet completely new requirements. And they need to do this immediately. To meet this challenge companies were forced to transfer their training and development activities from physical training spaces and face-to-face contact to the online environment. Not all firms had the capacity to do so. Reports which emerged during the Covid-19 pandemic indicate that 46% of employees worldwide faced with the dramatic reduction in upskilling and reskilling opportunities provided by their employers and 55% of employees experienced that as a decrease in confidence level in their skills and an increase in their stress levels (Degreed Report, 2020). This paints a tragic picture. Through 23 in-depth interviews with experienced HR managers in Poland (carried out in 2020), Krugiełka and Kostrzewa-Demczuk (2021) established that companies were adapting their HR development practices during Covid-19 at very different levels. According to their research, in some companies, the development area has completely ceased to exist due to layoffs, reduced budgets, and the termination of contracts with trainers. Other organizations were investing in remote tools and forms of employee development, starting a time of unprecedented rapid development of digital transformation in their HRD practices.

The SMEs have severely suffered because of the pandemic reality. Klein and Todesco (2020) pose that SMEs are more vulnerable to the current pandemic crisis than larger firms. Their scarcity of financial resources and gaps in specialized knowledge make it difficult for them to respond to the challenges posed by the Covid-19 crisis. Klein and Todesco identify the following characteristics of SMEs which impact this vulnerability: the lack of human resources, limited managerial capacity (procedures, techniques and tools), limited capital resources and knowledge management. This is echoed by Eggers (2020), who – based on a meta-analysis of 69 articles that studied SMEs in previous crises – concludes that they face a liability of smallness and of newness. The smaller the firm the fewer resources it typically controls, which makes it more vulnerable to internal and external events, such as a critical employee quitting his/her job, a decline in financing options, a reduction of demand due to a competitor entering the market, or a crisis hitting the global economy (Karas & Režňáková, 2021). Additionally, new organizations suffer a greater risk of failure than older organizations, because they lack established business models, depend on weak business relationships, and have low levels of legitimacy. However, the literature indicates that given their smaller size, SMEs tend to be rather flexible when opportunities or threats arise in their environment; the smaller the organization, the closer the decision-makers are to their customers and other stakeholders (Eggers, Hansen, & Davis, 2012).

Keeping in mind that survival, resilience, and adaptation of SMEs is a fragile process which can go two ways, we seek to explore two potential factors that may have had an impact on how well SMEs adapted their training and development during the Covid-19 pandemic – internationalization and innovation orientation.

Internationalization

Some studies revealed the significance of individuals' human capital on the internationalisation of SMEs (Mozas-Moral *et al.*, 2016; Pickernell *et al.*, 2016). International activities of firms require appropriate resources and competencies and human capital appears to be an important resource that impacts the identification and exploitation of international opportunities (Buzavaite & Korsakiene, 2019;

Virglerova *et al*., 2021; Ključnikov *et al*., 2022a; Ključnikov *et al*., 2022b). Furthermore, scholars claim that internationalisation is a learning-intensive process (Fletcher & Prashantham, 2011) as a firm's capability to learn is vital to support speedy decision-making. These firms learn from both internal and external sources; they must analyse what they are capable of, identify the gaps in their knowledge, and learn to fill in these gaps quickly to take advantage of international opportunities (Autio, Sapienza, & Almeida, 2000). On the other hand, they learn from their international encounters, about specific markets, products and business practices, which, in time, yields accumulated experience gained from operating in the international environment (Eriksson, Majkga˚rd, & Sharma, 1997). Firms' ability to 'recognize the value of new external information, assimilate it, and apply it to commercial ends' is referred to as absorptive capacity (Cohen & Levinthal, 1990). The SMEs that successfully operate on international markets are likely to have this absorptive capacity well developed.

It is important to take note of all kinds of knowledge exchange. Authors agree that internationalising organisations assimilate both explicit and tacit knowledge (Fletcher & Prashantham, 2011; Sapienza, Autio, George, & Zahra, 2006). While explicit knowledge is codified and reasonably easy to access, tacit knowledge is embedded in individuals and cannot easily be expressed explicitly or codified in written form. And yet it is tacit knowledge that sometimes carries the most valuable information of know-how, know-who, and know-where, and can be accessed only through direct interactions and personal relationships (Nonaka & Toyama, 2015). These personal relationships with outside partners would seem to be critical in times of sudden turbulence and crisis when firms have no time to prepare, plan and execute, but must rather rely on each other and seek advice, help, and support from their partners.

The assumption that internationalized SMEs would know more, have better-developed learning capabilities and possess broader access to tacit knowledge through their international relationships, is well illustrated by network theory. The network approach rests on the assumption that the networks in which firms are embedded determine the information, knowledge, and resources they can access (Adler & Kwon, 2002; Clarysse, Wright, Bruneel, & Mahajan, 2014). Networks are critical for learning in socio-constructivist approaches, especially in the context of entrepreneurship. Firms develop new ideas and new practices by recombining dispersed bits of incomplete knowledge that are spread across people, places and times, in novel ways that serve to create new value. This process is conditioned by the number of knowledge pools with which the entrepreneur is directly connected (Jack, 2005). Access to knowledge pools, interaction, and exchange appears to be at the heart of organizational learning and adaptation. It is fair to assume that firms operating on international markets have access to more diverse knowledge pools than those whose operations are limited to the domestic market. Therefore, knowledge sharing can be orchestrated on a wider scale for internationalized firms, resulting in potentially higher exposure to diverse knowledge pools where knowledge can be exchanged and developed. These criteria may have played an important role when firms were faced with unprecedented challenges during the Covid-19 pandemic. We hence hypothesize that:

H1: The SMEs with international operations adapted their training and development practices more quickly than those operating solely on the domestic market.

Innovation Orientation

Literature on innovative SMEs recognizes HR competencies as a factor facilitating the innovation process (Loufrani-Fedida & Aldebert, 2020). Innovative SMEs are those exhibiting an innovation orientation, which consists of both openness to innovation, intention to innovate, and innovation behaviours (Siguaw, Simpson, & Enz, 2006; Littunen *et al*., 2021). Innovation processes require innovation competence, such as creativity and many others, which can be trained and developed over time. Many SME owners and managers are aware of how important it is to develop these competencies within their critical workforce. Hero, Lindfors, and Taatila (2017) conducted a meta-analysis of individual innovation competence factors and found six upper categories: personal characteristics (sense of humour, motivation, takes initiative, goal orientation, self-management, ability to perform well under pressure), future orientation (creative visioning, alertness to new opportunities, pro-activeness, risk-taking ability), creative-thinking competencies (creativity, inventiveness, ability to acquire rapidly cognitive

competences, analytical thinking), social competences (cooperation, teamwork, interpersonal management, ability to create partnerships, networking, communication, negotiation, active listening, brokering), project management competences (planning, ability to use time efficiently, leadership), content knowledge and making competences (knowledge of other fields or disciplines). The majority of the above competencies come in very handy in times of turbulence and sudden change. The development of these features forms effective managerial systems including human resource management (Lulewicz-Sas *et al*., 2022) and social capital management (Mishchuk *et al*., 2022). For example, during the Covid-19 pandemic future orientation, creativity, and cooperation were the competence that may have been decisive in how quickly and how well firms adapt to the new realities and how resilient they are. Research indicates that the firms that adapted best leveraged their organizational capability to improvise and solve new problems by recombining already existing resources (Machaczka & Stopa, 2022; Marcazzan *et al.*, 2022; Montenero & Cazorzi, 2022). They are efficient also in meeting the changing consumers' interests influenced by pandemic circumstances (Rybaczewska *et al.*, 2021).

Because of the unpredictable nature of innovation which arises from informal collaboration across and beyond the firm and through designated creativity teams, uncertainty is embedded in the organisational outcomes of innovating SMEs (Shipton, Budhwar, Sparrow, & Brown, 2017). Innovation professionals and the firms they work for rely on exploring new ideas, experimentation and testing, and oftentimes failure. Innovation is a learning journey teaching us how to adapt. Therefore, we claim that the specific types of competence that innovative SMEs' employees possess and their familiarity with uncertainty is why these firms adapted more quickly to pandemic realities. We hence hypothesize that:

H2: The SMEs with an innovation orientation adapted their training and development practices more quickly than those without innovation orientation.

RESEARCH METHODOLOGY

To verify the hypotheses, we used data collected through a nationwide survey of enterprises. The main aim of that survey was to determine the impact of the business environment and the institutional support system on the functioning of enterprises in Poland during the first year of the Covid-19 pandemic. For the purpose of this research survey, we extracted responses regarding internationalization, innovation orientation, employee training, and development adaptation submitted by SMEs. The survey was carried out in November 2021 using the CATI method. Ultimately, 214 small and medium-sized enterprises participated in the survey.

The dependant variable in this study was the adaptation of training and development within the company. To gain deeper insight into the adaptation practices we measured it in terms of quantity (D1) and form (D2-D7). Firm internationalization was measured by a single item (I1) which enabled us to split the sample into two subgroups: firms which trade their goods and services solely domestically and those that trade also or solely abroad. Innovation orientation was measured by having a framework for developing innovation development and implementation (I2), openness to innovation (I3), and actual innovation behaviours (I4-I7). One of the items (I7) used reverse phrasing for control purposes. The description of the dependent and independent variables is provided in Table 1.

An ordered probit model was employed in the study to investigate the changes in the number of training sessions conducted in the company last year (compared to the period before the Covid-19 pandemic – D1). The probability that the variable (ordinal variable) takes a particular value is specified with the use of the standardised normal distribution function in the following manner (Greene, 2008):

$$\begin{aligned} P(Y=1) &= \Phi(\beta' x + \beta_1) \\ P(Y=2) &= \Phi(\beta' x + \beta_2) - \Phi(\beta' x + \beta_1) \\ &\vdots \\ P(Y=j) &= 1 - \Phi\left(\beta' x + \beta_{j-1}\right) \end{aligned} \tag{1}$$

where:

$\beta_1, \ldots, \beta_{j-1}$ - estimated constants;

Φ - the distribution function of the standard normal distribution;
β' - the vector of estimated parameters;
x - the vector of independent variables.

Table 1. Analysed variables

Variable code	Description	Value
Dependent variables		
D1	Training and development adaptation during Covid-19.	1 = we conducted much less training than usual; 5 = we conducted much more training than usual
D2	We suspended all training (we did not conduct training during the pandemic).	1= Yes, 0= No
D3	We partially abstained from training and carried out limited training at the company's headquarters.	1= Yes, 0= No
D4	We partially abstained from training and carried out limited training online.	1= Yes, 0= No
D5	We partially abstained from training and learn from each other within the company.	1= Yes, 0= No
D6	We did not conduct online training before the pandemic but tried to adapt quickly and managed to conduct online training during the pandemic.	1= Yes, 0= No
D7	Even before the pandemic, the training was partially online, so we expanded the number and scope of online training.	1= Yes, 0= No
Independent variables		
I1	Internationalization: Do you sell your products and services abroad?	1 = foreign customers; 0 = local or domestic customers
I2	We have a framework for developing innovation starting from the idea submission phase.	1= Yes, 0= No
I3	We are open to innovation.	1= Yes, 0= No
I4	We limit ourselves to imitating solutions introduced by competitors.	1= Yes, 0= No
I5	We buy out innovative enterprises to gain access to innovation.	1= Yes, 0= No
I6	We gain access to innovation through cooperation with external entities.	1= Yes, 0= No
I7	We do not have a strategy for implementing innovation.	1= Yes, 0= No

Source: own study.

The parameters of the model are estimated using the maximum likelihood. The positive value of the particular β parameter for the adequate independent variable x (with increasing values) increases the probability of the occurrence of the first value of dependent variable *Y* and reduces the probability of the occurrence of the last value j. In the case of the middle values of the dependent variable, the changes in the probability of the occurrence of these values are not unequivocal. It is impossible to determine (having the estimated parameter) in which direction the change of the probability goes in these classes. We can unequivocally interpret the parameters concerning the first and last class.

In the case of dependent variables was dichotomous (it assumes two values: *Y* = 1 or *Y* = 0), a logit model was used (D2-D7). Depending on certain factors (x_j), in this model, probability can be interpreted as a value of the distribution function described with the following formula (Maddala & Lahiri, 2009):

$$P(Y = 1) = \frac{exp(\alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \ \ldots + \alpha_k X_k)}{1 + exp(\alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \ \ldots + \alpha_k X_k)} \quad (2)$$

where:

Y - dummy dependent variable;
$X_1, \ldots, X_k$ - explanatory variables;
$\alpha_0, \ldots, \alpha_k$ - model parameters.

The parameters of the logit model are most often obtained using maximum likelihood estimation (MLE) by maximizing the logarithm of the probability function relative to the model parameters by means of iterative numerical procedures.

RESULTS AND DISCUSSION

In this study, Polish small and medium-sized enterprises were analysed, meaning those employing between 10 and 249 people. According to the survey, a minority of companies (16.17%) conducted more training during the year than before the pandemic (D1). While 38.72% conducted fewer training sessions and in 45.11% of the surveyed companies the pandemic did not affect the number of training sessions conducted. Regarding the training activities during the pandemic, most surveyed companies partially suspended training but tried to conduct the necessary ones online (D4 – 66.80%), or the employees tried to help each other and learn from each other within the company (D5 – 62.24%). A large group of companies (D6 – 55.6%) indicated that despite the lack of online training before the pandemic, they adapted quickly and managed to conduct many online training sessions during the pandemic. The online training offered before the pandemic was extended (D7) by 20.33% of the surveyed enterprises. Trainings were partially suspended by 43.15% of companies, carrying out the necessary training at the company's premises (D3). Only a few companies stopped training during the pandemic (D2 – 14.94%).

Table 2. Sample characteristics

Variable	%	Variable	%	Variable	%
D1.1	17.02	D2	14.94	I1	21.99
D1.2	21.70	D3	43.15	I2	20.33
D1.3	45.11	D4	66.80	I3	54.36
D1.4	9.79	D5	62.24	I4	14.11
D1.5	6.38	D6	55.60	I5	7.05
–	–	D7	20.33	I6	11.20
–	–	–	–	I7	34.85

Source: own study.

Nearly 4/5 of the firms included in the sample directed their offer exclusively to regional or domestic customers, and 22% only to foreign customers or both domestic and foreign customers (I1). Regarding innovation orientation, openness to innovation was indicated by the majority of firms (I3 – 54.36%). However, regarding the innovative behaviours of the surveyed enterprises, 20.33% (I2) had a framework for developing innovation in place, starting from the idea submission phase, while 34.85% of enterprises did not have an innovation implementation strategy (I7). To gain access to innovation (I5) 7.05% of companies bought out innovative enterprises, 11.20% gained access to innovation through cooperation with external entities (I6) but 14.11% limited innovation to imitating solutions introduced by competitors (I4).

The relationship between training adaptation during a pandemic in relation to internationalization and innovation orientation was then investigated. Statistically significant relationships confirmed by the chi-square test of independence and measured with Cramér's *V* correlation coefficient are presented in Table 3.

The results (Table 3) suggest that openness to innovation (I3) had a statistically significant impact on the overall number of training and development activities carried out during the Covid-19 pandemic – D1 (0.2020; $p<0.1$). Openness to innovation (I3) and internationalization (I1) had a statistically significant impact on the quick adaptation of training and the number of training sessions conducted during the pandemic – D6. Furthermore, internationalization (I1) and access to innovation through external cooperation (I6) had a statistically significant impact (0.2456; $p<0.01$) on mutual learning and learning from others during the Covid-19 pandemic (D5). Lack of strategy for implementing innovation (I7) had a statistically significant impact (0.1885; $p<0.05$) on halting training in the company (D2), suggesting that firms without an

innovation strategy have suspended their training during Covid-19. Another noticeable statistically significant relationship was observed for the firms which declared having a framework for developing innovation (I2) – they have carried out their most necessary training sessions on company grounds – D3 (0.1501; p<0.1). On the other hand, we observed a statistically significant relationship between carrying necessary training sessions online (D4) and firms copying innovation from the competition – I4 (0.1736; p<0.05).

Table 3. Correlation matrix (Cramér's V correlation coefficient)

Specification	I1	I2	I3	I4	I6	I7
D1	–	–	0.2020*	–	–	–
D2	–	–	–	–	–	0.1885**
D3	–	0.1501*	–	–	–	–
D4	–	–	–	0.1736**	–	–
D5	0.2456***	–	–	–	0.1428*	–
D6	0.2529***	–	0.1709**	–	–	–

* – p<0.1; ** – p<0.05; *** – p<0.01.
Source: own study.

The next phase of analysis was to build on the implied relationships confirmed by the chi-square test and further test the impact of internationalization and innovation orientation on training and development adaptation during Covid-19 in terms of the number of training sessions conducted (D1) using the ordered probit model (Table 4).

Table 4. Estimation results of ordered probit model for training and development adaptation during Covid-19 (D1)

Specification	Coef.	Standard error	Wald statistics	*p*-value
Constatnt 1	-0.712	0.204	12.151	0.000
Constatnt 2	-0.030	0.200	0.023	0.881
Constatnt 3	1.275	0.212	36.293	0.000
Constatnt 4	1.828	0.230	63.382	0.000
I1	0.250	0.173	2.084	0.149
I2	-0.426	0.192	4.927	0.026
I3	-0.114	0.168	0.461	0.497
I4	-0.256	0.212	1.450	0.228
I5	-0.261	0.282	0.857	0.354
I6	-0.347	0.229	2.303	0.129
I7	-0.221	0.194	1.294	0.255
Model fitting				
AIC	667.34			
Log(likelihood ratio)	-322.67			

Source: own study.

The results of the parameter estimation of the ordered probit model (Table 4) indicated a significant impact of having a framework for developing innovation on the probability of providing more training than usual. However, no significant impact was recorded for internationalization (Table 4).

Further analysis continued with testing for relationships between the independent variables and forms of training (D2-D7). The results of the parameter estimations for the logit models for selected training activities during Covid-19 are presented in Table 5. Although the values of the pseudo-R2 coefficient – which in the case of the estimated models were not high – were acceptable in the case of these types of models when applied to individual data (Gruszczyński, 2012). The lack of significance returned by the Hosmer-Lemeshow test (in each of the models) allows us to conclude that the observed and predicted values were sufficiently close. It may therefore be assumed that the models represented a good fit with the actual data.

Table 5. Estimation results of the logit model

Specification	D3		D4		D5		D6		D7	
	coef.	***p*-value**	**coef.**	***p*-value**	**coef.**	***p*-value**	**coef.**	***p*-value**	**coef.**	***p*-value**
Constant	-0.342 (0.384)	0.374	0.758 (0.397)	0.056	-0.476 (0.513)	0.496	0.340 (0.438)	0.374	-1.074 (0.460)	0.020
I1	0.478 (0.337)	0.156	-0.302 (0.346)	0.383	0.152 (0.182)	0.422	-1.158 (0.343)	0.001	0.709 (0.137)	0.057
I2	-0.894 (0.387)	0.021	0.124 (0.393)	0.752	-0.106 (0.387)	0.776	-0.385 (0.375)	0.339	-0.190 (0.443)	0.668
I3	0.429 (0.331)	0.195	0.162 (0.341)	0.636	0.671 (0.342)	0.049	0.551 (0.327)	0.093	-0.348 (0.399)	0.383
I4	-0.434 (0.418)	0.299	-0.930 (0.410)	0.023	0.259 (0.434)	0.561	-0.329 (0.418)	0.430	-0.155 (0.502)	0.757
I5	-0.095 (0.574)	0.869	-0.405 (0.570)	0.477	0.895 (0.631)	0.157	0.153 (0.569)	0.788	-0.050 (0.632)	0.937
I6	0.063 (0.441)	0.887	0.566 (0.504)	0.261	1.249 (0.538)	0.022	0.220 (0.456)	0.630	0.428 (0.484)	0.376
I7	-0.023 (0.376)	0.951	0.141 (0.540)	0.722	0.620 (0.395)	0.124	-0.082 (0.383)	0.830	-0.800 (0.488)	0.101
Model fitting										
AIC	328.69		306.53		316.44		318.38		248.51	
Nagelkerk R^2	0.0618		0.0525		0.0629		0.1194		0.0558	
Log(likelihood ratio)	-156.35		-145.26		-150.22		-151.19		-116.25	
Hosmer Lemeshow Test	6.158		3.792		4.675		0.6517		1.6551	
	p = 0.2911		p = 0.5797		p = 0.5862		p = 0.9855		p = 0.8945	

Standard errors are presented in parentheses.
Source: own study.

Several relationships implied by the chi-square test were confirmed. The results of the parameter estimations for the logit models indicated that companies having a framework for developing innovation (D3) were less likely to abstain training and development activities (I2). Companies which limited their innovation orientation to imitating solutions introduced by competition (I4) were less likely to carry out training online (D4).

The companies which were more likely to substitute part of their training with mutual learning (D5) were those that were open to innovation (I3) and those which gained access to innovation through cooperation with external entities (I6).

The probability of quick adaptation and switching to online training sessions (D6) was greater for those companies which were open to innovation (I3) and lesser for those which sold their goods and services abroad (I1). However, the probability of extending already existing online training sessions during the pandemic (D7) was greater for companies which sold their goods and services abroad (I1).

The above results confirmed our second hypothesis and indicated that innovation orientation had a positive impact on the adaptation of training and development practices within Polish small and medium companies during the first year of the Covid-19 pandemic. The results of the parameter estimations for the logit models suggest that openness to innovation, having a framework for developing innovation and gaining access to innovation through cooperation with external entities were the three factors that influenced the speed and scope of adaptation processes in small and medium firms during the first year of Covid-19 pandemic. Copying innovation of competitors and firm buy-outs are innovation behaviours which did not impact adaptation, which might be explained by prior findings suggesting that imitation of innovation does not reflect a truly innovative culture and innovation orientation of a given firm (Naranjo-Valencia *et al.*, 2011).

True innovation orientation and pioneering original innovation development imply organizational commitment and having an innovation framework implies having a set of procedures to exercise this

commitment. This finding falls in line with prior research which indicated that organisational commitment activated by the frequency of company activities and their level of formalisation are strongly interrelated with firm reaction strategies (Marcazzan *et al.*, 2022). Preparedness to adapt to unforeseen circumstances is therefore determined by the procedures and practices in place, embedded into the DNA of a company. The SMEs with an innovation orientation, a working framework for developing innovation, and a practice of cooperating with external partners may exhibit a natural tendency to proactively react to unforeseen circumstances such as the consequences of pandemic outbreak in 2020.

While innovation orientation clearly positively impacts adaptation of training and development within SMEs, the impact of internationalization is not that clear. The results deliver somewhat mixed implications. Statistically significant relationships confirmed by the chi-square test of independence and measured with Cramér's *V* correlation coefficient include internationalization and (i) quick adaptation of training, (ii) the number of training sessions conducted during the pandemic, as well as (iii) mutual learning and learning from others during the Covid-19 pandemic. However, the results of the parameter estimation of the ordered probit model indicated no statistically significant impact of internationalization on the probability of providing more training than usual. This relationship is only true for those firms which already delivered training sessions online prior to the pandemic and after its outbreak increased their number. These results suggest that the existence of prior experience with online technologies may have moderated the relationship between internationalization and adaptation of training and development during the first year of the pandemic. Early adoption of online learning technologies usually determines the development of online training programs in firms as recently hinted by prior research (Żur & Friedl, 2021); the first step is always the most difficult for firms; the initial adoption of online learning usually leads to a sharp adoption curve. Additionally, as Coetzer *et al.* (2022) have found in a study dedicated to distinctive characteristics of small businesses which affect employee learning, SME owners value physical and social proximity to employees as it creates the potential to facilitate learning through direct provision of immediate feedback and guidance.

The findings of this study present valuable contribution to the research on SMEs adaptability in times of crisis. This stream of research is extremely important considering the harsh realities of the VUCA (volatile, uncertain, complex, and ambiguous) environment we live in with its extreme effects, either ecological, health and/or economic consequences. The SMEs adaptability to challenging and unpredictable circumstances is a unique area of research, as SMEs are not small versions of large firms. They are more vulnerable than larger organisations to shocks because of their relative shortcomings regarding technological, managerial and human capabilities, lower diversification opportunities, and a strong dependence on a few customers and suppliers (Marcazzan *et al.*, 2022). In Europe, SMEs account for 99% of all businesses, between 50 and 60% of value added, and 67% of private sector employment (OECD, 2021), so their adaptation and resilience are critical to the economy. Adaptation capabilities will very likely determine the survival and success of SMEs in the years to come and new shocks to hit.

Researchers agree that companies obtain and maintain their competitive advantage through their ability to renew and integrate their competencies and develop new ones (Teece, Pisano, & Shuen, 1997; Zahra & George, 2002). Therefore, continuity of training and development programs in times of crisis is critical. This research is novel as it is the first study to provide evidence that innovation orientation can positively influence how firms adapt their training and development in times of crisis.

The practical implications of this research encourage SMEs to develop an innovation orientation to implement lasting learning practices across the organization which will be shock-free. Furthermore, managers should encourage and facilitate mutual learning within the organization and take every opportunity to learn from external partners. Finally, our research findings suggest that SMEs should take the opportunity of new technologies and ensure that training and development do not cede to take place despite any developments.

CONCLUSIONS

The Covid-19 pandemic will be studied and remembered as a time of unprecedented turmoil and test for many companies around the world. The first year was a time of adaptation to the new reality

brought in by lockdown, remote work, and resultant business challenges. Employees needed to quickly acquire new skills and competence. The goal of this research was to investigate whether SMEs with a higher level of internationalization and innovation orientation were able to adapt their training and development activities quicker and better than others. The results indicated that internationalization did not exhibit any significant impact on the number of training sessions conducted during the first year of Covid-19. However, for those companies, which were conducting some training sessions online before the pandemic, internationalization does have an impact on expanding the scope and scale of employee training and development. The results clearly indicated that innovation orientation had an impact on the adaptation of training and development for Polish SMEs.

The study had several limitations. As the data collection was part of a larger nationwide survey, the study was based on a purely Polish sample. There is no reason to assume that Polish SMEs are different and distinct in terms of adaptation from other EU counterparts. Therefore, replication studies in other geographical contexts are much encouraged. Second, the study did not employ commonly accepted measures of innovation such as new product development but focused on innovation orientation. Future studies should investigate the impact of innovation performance on adaptation. Future researchers investigating SME adaptation during Covid-19 can take advantage of qualitative methods to explore individual factors of owners, managers and employees through retrospective narrative. Individual testimonies might uncover nuances and factors not tested by quantitative research. Finally, the existence of prior experience with online technologies as a moderator of the relationship between internationalization and adaptation of training and development during the first year of the pandemic requires further testing.

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Knowledge management orientation as a driver of competitive performance: Evidence from Polish SMEs in the aviation industry

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ABSTRACT

Objective: This study aimed to investigate the role of knowledge management orientation (KMO) in small and medium-sized companies (SMEs) as a driver of competitive position, with customer orientation and participation in international networks as mediating variables.

Research Design & Methods: The analysis involved structural equation modelling on a dataset of 281 SMEs from south-eastern Poland specializing in the aviation industry.

Findings: The study found that KMO was the strongest positive determinant of the competitive position in the model, with more than half of the effect contributed by indirect regression paths involving mediator variables. Customer orientation enhanced competitive position only through direct effects, while international network involvement contributed to competitive advantage indirectly through the network benefits variable. Interestingly, the only meaningful difference between small and medium firms was found in the regression link between network benefits and competitive position, suggesting that larger firms are better equipped to translate benefits from cooperating with international supply chain partners into advantages against business rivals.

Implications & Recommendations: To practitioners, the study demonstrates how the interplay between knowledge management and cooperation with the supply chain can provide substantive business advantages.

Contribution & Value Added: The study adds to the existing theory by underscoring the importance of KMO to SMEs and explaining its role as an antecedent of beneficial cooperation within international networks of business partners.

Article type:	research article
Keywords:	knowledge management orientation; internationalization; competitive performance; small and medium enterprises; intangible resources
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INTRODUCTION

In today's information-based and deeply interconnected economy, organizational knowledge is more important than ever for firms of all sizes in the process of gaining a competitive advantage (Prieto & Easterby-Smith, 2006). Despite its prominence in published research, the mechanisms through which organizational knowledge can affect competitive advantage in SMEs are still unclear and warrant further investigation (Genc *et al.,* 2019; Kmieciak & Michna, 2018).

In empirical studies, the firm's capacity to acquire, generate, and employ knowledge is often considered to be part of organizational culture, as it is defined by the dominant shared beliefs and values in the organization that shape employees' perceptions and regulate behaviours regarding organizational knowledge and its application (Janz & Prasarnphanich, 2003). This aspect of organi-

zational culture is central to this research and formally defined as the construct of knowledge management orientation (KMO).

The choice of KMO is driven by two reasons. Firstly, it represents the most comprehensive perspective on the firm's knowledge management practices, encompassing its systematic capacity to assimilate, build, share, and use knowledge in its strategy and operations (Wang *et al.*, 2008). Secondly, the theory and practice of investigating organizational knowledge are well-developed in the literature, including a variety of scales for KMO and its sister concepts of knowledge management and learning orientation (Farooq, 2019), which provide robust methodological foundations with valid and reliable metrics for statistical analysis.

One avenue of research into ties between KMO and competitive advantage is to treat knowledge as a coordinating and supporting mechanism that aids the firm in acquiring and converting resources into capabilities (Darroch, 2005). By analysing the literature on the subject, it should be noted that there is a whole spectrum of factors that directly impact the competitiveness of businesses, however, knowledge management seems to be essential from the standpoint of the use of knowledge resources existing in the firm. Knowledge management was identified by the authors of this study as a factor that has a major influence on SMEs in the process of building their competitive position in the aviation industry. This idea served as the main inspiration for writing this article.

As such, firms with stronger KMO might be more inclined to seek external knowledge by forming closer cooperation networks with their value chain stakeholders, including suppliers, distributors, and clients (Nahapiet *et al.*, 2005). According to the concept of open innovation, such interactions stimulate two-way knowledge transfer, which could be transformed into improved competitive positions for all parties involved (Mazur & Zaborek, 2016). This blueprint for creating knowledge is deemed particularly valid for small and medium-sized businesses, which rarely control sufficient resources to develop critical innovations in-house (Terziovski, 2010). As a means of overcoming resource constraints, they could seek to forge tighter working relationships with other SMEs and large companies. This could provide ample opportunity for acquiring new competencies through observing and replicating partners' best practices, direct knowledge transfers, and joint projects on developing new technologies and other innovative solutions (Banerjee *et al.*, 2015). In the context of cooperative knowledge development, what stands out in the literature as particularly important is international partnerships of SMEs in strategic networks or business groups, which can facilitate access to innovations not only new to the firm, but also to its entire home market, thus stimulating growth, profitability, and other performance metrics (Vătămănescu *et al.*, 2020).

In this study, we aimed to model this cooperative mechanism by proposing that KMO corresponds to stronger international orientation and customer orientation, which are dimensions of organizational culture corresponding to two major sources of external knowledge. This in turn can lead to a stronger involvement in international networks, bringing about a number of network-related benefits, that, if successful, should improve the firm's competitive position. These phenomena were considered against the backdrop of enabling factors reflecting the firm's infrastructure level, such as IT technology and internationalization capacity. Moreover, an important contextual factor that we considered a control variable was the level of internationalization in the company's industry, which can drive organizational behaviours in addition to firm-specific considerations and preferences.

What is unique about the conceptual approach underlying this research is that KMO is considered an antecedent of a wide range of benefits that could be triggered by cooperative behaviour with international partners, going above and beyond those advantages that are derived solely from greater innovativeness. Thus, KMO is cast here as a critical driver of multiple contributions to competitive advantage and empirically tested as such.

This article is structured as follows. The subsequent section will overview pertinent literature sources and develop hypotheses. Then, research methods will be outlined, including the presentation of a conceptual model, sample characteristics, measurement scales, and statistical analysis procedures. The next section will report research findings with hypothesis verification tests, which will be followed by a discussion of the results against the backdrop of earlier published research. The article will conclude by considering limitations and directions for further research.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Nowadays, it is widely recognised that knowledge-based resources are key determinants of a firm's ability to compete in international markets. A number of studies have already demonstrated the strategic importance of knowledge-based resources, knowledge orientation and knowledge management in achieving a superior competitive advantage for the firm (Lee & Tsai, 2005; Subramanian *et al.*, 2009).

Resource-based view (RBV) and knowledge-based view (KBV) provide a theoretical framework that is helpful in understanding the direct mechanism of influence of knowledge management assets and knowledge management orientation (KMO) on competitive advantage. Because of their inimitability and rarity, intangible, knowledge-based assets are crucial for firms to amplify their abilities in the development and deployment of existing resources and create new ones (Porter, 1985). The strategic importance of knowledge is even greater in the case of SMEs, as it can compensate for shortages of tangible resources (Mejri & Umemoto, 2010; Musteen *et al.*, 2014).

The indirect effects of knowledge management orientation on competitive advantage could be captured by distinguishing the key dimensions of knowledge management: knowledge creation/acquisition (learning orientation); knowledge gathering, storing; knowledge transferring and sharing; knowledge exploitation and responsiveness (knowledge reuse). This model is widely used as a reference concept in knowledge management studies (Wang *et al*., 2008; Massa & Testa, 2009; Farooq, 2019; Lin, 2015).

The first process, knowledge creation and acquisition, underpins the fact that knowledge resides not only in the organization but also beyond its formal boundaries (Dyer & Singh, 1998). The crucial factor for the effective internal creation of knowledge is organizational culture, in particular learning orientation, which shapes employees' perceptions and behaviours by enhancing their willingness to create and apply knowledge (Janz & Prasarnphanich, 2003; Rahimnia & Alizade, 2009; Farooq, 2019). Effective acquisition of external knowledge requires the firm's ability to leverage its inter-organizational relationships to learn from customers, suppliers, competitors, other value-chain members and the public (Malhotra *et al.*, 2005). While network relationships enable access to market-specific and technological knowledge, the individual level of exploration and use of externally sourced knowledge by a firm depends on its dynamic knowledge-based capabilities (Monferrer *et al.*, 2014). Additionally, for SMEs, KMO seems to be a crucial antecedent of their involvement in international networks and internationalization (Saarenketo *et al.*, 2004; Mejri & Umemoto, 2010). In particular, two types of knowledge have been found to facilitate firm internationalization: foreign market knowledge (*e.g.* entrepreneurs' and employees' international experience (Prabandari & Xiu-Hao, 2018; da Rocha *et al.*, 2019; Naldi *et al.*, 2020)) and technological knowledge (Fletcher & Harris, 2012; Naldi *et al.*, 2020).

The second process, knowledge gathering and storage, encompasses the processes of knowledge structuring and formalizing, while the third process refers to the distribution and exchange of knowledge within the company and with external stakeholders. An important factor that affects the firm's ability to store, exchange, and deploy knowledge is its IT infrastructure (Kumar, 2001; Jeong & Hong, 2007). The technological support for knowledge management is particularly designed for explicit and codified knowledge. Different, 'softer' tools and practices are required for tacit knowledge (Hansen *et al*., 1999). Tacit knowledge sharing and management are based on social mechanisms and interpersonal interactions (Shin, 2004; Massa, & Testa, 2009).

The fourth process, knowledge exploitation and responsiveness, refers to the application of knowledge into products, services, and practices to create market value. Some studies indicate a crucial interactive effect of market orientation on the indirect relationship between knowledge management and competitive advantage (Teece *et al.,* 1997; Jeong & Hong, 2007; Werr *et al.,* 2009). As Kamya *et al.* (2010) point out, 'knowledge management interacts positively with market orientation through the conversion of market information into knowledge that creates competitive advantage.' Among the components of market orientation, customer orientation is recognized as the most important element that provides the foundation for the entire supply chain (Deshpande *et al.*, 1993; Heikkilä, 2002) and serves as the major driver of competitive advantage (Ziggers & Henseler, 2016).

Slater (1995) proposes a culturally based perspective, according to which customer orientation is part of organizational culture manifested through organizational practices targeted at the creation of customer value. These customer-focused practices not only facilitate satisfying customers' needs better than competitors but also may contribute positively to network infrastructure design (Jeong & Hong, 2007). Moreover, market-specific knowledge plays an important role in SMEs' internationalization as it constitutes a key variable in the proactive search for international market opportunities (Monferrer *et al.*, 2014). As a result, there is a better understanding of current and future market trends and a more effective response to market knowledge, which augment firm's competitiveness. A customer-led approach was found to be essential in successfully applying new technology, as well as in the firm's internationalization, which makes it an instrumental predictor variable for business success (Kim *et al.*, 2011).

While the intra-organizational aspects of knowledge management have been widely studied, the literature calls for more theoretical and empirical work to investigate in-depth inter-organizational processes related to knowledge-oriented practices (Lancini *et al.*, 2015; Werr *et al.*, 2009), especially across the supply chain (Russel & Hoag, 2004). Supply chain management requires understanding the processes involved and the accompanying knowledge transfers. Collaboration in sharing this knowledge is crucial. Much research was focused on demonstrating that collaborative knowledge sharing and transfer in supply chains can result in value creation (Tan *et al.*, 2016). According to Shih *et al.* (2012), knowledge sharing has an impact on efficient and effective decision-making. Other authors point out another benefit of knowledge transfer, *i.e.*, relationship flexibility (Blome *et al.*, 2014). Lee *et al.* (2021) add agility, adaptability, and alignment to the list of benefits. According to Fugate *et al.* (2012), knowledge sharing in supply chains can help build a competitive advantage in global markets. From these findings, one can conclude that knowledge management is directly related to supply chain performance (Dost & Rehman, 2016).

Based on the above theoretical considerations, the following hypotheses were proposed:

H1: Knowledge management orientation (KMO) is positively correlated with: H1a) customer orientation (CO); H1b) IT capacity (IT CAP); H1c) international orientation (IO), and H1d) competitive position (COM POS).

H2: Customer orientation is positively correlated with: H2a) international orientation (IO); H2b) involvement in international networks (NET INV), and H2c) competitive position (COM POS).

H3: International orientation (IO) is positively correlated with: H3a) capacity for building international networks (NET CAP); and H3b) involvement in building and coordinating international networks (NET INV).

In order to effectively deploy market-based knowledge across the supply chain, a firm has to develop adequate capabilities (Werr *et al.,* 2009). According to Johanson and Vahlne (2003, p. 93), the development of network relations is gradual and requires both time and resources. Collaboration in the supply chain is facilitated by the physical (IT) infrastructure and the social setting (social dynamics and links among network members) (Lancini *et al.*, 2015). New technology developments in the field of ICT enable firms to acquire new networking capabilities. IT systems support inter-organizational communication, coordination and collaboration (Kumar, 2001). In addition, the Internet has provided numerous cost-saving opportunities for supply chains and has contributed to the rise of new supply chain practices. The development of inter-organizational networks, however, depends not only on technology, but also on people-related aspects (Jeong & Hong, 2007). Essential factors for building long-term cooperative business networks are trust and commitment (Spekman *et al.*, 1998). As noted by Werr *et al.* (2009) 'relationships with customers and distributors are built on trust rather than contracts' and trust is generally 'a result of previous positive interactions.'

The construct of network involvement encompasses a quantitative dimension (the frequency of information and knowledge exchange) and a qualitative one (*e.g.* the nature of information and knowledge exchange, types of activities supported, etc.). Network involvement is generally thought to be driven by the search for knowledge, search for legitimacy and improved market status (Lancini *et al.*, 2015). Frequency and quality of knowledge flows impact network performance in terms of infor-

mation outcomes (involvement in R&D, innovative capabilities, and market communication), operational outcomes (competitive advantage regarding cost efficiencies, lead times, and product quality) and customer outcomes (satisfaction, retention and loyalty) (Jeong & Hong, 2007).

Thus, the following set of hypotheses was developed:

H4: Capacity for building international networks (NET CAP) is positively correlated with involvement in building and coordinating international networks (NET INV).

H5: IT capacity is positively correlated with: H5a) involvement in building and coordinating international networks (NET INV), and H5b) capacity for building international networks (NET CAP).

H6: Involvement in international networks (NET INV) is positively correlated with benefits from international networks (NET BEN).

H7: Benefits from international networks (NET BEN) are positively correlated with competitive position (COM POS).

A firm's internationalization activity and its involvement in transnational networks cannot be adequately understood without accounting for its industry context. Previous research shows that higher levels of internationalization tend to occur more frequently in highly competitive industries (Fernhaber *et al.*, 2008), since establishing contacts outside one's home market is perceived as a valid strategic response to competitors' behaviour (da Rocha *et al.*, 2019). As a result, business contexts where internationalization is commonplace put greater pressure on incumbents and newcomers to follow suit by forming foreign linkages and partnerships and competing on an equal playing field against market rivals (da Rocha *et al.,* 2019; Naldi *et al.,* 2020). Given that in highly internationalized markets the internationalization of an individual company is a necessity and thus hardly a source of competitive advantage, industry internationalization should be controlled for to better explain individual differences between firms in their asset configurations and impacts on performance. Therefore, we propose the following:

H8: Industry internationalization (IND INT) is positively correlated with: H8a) capacity for building international networks (NET CAP), H8b) involvement in international networks (NET INV), H8c) benefits from international networks (NET BEN).

In investigating the role of KMO on competitive advantage, the current research draws heavily on the theoretical background of the resource-based view, the network approach and the dynamic capabilities perspective, all of which anticipate diverse challenges and implementation effects for smaller and larger companies. A conceptual model based on such theoretical foundations is apt to demonstrate considerable differences in regression weights for firms of various sizes. As such, to avoid possible confounding effects, it is instrumental to statistically test the relationships among the focal constructs for moderation based on firm size. Thus, we hypothesize:

H9: Relationships represented in hypotheses 1-8 have different strength in small versus medium companies.

For the sake of clarity, the scope of the study, including investigated constructs, their relationships and proposed hypotheses, was depicted in Figure 1.

As shown in the diagram, the research focused on the concept of knowledge management orientation (KMO) and how it drives the competitive position of the firm (COM POS). Following the literature review reported earlier, we proposed a series of regression paths representing both direct (H.1d) and indirect (H.1a – H.1c) influences of KMO on COM POS. In particular, we expect greater levels of KMO to correspond with stronger international orientation (H.1a), higher customer orientation (H.1b), and increased IT capacity (H.1.c). The assumed relationships of KMO with IO, CO and IT CAP are the starting points of several possible pathways tracing the indirect effects of KMO on COM POS.

The direct link between KMO and COM POS (H.1d) accounts for the positive impact companies can derive from knowledge orientation in addition to those brought by the intensity and scope of their interactions with international business partners in the supply chain (NET INV). This form of benefit (NET BEN) could be attributed to all factors that were not explicitly controlled by the model as separate variables. Such effects may in part stem from the greater flexibility, adaptability, and overall productivity of knowledge-intensive firms. Accordingly, some advantages from network participation are fre-

quently intangible and, thus, difficult to establish with the survey method, but may be observed – for instance – through improvements in pertinent productivity metrics. These benefits are more likely to occur in firms with organizational cultures that enable comprehensive and rapid knowledge acquisition and deployment. Such firms are apt to find additional ways to leverage their presence in networks, for example, by gradually fine-tuning internal processes in line with the best practices observed in close business partners (Michna *et al.*, 2020).

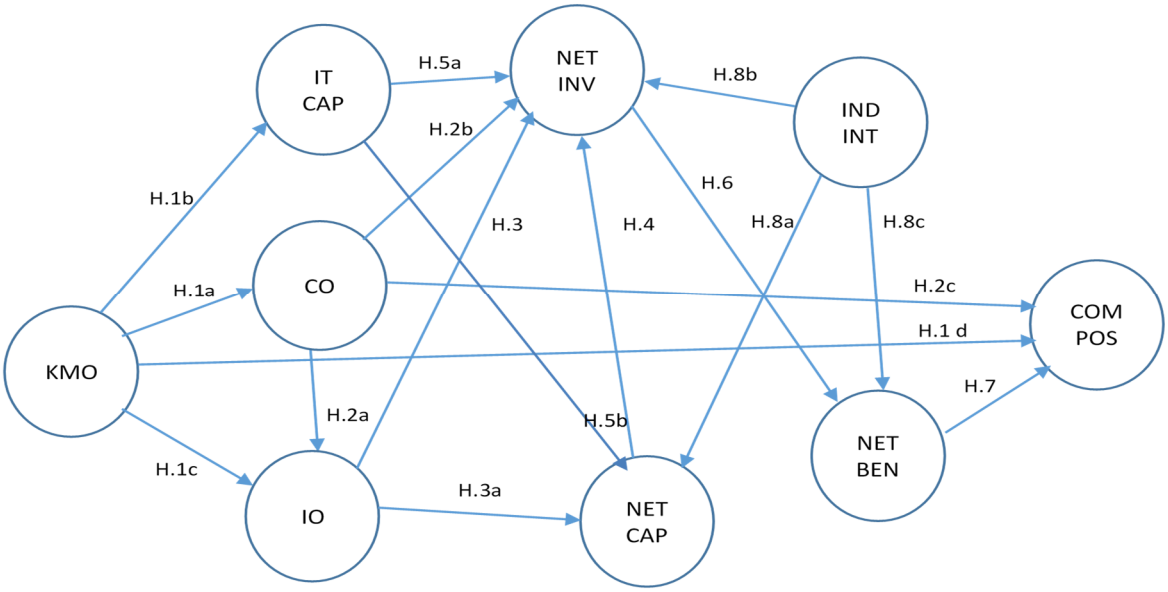

Figure 1. Conceptual model and hypotheses of the study
Source: own elaboration.

The variable of industry internationalization (IND INT) was introduced into the model to control for possible confounding effects of common involvement levels in transnational networks in different industries from which our data points were sampled. Considering that the ultimate measure of success is an improved competitive position, which is assessed in relation to other similar companies, we believe that the prospects for a firm to register competitive advantages are better if its engagement in international networks is greater than that of its market rivals. Hence, the variable IND INT provides a means to disentangle company-specific impacts from industry-wide influences.

In addition to IND INT, we looked at the moderating effect of a company's size, as measured by the number of employees. To this end, the entire model was estimated three times, separately for the whole sample and the subsamples of small firms (employing less than 50 employees) and medium ones (between 50 and 250 employees); then the regression weights were tested for significant differences. The assumption underlying this comparison is that medium firms may benefit more from international networks, due to controlling more extensive resources and wielding greater bargaining power. Furthermore, the typically more complex internal processes in bigger firms can offer more scope for improvement through the adoption of best practices and other forms of know-how from innovative and efficient foreign counterparts.

RESEARCH METHODOLOGY

A dataset for the study was obtained in 2019 by a survey of 281 managers (computer-assisted web interview; CAWI) of 281 firms operating in the south-eastern part of Poland including the city of Rzeszow, which is recognized as the regional hub of smart specialization (It should be mentioned that the highest concentration of aviation industry entities in the region under study is in Rzeszow). This area is dubbed 'the Aviation Valley' due to its high concentration of businesses in the aerospace sector and cooperating industries, such as IT, telecommunications, and astronautics. The existence of an aviation industry cluster

backed by a well-developed physical and institutional infrastructure attracted internationally recognised corporations such as Boeing, Airbus, Mitsubishi, Lockheed Martin, Bombardier, Embraer. As such, many of the investigated firms were relying on advanced technologies and were part of extensive, international supply chains. Such an environment seemed a suitable setting to investigate how KMO and internationalization can lead to a variety of operational and financial benefits.

The dataset was compiled through a simple random sampling conducted by the Regional Statistical Office in Rzeszow from a comprehensive register of businesses operating in the Subcarpathian Voivodeship in the three smart specialization industries of aviation, automotive, and IT. Overall, the collected sample can be considered representative of the population of 8073 enterprises included in the sampling register.

The latent variables comprising the research model were measured through sets of indicators of the Likert-scale type. Each indicator or proxy variable was a single manifestation (in reflective constructs) or a building block (in formative constructs) of its underlying latent variable. Statements for indicators were presented to respondents, who were asked to indicate to what extent they applied to their firms on a scale from 1 to 7, in which 7 represented the highest level of agreement.

The concept of empirical research and the selection of research tools were developed following earlier published studies. The complete list of indicators was given in Table 1, together with literature sources and factor loadings informing of the correlation level of each statement with its estimated latent variable.

Table 1. Likert statements used in the survey for multiple scales measuring latent variables with factor loadings for the overall model (including all sampled firms)

Item designation	Item content	Factor loadings for the pooled model	Literature sources
Knowledge management orientation			
KMO_1	Searching for information about our industry is an everyday routine in our firm.	0.745	(Moilanen *et al.*, 2014; Teece *et al.*, 1997; Nonaka, 2007, p. 162; Perechuda, 2005, p. 219).
KMO_2	Our management encourages employees to make use of external sources of information on our industry.	0.724	
KMO_3	Management expects that employees are regularly acquiring market information useful for the company.	0.823	
KMO_4	In our company information flow is fast.	0.715	
KMO_5	Employees have skills and competences to absorb new knowledge.	0.776	
KMO_6	Employees know how to quickly employ newly acquired knowledge to solve work-related problems.	0.776	
KMO_7	New ideas disseminate quickly among organizational units of the company.	0.822	
KMO_8	Management sets up regular meetings at which new occurrences and problems are discussed.	0.727	
KMO_9	Management supports the development of new and innovative products and solutions.	0.816	
Customer orientation			
CO_1	Satisfying customer needs is the priority of our firm.	0.834	(Lee *et al.*, 2021; Zadykowicz *et al.*, 2020; Weerawardena *et al.*, 2007; Kirca *et al.*, 2005).
CO_2	We are constantly involved in satisfying customer needs.	0.886	
CO_3	Our strategy for attaining competitive advantage is based on a deep understanding of customer needs.	0.849	
CO_4	The business raison d'etre of our company is serving customers in the best possible way.	0.837	
International orientation			
IO_1	Employees of the company have experience of working abroad.	0.820	(Camisón & Villar, 2009, p. 135; Colton *et al.*, 2010, pp. 4, 16-18).
IO_2	Our firm knows how the markets function in other countries.	0.889	
IO_3	Our e-commerce strategy accounts for differences between the national and foreign markets.	0.785	

Item designation	Item content	Factor loadings for the pooled model	Literature sources
Involvement in international networks			
	Our firm is involved in the building and coordinating of networks to create:	0.892	(Raymond *et al.*, 2014, p. 238; Weerawardena *et al.*, 2007; Mandell & Keast, 2008).
NET_INV_1	a learning organization through cooperation with other companies	0.900	
NET_INV_2	a transnational supply chain strategy	0.932	
NET_INV_3	a transnational marketing strategy	0.729	
NET_INV_4	Internet-based segmentation and positioning in the global market	0.892	
Capacity for building international networks			
NET_CAP_1	Our firm is capable of creating transnational networks while retaining its local sensitivity.	0.905	(Ma *et al.*, 2013; Levy & Haber, 1988; Chen *et al.*, 2019).
NET_CAP_2	The same components of our organizational structure serve both domestic and international operations.	0.868	
NET_CAP_3	Our company shows high levels of internal integration across its all geographical markets.	0.910	
NET_CAP_4	Our company maintains an intense exchange of products, resources, people, and information with our business partners.	0.870	
NET_CAP_5	Our organization is ready to transfer and acquire knowledge with our business partners.	0.881	
NET_CAP_6	The firm can build cross-border structures to connect firms in its border region.	0.887	
IT capacity			
IT_CAP_1	The firm has a scalable IT platform to enable future development.	0.846	(Colton *et al.*, 2010, p. 18; Iyengar *et al.*, 2015).
IT_CAP_2	Key production processes are automated supporting increased cost efficiencies from future volume growth.	0.813	
IT_CAP_3	The firm is using IT technologies to facilitate supporting processes, such as decision-making, accounting, reporting, planning, and statistical data analysis.	0.869	
IT_CAP_4	All employees have sufficient skills to make adequate use of IT technologies.	0.707	
IT_CAP_5	The current know-how of the company does not hamper further development of IT solutions.	0.805	
Industry internationalization			
IND_INT_1	In our industry, most customers search for suppliers all over the world before making the final purchasing decision.	0.917	(Oczkowska *et al.*, 2016, p. 39; Naldi *et al.*, 2020; da Rocha *et al.*, 2019; Prabandari & Xiu-Hao Ding, 2018).
IND_INT_2	Our domestic market has norms, standards, and customer expectations that are similar to the global market.	0.839	
IND_INT_3	The main direct competitors in our industry come from different countries.	0.877	
Benefits from international networks			
The company's involvement in international networks has a positive effect on:		For formative constructs, factor loadings cannot be computed.	(Flatten *et al.*, 2011, p. 152; Johanson & Vahlne, 2003; Zhang *et al.*, 2016).
NET_BEN_1	financial outcomes		
NET_BEN_2	involvement in R&D		
NET_BEN_3	capacity for market communication		
NET_BEN_4	acquiring new experience and knowledge		
NET_BEN_5	diversification of the product portfolio		
Competitive position			
Your evaluation of the firm's market position against major competitors		For formative constructs, factor loadings cannot be computed.	(Hall, 1993; Kapler, 2007; Day & Wensley, 1988).
COM_POS_1	cost structure		
COM_POS_2	brand recognition among customers		
COM_POS_3	technological competencies and know-how		
COM_POS_4	profitability		
COM_POS_5	productive organizational culture		
COM_POS_6	marketing know-how		

Source: own study.

To verify the hypotheses, a structural equation model was estimated with the partial least squares method (PLS-SEM) using the SMART PLS software, version 3.3. We opted to use PLS-SEM instead of another common approach known as covariance-based SEM (CB SEM) because of two distinct characteristics of the data. Firstly, most Likert-scale indicators did not have a multivariate normal distribution, which is mandatory for a CB SEM model to be estimated with accurate standard error values, while PLS-SEM, which relies on bootstrapping, does not make such an assumption. Secondly, the need to estimate two formative constructs favours PLS-SEM, which is often considered the better choice over CB SEM for such analytical tasks (Hair *et al.*, 2014, p. 15).

RESULTS AND DISCUSSION

The SEM analysis generated three models representing different groups of surveyed companies. The first model illustrates the hypothesized relationships in the entire sample of 281 firms. Then, the sample was split into two parts according to employment and separate models were estimated for small companies (less than 50 employees), and medium firms (between 50 and 250 employees). As was already indicated, the need to compare smaller and larger businesses was grounded in our literature-backed expectation of dissimilar mechanisms operating in each subgroup, possibly resulting in markedly different strengths of regression paths.

The three models were shown in Figures 2-4. To make the interpretation of regression paths easier, the diagrams were simplified by leaving out indicators of latent variables (factor loadings for indicators in the first, general model were listed in Table 1; the two size-specific models had similar patterns of factor loadings, not showing statistically significant differences). The numbers next to regression paths represent standardized regression weights between respective pairs of constructs, while those inside construct circles are coefficients of determination (R-squared) informing on the proportion of variance in the construct explained by the model.

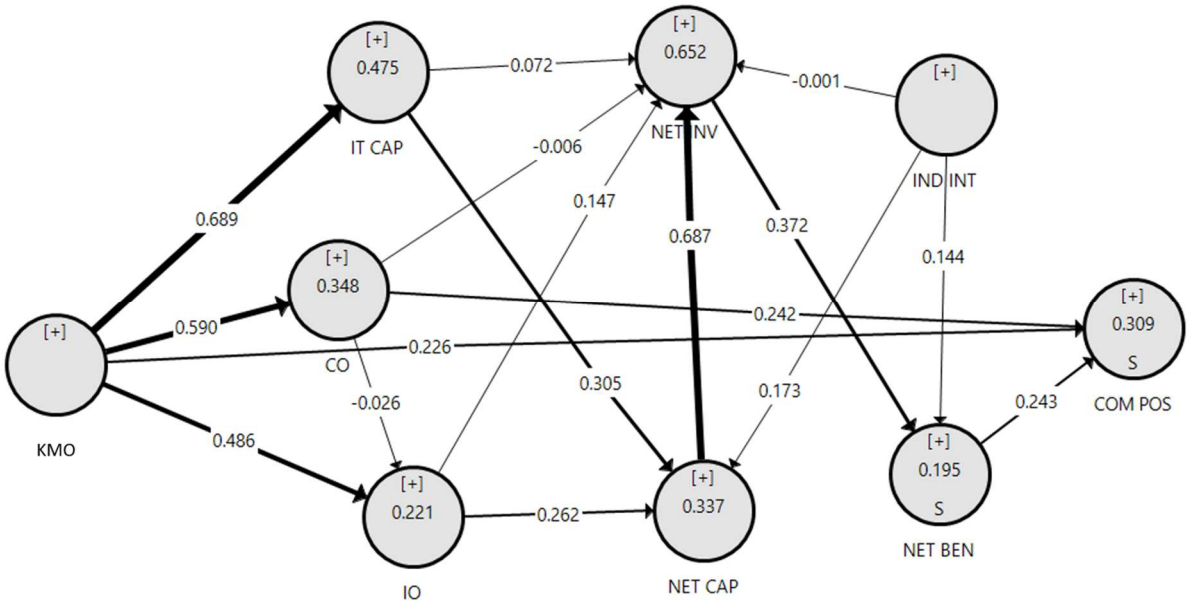

Figure 2. Structural model of relationships between knowledge management orientation and competitive position for the entire sample (n=281)
Source: own elaboration.

Prior to discussing the patterns found in the models, it is instrumental to establish the quality of the obtained solution in terms of the reliability and validity of the latent variable estimates (*i.e.,* the quality of the measurement model), as well as the significance of the regression paths.

To assess the match of the latent variables with their indicators, one needs to investigate each construct in terms of its internal reliability, convergent validity, and discriminant validity.

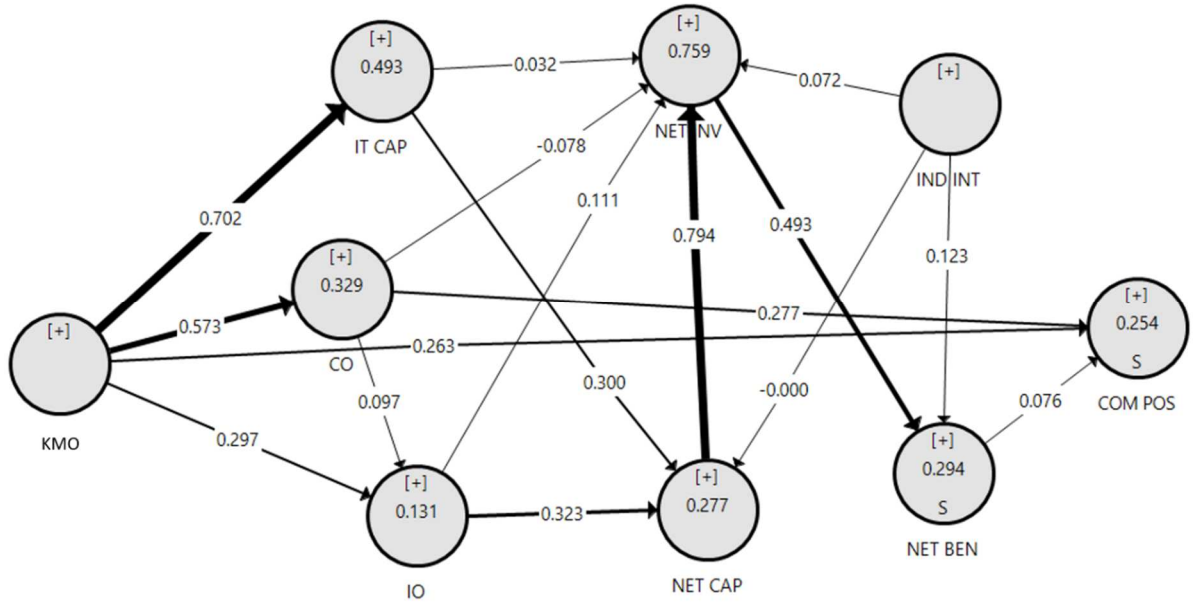

Figure 3. Structural model of relationships between knowledge management orientation and competitive position for small firms (employment < 50; n=93)
Source: own elaboration.

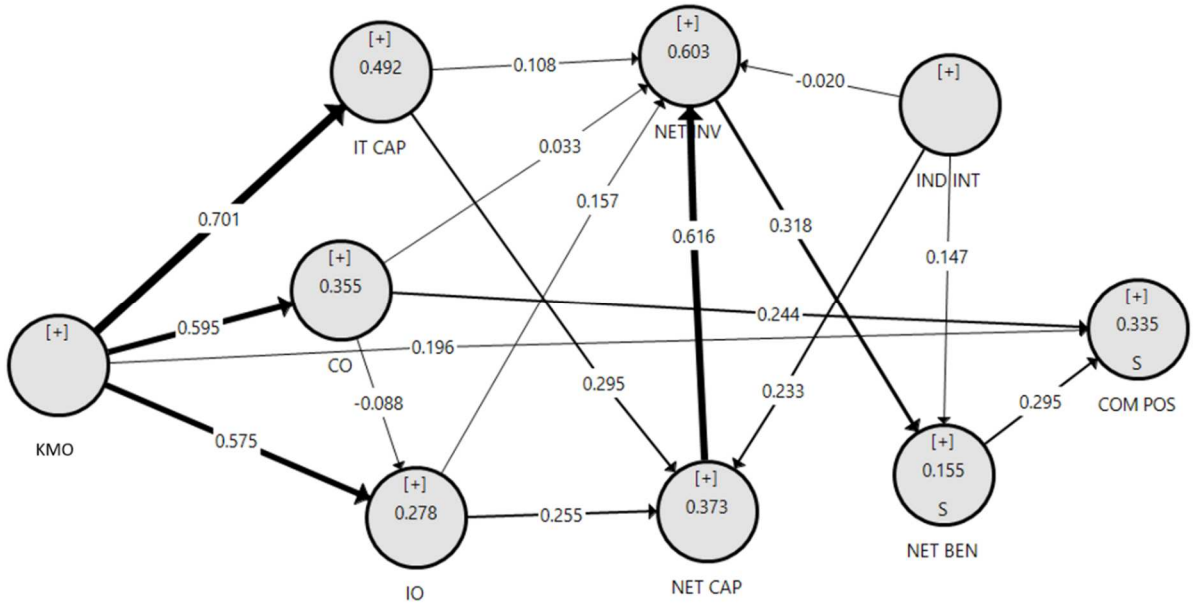

Figure 4. Structural model of relationships between knowledge management orientation and competitive position for medium-sized firms (employment > = 50 & <250; n=188)
Source: own elaboration.

A common metric of internal reliability is Cronbach's alpha, which corresponds to the average level of correlations among indicators of a construct. For a scale to be deemed reliable, Cronbach's alpha should be greater than 0.7 (Malhotra, 2010, p. 287).

Convergent validity informs how much variability in indicators is explained by a construct. The metric used here is AVE (average variance extracted) and must be greater than 0.5, which means that at least 50% of the variance in a set of observable variables is explained by their underlying construct (Hair *et al.*, 2009).

The third aspect of model quality is discriminant validity, which represents the extent to which indicators are more correlated with their designated constructs than with other constructs meas-

uring different concepts. When a set of indicators is, on average, more correlated with another latent variable than its own, it suggests a misspecified model with too much overlap between concepts' content. This approach, known as the Fornell-Larcker criterion, suggests that discriminant validity can be established when AVE is greater than MSV (maximum shared variance with other constructs in the model) (Hair *et al.*, 2009).

Table 2 sets out Cronbach's alphas, AVE and MSV metrics for each reflective construct in the model. It can be noted that the table does not include competitive position and benefits from international networks, since these are formative constructs and, as such, do not need to display consistent correlational patterns. Rather than extracting a single score from the shared variance in indicators, the two formative constructs in the model were computed by taking the mean of all observed variables representing each construct. Thus, each manifest variable was assumed to contribute the same relative amount to the value of the construct indices.

Table 2. Measures of internal reliability, convergent validity, and discriminant validity for three structural models

Construct	Entire sample			Small firms (<50)			Medium (=>50<250)		
	C.'s alpha	AVE	MSV	C.'s alpha	AVE	MSV	C.'s alpha	AVE	MSV
Knowledge management orient.	0.914	0.594	0.475	0.870	0.502	0.493	0.927	0.633	0.491
Customer orientation	0.875	0.725	0.348	0.819	0.649	0.328	0.893	0.757	0.354
International orientation	0.778	0.693	0.268	0.864	0.786	0.245	0.734	0.655	0.285
Involvement in international networks	0.888	0.751	0.627	0.868	0.726	0.713	0.900	0.769	0.564
Capacity for building international networks	0.946	0.787	0.627	0.952	0.808	0.713	0.940	0.771	0.564
IT capacity	0.870	0.656	0.475	0.877	0.671	0.493	0.866	0.655	0.491
Industry internationalization	0.852	0.772	0.193	0.813	0.725	0.208	0.860	0.781	0.190

Source: own study.

The metrics given in Table 2 are indicative of adequate measurement models for the investigated constructs. For all latent variables, Cronbach's alphas were greater than 0.7 and the smallest AVE was above a cut-off point of 0.5. Moreover, all AVEs were greater than their respective MSVs. These results imply that the constructs were measured with sufficient reliability and demonstrate adequate levels of convergent and discriminant validity. However, medium-sized firms seem to have better diagnostics overall, indicating that the scales and possibly the underlying theory may be better suited for studying these phenomena in bigger companies.

Having validated the fit of the model with empirical data, the next step in the analysis was to test the research hypotheses. It was accomplished with the bootstrapping method, which produced confidence intervals and p-values for regression weights. Here, the bootstrapping procedure involved 5000 resamples, which is considered a sufficient number to reliably estimate standard errors. Table 3 provides regression weights and significance values for the relationships indicated in the hypotheses of the study.

Tests for the significance of regression paths can determine if direct correlational effects exist between pairs of constructs. Positive outcomes (p-values < 0.05) give support to respective hypotheses, whereas insignificant results indicate that the pertinent relationships are unlikely to exist in the general population of firms. Noteworthy, direct effects do not provide the full picture of associations in the model; for pairs of variables that are linked not only by direct regression lines but also through indirect paths involving other variables (*e.g.*, KO and COM POS), it is informative to investigate indirect and total effects. Accordingly, the total effects observed in the model were reported in Table 5. However, the mere existence of direct effects is enough to validate the study hypotheses. Thus, based on the significance of the direct regression links it can be argued that:

1. Hypotheses H1a through H1d, H3a, H4, H5b and H6 are true in the general sample and in both subgroups of firms.
2. Hypothesis H2c is true in the general sample and in small firms but not in medium-sized firms.
3. Hypotheses H.3b, H.7, H.8a and H.8c are validated for the overall sample and medium firms but seem to be false for small firms.
4. There is no support for H.2a, H.2b, H.5a and H.8b in any group of companies.

Table 3. Significance tests of regression weights between constructs for the three estimated models (significant values at the 0.05 level marked in bold)

Hypotheses	Regression paths	Entire sample		Small firms		Medium firms	
		Regression weights	Bootstrap p values	Regression weights	Bootstrap p values	Regression weights	Bootstrap p values
H.1a	KMO -> CO	**0.590**	**0.000**	**0.573**	**0.000**	**0.595**	**0.000**
H.1b	KMO -> IT CAP	**0.689**	**0.000**	**0.702**	**0.000**	**0.701**	**0.000**
H.1c	KMO -> IO	**0.486**	**0.000**	**0.297**	**0.029**	**0.575**	**0.000**
H.1d	KMO -> COM POS	**0.226**	**0.002**	**0.263**	**0.025**	**0.196**	**0.032**
H.2a	CO -> IO	-0.026	0.759	0.097	0.564	-0.088	0.394
H.2b	CO -> NET INV	-0.006	0.871	-0.078	0.208	0.033	0.471
H.2c	CO -> COM POS	**0.242**	**0.025**	**0.277**	**0.044**	0.244	0.082
H.3a	IO -> NET CAP	**0.262**	**0.000**	**0.323**	**0.006**	**0.255**	**0.001**
H.3b	IO -> NET INV	**0.147**	**0.016**	0.111	0.274	**0.157**	**0.043**
H.4	NET CAP -> NET INV	**0.687**	**0.000**	**0.794**	**0.000**	**0.616**	**0.000**
H.5a	IT CAP -> NET INV	0.072	0.309	0.032	0.725	0.108	0.264
H.5b	IT CAP -> NET CAP	**0.305**	**0.000**	**0.300**	**0.013**	**0.295**	**0.001**
H.6	NET INV -> NET BEN	**0.372**	**0.000**	**0.493**	**0.000**	**0.318**	**0.000**
H.7	NET BEN -> COM POS	**0.243**	**0.000**	0.076	0.258	**0.295**	**0.000**
H.8a	IND INT -> NET CAP	**0.173**	**0.003**	-0.000	0.999	**0.233**	**0.002**
H.8b	IND INT -> NET INV	-0.001	0.988	0.072	0.278	-0.020	0.713
H.8c	IND INT -> NET BEN	**0.144**	**0.019**	0.123	0.339	**0.147**	**0.040**

Source: own study.

Even though a lot could be inferred from the above statistics about similarities and differences between small and medium firms, Hypothesis 9 was omitted from the table, because it calls for dedicated formal tests of differences. Such tests – again, based on a bootstrapping procedure – were summarized in Table 4.

Table 4. Tests for the difference of regression weights between small and medium firms (based on bootstrapping with 5000 resamples and Welch-Satterthwait formula; significant outcomes at the 0.05 level highlighted in bold)

Regression paths	Path coefficients difference (small firms - medium firms)	t-Value	p-Value
KMO -> CO	-0.022	0.210	0.834
KMO -> IT CAP	0.001	0.014	0.989
KMO -> IO	-0.278	1.793	0.076
KMO -> COM POS	0.067	0.452	0.652
CO -> IO	0.185	0.954	0.342
CO -> NET INV	-0.111	1.437	0.153
CO -> COM POS	0.033	0.168	0.867
IO -> NET CAP	0.068	0.484	0.629
IO -> NET INV	-0.046	0.366	0.715
NET CAP -> NET INV	**0.177**	**2.074**	**0.040**
IT CAP -> NET INV	-0.076	0.577	0.565
IT CAP -> NET CAP	0.005	0.033	0.973
NET INV -> NET BEN	0.175	1.667	0.098
NET BEN -> COM POS	**-0.219**	**2.395**	**0.018**
IND INT -> NET CAP	-0.233	1.873	0.064
IND INT -> NET INV	0.092	1.076	0.284
IND INT -> NET BEN	-0.024	0.166	0.869

Source: own study.

As can be seen from Table 4, smaller and larger firms had very similar regression patterns for most of the pairs of variables in the model. It could be observed that KMO has a positive direct impact on IT CAP, CO, IO, and COM POS. In all models, the strongest correlation occurred between KMO and IT CAP (0.689 in the entire sample, 0.702 in small firms, 0.701 in medium-sized firms), which explains ca. 47.5%-49.2% of the variance in these three endogenous variables (Figures 2-4). This could suggest that organizational knowledge management in companies is focused on developing technical capacities, improving marketing skills (through customer orientation), and extending international networks.

The two cases where firms of different sizes showed meaningful differences involve the relationships: NET CAP -> NET INV and, even more notably, NET BEN -> COM POS. Accordingly, the data imply that *benefits from involvement in international networks translate into an improved competitive position only for medium-sized companies*, while such an effect was not found in small firms. This suggests different mechanisms at play within each type of business, possibly linked to a greater scope, complexity and bargaining power in larger firms that serve as enabling factors for transforming direct benefits from cooperation in supply chains into a substantive competitive advantage. These findings are consistent with research by Musteen *et al.* (2014) showing that building networks might be a necessity for SMEs in order to overcome a lack of resources and achieve success.

The second significant difference involves smaller firms having stronger links between their capacity to participate in international networks and their actual involvement in such cooperative structures. This could also be interpreted in light of the superior potential and bargaining power of larger firms, which may enable them to form transnational networks that rely more on partners' resources than their own. Overall, one can conclude that the evidence collected partially supports Hypothesis 9.

In interpreting the results, additional valuable insights could be gleaned from investigating the indirect and total effects of the study variables on the benefits of participation in international networks and an improvement in a competitive position. This information can be found in Table 5.

Table 5. Total and indirect effects of model variables on joint and individual benefits from cooperation (the values could be interpreted as ordinary correlation coefficients)

Construct	Small firms				Medium firms			
	Indirect effects		Total effects		Indirect effects		Total effects	
	NET BEN	COM POS	NET BEN	COM POS	NET BEN	COM POS	NET BEN	COM POS
KMO	0.135	0.169	0.135	0.432	0.123	0.182	0.123	0.377
CO	-0.021	-0.002	-0.021	0.275	0.002	0.001	0.002	0.244
IO	0.181	0.014	0.181	0.014	0.100	0.030	0.100	0.030
NET CAP	0.391	0.030	0.391	0.030	0.196	0.058	0.196	0.058
IT CAP	0.133	0.010	0.133	0.010	0.092	0.027	0.092	0.027
IND INT	0.036	0.012	0.159	0.012	0.039	0.055	0.187	0.055
NET INV		0.038	0.493	0.038		0.094	0.318	0.094
NET BEN				0.076				0.295

Source: own study.

Despite the identified differences between the two types of companies in how network benefits correspond to a better competitive position, there are also some striking similarities in the hierarchy of drivers of competitive advantage. In both cases, the strongest positive determinant of competitive position was knowledge orientation. The findings are directly in line with previous observations. Knowledge orientation is regarded by many authors as a crucial element in building competitive advantage (Ndlela & du Toit, 2001; Muthuveloo *et al.*, 2017). Regardless of the company's size, the absolute strength of the effect was similar, and less than half of the total effect was contributed by indirect regression paths (48% for medium companies and 39% for small firms). This finding seems to underscore the importance of cultivating organizational culture and developing procedures that support the effective creation, absorption and application of knowledge. A similar conclusion was reached by Liu *et al.* (2021) in a meta-analytic study. They have demonstrated that there is a positive relationship between knowledge-friendly organizational culture and organizational performance (both financial

and non-financial). Rahimnia and Alizade (2009) stress the importance of culture for managing knowledge successfully. In the absolute sense, in our study, customer orientation was a slightly more potent factor for the competitive position of smaller versus larger companies (0.432 and 0.377). In relative terms, CO was the second most important factor in small firms but only the third one in medium-sized businesses, where it was surpassed by beneficial influences of network benefits (0.295). Aside from these three variables (KMO, CO and NET BEN), the other components of the model did not seem to have significant impacts on the competitive advantage of the surveyed firms. Overall, these findings are consistent with results reported by other researchers (Kirca *et al.*, 2005; Ziggers & Henseler, 2016). These studies suggested that customer orientation is a building block of the competitive position of firms, although no distinction was made regarding the size of companies.

One of the major findings of the study was the observation that reported network benefits do not seem to be associated with the competitive position of small companies. As it was previously mentioned, we attributed this fact to the different nature of processes operating in small versus larger firms. However, one could offer a different explanation, arguing that the main reason for the existence of such a pattern was that smaller companies obtained substantively fewer benefits from international networks than their larger counterparts. To investigate if the average amount of reported network benefits in smaller firms was any different than in larger businesses, we performed a t-test for two independent samples using construct scores obtained from the model. The outcomes of t-tests for these and other constructs in the study are shown in Table 6.

Table 6. T-tests for differences in means comparing small and medium firms on investigated constructs (significant differences marked in bold)

Constructs	Levene's test for equality of variances		t-test for equality of means			
	F	p-value	t	df	p-value	Mean Difference (smaller firms - larger firms)
KMO	2.488	0.116	0.742	279	0.458	0.094
CO	0.515	0.474	0.346	279	0.730	0.044
IO	0.010	0.921	0.675	279	0.500	0.086
NET CAP	3.051	0.082	2.380	**279**	**0.018**	**0.300**
IT CAP	0.018	0.895	1.849	279	0.065	0.234
IND INT	**4.367**	**0.038**	**2.734**	**228.49**	**0.007**	**0.316**
NET INV	1.336	0.249	1.555	279	0.121	0.197
NET BEN	1.573	0.211	1.619	279	0.107	0.205
COM POS	3. 229	0.073	1.934	279	0.054	0.244

Source: own study.

The performed t-tests indicated that only for two latent variables small and larger firms displayed meaningful differences: smaller firms appeared to have on average higher scores in NET CAP and IND INT, pointing to better-declared network capacities and a higher level of internationalization in their industries as compared to medium companies. However, these differences, although statistically significant, are not very substantial. Interestingly, in terms of other variables, no significant differences were found, implying that both groups of firms had similar levels of average values. Consequently, this observation strengthens the case for observed differences being caused by diverse organizational dynamics and mechanisms rather than unequal levels of KMO, IO, CO, or NET BEN.

CONCLUSIONS

The study sought to investigate the role of intangible resources in generating competitive advantage in high-tech SMEs. In particular, we focused on knowledge management and its interplay with cooperative behaviour in international supply chains.

The findings confirmed our assumption about the vital importance of knowledge management in building competitive advantage and the role of internationalization as a mediator between the

firm's capacity for effectively managing knowledge and its competitive performance. One of the most interesting insights emerged from the comparison of small and medium-sized businesses, showing that medium firms are much more successful in transforming their involvement in international networks into competitive benefits while in other aspects of the model both groups of enterprises did not show meaningful differences.

This implies that in order to improve a firm's market position through this type of internationalization, some additional conditions must be met, which appear to be lacking in the small firms in our sample. Since the current study did not involve additional metrics to identify the reasons for this observation, one can only speculate about the true causes. Firstly, small firms tend to have weaker bargaining power versus their medium-sized counterparts, which can influence the cooperative arrangements in the international supply chain and make them less advantageous. Another enabling factor at play here could be a critical mass of knowledge, skills, and capacities necessary for effectively employing new knowledge gained from foreign partners, which might not have been attained by many small enterprises. Whatever the underlying mechanism responsible, this finding appears to offer considerable contributions to both practice and theory, as it can point to vital managerial issues and indicate directions for new research into the topic.

Future research projects may try to replicate the outcomes of this study in other settings (both country- and industry-wise) and at the same time, they should attempt to explain the mechanism leading to the differences between small and medium firms. One avenue to follow would be to include in the conceptual model additional moderators representing pertinent resources, both tangible and intangible, that could serve as enabling factors in transforming network benefits into business performance. Moreover, it would be interesting to see how the relationships depicted by our model evolve over time in the same set of companies, which would call for longitudinal design. Some valuable explanations could also be provided by case-study research, involving a detailed in-depth analysis of a small group of companies, relying on the triangulation of multiple, detail-rich internal data sources.

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BW, PZ, MW, TS – conceptualization, BW, PZ, MW, TS – literature review, BW, PZ – methodology, PZ – calculations, BW, PZ, MW, TS – analysis and interpretation of data, discussion. The contribution of each author equals 25%.

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Graduates' intention to develop live commerce: The educational background perspective using multi-group analysis

Kyeong Kang, Lifu Li, Osama Sohaib

ABSTRACT

Objective: This study explores graduates' intention to develop live commerce based on the theory of planned behaviour (TPB) and it analyses influencing factors based on attitude, subject norm, and perceived control aspects. Moreover, it focuses on the impact of graduates' educational background and explores its moderating role using multi-group analysis.

Research Design & Methods: Through analysing 420 graduate samples based on the partial least squares path modelling and variance-based structural equation modelling (PLS-SEM), the study results proved that attitude, subject norm, and perceived control factors positively affect graduates' live commerce intention.

Findings: The research results show that – compared to the high school or junior college background – the subject norm factor exerts a more substantial influence on the live commerce intention of graduates with a bachelor's degree. Meanwhile, the subject norm factor exerts a more significant impact on the live commerce intention of graduates with master's or doctoral degrees than those with Bachelor's degrees.

Implications & Recommendations: Considering the impact of educational background, this article explores the moderating role of educational background and promotes the multi-group analysis based on it.

Contribution & Value Added: The study proved that graduates with a higher degree will pay more attention to the subject norm factor while making live commerce decisions thus contributing to educational management.

Article type: research article

Keywords: graduates' entrepreneurship; live commerce intention; TPB model; educational background; multi-group analysis

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INTRODUCTION

As live-streaming technology becomes increasingly popular, many online entrepreneurs on social media platforms have adopted live streaming as a tool to enhance their sales performance and attract online consumers' shopping intentions (Sun, Shao, Li, Guo, & Nie, 2019). From an entrepreneur's perspective, taking advantage of live-streaming technology opens up a wealth of opportunities in advertising, marketing, and interacting with online consumers, which lead to winning online consumers' trust (Xu, Wu, & Li, 2020). The advantages of live commerce can explain why many retailers such as Amazon and Taobao have begun to design their live commerce platforms and cooperate with live streamers. Meanwhile, unlike traditional social commerce, where customers should leave the product page to contact the seller, live commerce provides a comfortable platform for online consumers to communicate with entrepreneurs through various convenient functions, such as real-time interaction, bullet screen, and online store (Sun *et al*., 2019). The application of live commerce to advertise products and promote brands is booming in many countries. For example, the Taobao Live platform in China has already attracted more than 10 000 online entrepreneurs to promote live commerce and advertise various prod-

ucts, such as makeup, clothing and food (Cai & Wohn, 2019). According to the 2019 Taobao Live Streaming Ecological Development Report, live commerce on the Taobao Live platform has assisted online entrepreneurs in achieving over 100 billion Yuan in sales in 2018 (Sun *et al*., 2019).

Attracted by the comfortable online business environment and convenient interactive functions, more and more graduates are willing to develop live commerce on live streaming platforms to implement innovative ideas, which is significant for researchers to focus on (Li & Kang, 2021a; Li, Kang, & Sohaib, 2021). Different from the traditional entrepreneurship model, live commerce established on live streaming platforms has no strict requirements for capital, sites and human resources, and it is suitable for graduates to practice their entrepreneurial plans (Ismail *et al*., 2019). Due to the lack of financial reserves and entrepreneurial experiences for college students, starting live commerce on live streaming platforms is more suitable for them than a traditional offline business. Meanwhile, unlike other entrepreneurial groups, many graduates have accepted entrepreneurial education at universities and controlled advanced online business skills that can be applied in their future entrepreneurial activities. Hence, whether in developing countries or developed countries, both of their educational departments focus on graduates' entrepreneurial capabilities and design suitable policies to enhance their entrepreneurial intention (Yu, 2018). Although existing scholars pay much attention to graduates' entrepreneurial advantages and analyse their entrepreneurial intention (Al-Jubari, 2019; Fatoki, 2014), almost none of them analyse the features of live commerce and discuss graduates' intention to develop live commerce on live streaming platforms. Based on the differences between live-streaming commerce modes and traditional commerce modes, graduates could have a different entrepreneurial intention and be affected by specific factors. Thus, it is necessary to analyse the influencing factors of graduates' live commerce intention based on a theoretical model.

This article draws on the theory of planned behaviour (TPB), which is the widely accepted theory in entrepreneurial research (Al-Jubari, 2019). Ajzen (1991) proposes the TPB to explain and predict human intention patterns based on attitude, subjective norms, and perceived control aspects, and these factors have a positive relationship with personal intention (Ajzen, 1991). Hence, given its theoretical basis, it is suitable to apply the TPB to analyse graduates' live commerce intention based on three different aspects. However, graduates' educational background would potentially affect their intention to develop live commerce on live streaming platforms, which is ignored by existing studies (Zhang, Duysters, & Cloodt, 2014). The entrepreneurial motivation of graduates at lower levels of education and doctoral graduates may be different because of their unique knowledge backgrounds. Although prior studies have investigated the role of graduates' gender, age, and cultural background, few of them pay much attention to the impact of educational backgrounds and discuss its moderating role (Ferreras-Garcia, Hernández-Lara, & Serradell-López, 2021; Israr & Saleem, 2018; Li & Kang, 2021b). Specifically, with their educational level increasing, graduates could have more opportunities to control entrepreneurial knowledge and practice their innovative idea. Grounded by human capital theory and entrepreneurial self-efficacy theory, graduates' educational background can directly influence their entrepreneurial intention (Bae, Qian, Miao, & Fiet, 2014; Gurel, Madanoglu, & Altinay, 2021). Hence, it has a significant impact on the relationship between influencing factors and graduates' live commerce intention. For example, graduates holding a higher education degree probably accept improved entrepreneurial education and have greater confidence to accept the live commerce mode (Gibson, Harris, Mick, & Burkhalter, 2011; Pulka, Aminu, & Rikwentishe, 2015). Conversely, others graduating from junior colleges could be unfamiliar with a new business model, and their entrepreneurial intention could be potentially influenced by the perceived control factor. In detail, due to the lack of entrepreneurial capabilities, graduates with lower educational degrees, such as high school and junior college degrees, would think it is difficult for them to develop live commerce (Pulka *et al.,* 2015*)*. Hence, it is important to explore graduates' educational backgrounds as a moderating role and promote the multi-group analysis. Hence, the research question of the study question is:

> How does graduates' educational background moderate the relationships between influencing factors and live commerce intention?

This article contributes both to the theoretical and practical implications. Regarding the theoretical implication, it focuses on graduates' live commerce intention based on the TPB model. Its effectiveness has been demonstrated by the existing literature. Meanwhile, graduates with different educational backgrounds could have different opinions on live commerce, and hence this article designs their educational background as a moderating factor to promote multi-group analysis, which existing studies ignore. Moreover, considering the rapid development of live-streaming technology, more and more graduates are attracted by live-streaming commerce and are willing to implement innovative ideas through this new entrepreneurial model. Hence, according to the final research results, the suggestions related to educational management can be presented in the practical implications part, benefiting educational departments to design specific policies.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Live Commerce

Live commerce is an innovation to the traditional business model. It consists of both live-streaming commerce and e-commerce models. Unlike the traditional social media shopping mode, live commerce, as a new online shopping mode, provides a real-time interactive experience between entrepreneurs and consumers (Wongkitrungrueng, Dehouche, & Assarut, 2020). A growing number of scholars have proved that online entrepreneurs are attracted by live commerce because of its advanced functions, such as real-time interaction, virtual gift-sending systems, and group chat functions (Li & Kang, 2022). Based on various interactive functions, online entrepreneurs can conveniently communicate with online consumers and understand their shopping experiences in real time. In China, the number of live-streaming users has reached 617 million and the number of live commerce users reached 388 million in 2020 (Lee & Chen, 2021). Meanwhile, considering that developing live commerce has no strict requirements for capital and sites, more and more graduates are more willing to establish online business activities on live streaming platforms rather than develop offline modes (Li *et al*., 2021). This business model can alleviate the entrepreneurial pressure on graduates. Furthermore, to provide graduates with a comfortable entrepreneurial environment, many educational departments cooperate with related network industries, such as Tencent and Alibaba, to establish entrepreneurial training centres and help graduates understand live commerce strategies (Huang, Liu, & Li, 2020; Yu, 2018). Thus, compared with other entrepreneur groups, graduates have more opportunities to control online start-up capabilities and receive policy support from related departments. With the improvement of live commerce, more and more graduates could have a solid intention to develop live commerce, which scholars need to explore.

Theory of Planned Behaviour

The TPB is an extension of the theory of reasoned action, and it has been widely applied to explain individuals' entrepreneurial intentions and behaviours by previous studies (Maes, Leroy, & Sels, 2014; Robledo, Arán, Sanchez, & Molina, 2015). The TBP provides a theoretical framework to explore the effect of attitude, subjective norms, and perceived behavioural control on entrepreneurial intention. Although prior research applied the TPB to discover graduates' entrepreneurial intentions and identified the significant impact of three factors (Liñán & Rodríguez‐Cohard, 2015; Rueda, Moriano, & Liñán, 2015; Sharahiley, 2020), few of them pay much attention to graduates' intention to develop live commerce on live streaming platforms. As a new entrepreneurial model, live commerce is different from the traditional entrepreneurship model. Its unique features, such as real-time interaction, product presentation, and sales logic significantly impact graduates' entrepreneurial activities. To systematically analyse graduates' live commerce intentions, it is significant for this study to use the TPB. Specifically, based on the TPB approach, it could be argued that graduates take their decision to develop live commerce based mainly on those three motivational factors, including attitude towards developing live commerce, subject norm towards developing live commerce, and perceived control towards developing live commerce (Ajzen, 1991). According to the TPB, attitude towards live commerce refers

to the degree to which a graduate has a favourable or unfavourable evaluation of the behaviour, subjective norm means a graduate with the perceived social pressure to perform or not to perform live commerce, and perceived control is defined as graduates' perception of the ease or difficulty of promoting live commerce (Ajzen, 1991; Taha, Ramlan, & Noor, 2017). Based on the empirical results provided by entrepreneurial research, these three influencing factors would have a significant impact on graduates' live commerce intention.

Graduates' Educational Background

To understand graduates' entrepreneurial intention comprehensively, existing studies have designed graduates' gender, age, income level, and family background as moderating factors to present specific research results (Moreno-Gómez, Gómez-Araujo, & Castillo-De Andreis, 2020; Nguyen, 2018). However, few of them consider the moderating role of the educational background while analysing graduates' live commerce intention. According to the entrepreneurial intention research designed by Nguyen (2018), entrepreneurs' educational level has a positive relationship with their entrepreneurial intention, because their educational background plays an essential role in controlling entrepreneurial knowledge and skills. Graduates holding higher education degrees could have more opportunities to study related entrepreneurial knowledge, such as real-time interaction skills, online marketing strategies, and human resource management (Gibson *et al*., 2011; Pulka *et al*., 2015). This means that graduates with a higher educational level could have greater confidence in developing live commerce. Meanwhile, due to the lack of entrepreneurial knowledge and experience, graduates with a lower educational level could face much pressure from their family members and focus more on the subject norm effect (Li & Kang, 2021a). In light of this, this study needs to design graduates' educational background as a moderating role and promote the multi-group analysis.

Research Model and Hypotheses

As mentioned in section 2.2, the study established the research model based on the TPB and designed the attitude, subject norm, and perceived control as influencing factors to discover graduates' live commerce intention. Meanwhile, considering the effect of educational background, this study discussed it as a moderating factor and made some comparisons based on graduates' educational background, as Figure 1 shows.

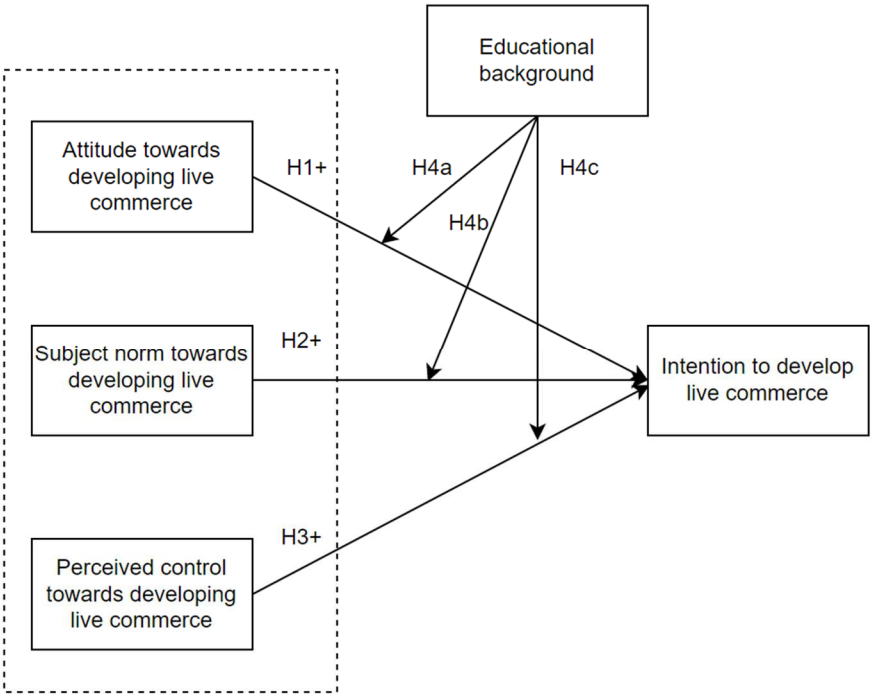

Figure 1. The research model

Source: adapted from Ajzen (1991); Taha, Ramlan, and Noor (2017).

Intention to Develop Live Commerce

Graduates' live commerce intention reflects their level of interest in starting an online business on live streaming platforms. To analyse graduates' live commerce intention, the study applied the TPB approach that is widely adopted to test individuals' entrepreneurial behaviours (Alam, Kousar, & Rehman, 2019). According to the TPB, graduates' attitudes towards developing live commerce, coupled with subjective norms and perceived control factors, all serve to affect graduates' intention to promote live commerce (Ajzen, 1991). As mentioned in section 2.2, graduates' attitude towards live commerce refers to the degree to which a graduate has a favourable or unfavourable evaluation of the behaviour, subjective norm means a graduate with the perceived social pressure to perform or not to perform live commerce, and perceived control is defined as graduates' perception of the ease or difficulty of promoting live commerce (Ajzen, 1991; Taha *et al*., 2017). Meanwhile, whether in Eastern or Western countries, the theoretical foundation of TPB has been supported by existing entrepreneurial research. Prior scholars have successfully utilised the TPB to predict the impact of entrepreneurial attitudes, subject norms and perceived control on students' entrepreneurial intention (Farrukh, Alzubi, Shahzad, Waheed, & Kanwal, 2018; Karimi *et al*., 2013). Specifically, as the results proposed by Karimi (2013) claim, all of these influencing factors, including attitudes, subjective norms and perceived control positively impact graduates' entrepreneurial intention. Based on the similarities between live commerce mode and traditional entrepreneurial mode, the research results could be applied to explain graduates' live commerce intention. Thus, we hypothesize:

H1: Graduates' attitude towards developing live commerce positively affects their intention to develop live commerce.

H2: Graduates' subject norm towards developing live commerce positively affects their intention to develop live commerce.

H3: Graduates' perceived control towards developing live commerce positively affects their intention to develop live commerce.

The Moderating Role of Educational Background

Graduates' educational background could significantly moderate the relationship between influencing factors and personal entrepreneurial intention, which the study needs to identify. Graduates with different educational backgrounds could accept different entrepreneurial education and have a specific understanding of live commerce mode (Li & Kang, 2022). For instance, entrepreneurial education received by graduates can promote the intention of entrepreneurial creation because entrepreneurial knowledge and skills stimulate graduates' motivation to create new entrepreneurship. Graduates with a higher educational level could have greater confidence in developing live commerce than those with a lower educational level because of their abundant entrepreneurial knowledge, which might lead them to a perception of the ease of promoting live commerce (Pulka *et al*., 2015). Compared with master's degree graduates, others graduating from junior colleges could be unfamiliar with entrepreneurial skills, such as marketing skills, advertising strategies, and human resource management. Entrepreneurial pressure and diffident psychology could make lower-degree graduates concerned more about the subject norm and perceived control factors. Hence, graduates having different educational backgrounds could have different opinions to live commerce, which the study needs to compare. Hence, we hypothesize:

H4a: Graduates' educational background could moderate the effect of attitude towards developing live commerce.

H4b: Graduates' educational background could moderate the effect of subject norm towards developing live commerce.

H4c: Graduates' educational background could moderate the effect of perceived control towards developing live commerce.

RESEARCH METHODOLOGY

Research Setting and Measurement

As identified by prior scholars (Li, Kang, Zhao, & Feng, 2022), to test the hypotheses proposed in section three and implement a quantitative approach, an online questionnaire-based survey was appropriate. Considering the influence of the COVID-19 pandemic, the remote access and flexible filling time provided by the online questionnaire method were of particular importance for the current study. Meanwhile, because of the rapid development of The Fourth Wave of entrepreneurship in China, numerous graduates have accepted the live commerce mode and promoted online business activities on live streaming platforms, such as Taobao Live, Jingdong Live, and TikTok platforms (Li *et al*., 2021). Hence, it is reasonable for this article to select the Chinese live commerce environment as the research context and explore Chinese graduates' live commerce intentions. The online questionnaire is distributed among Chinese graduates in Mainland China.

All constructs measured in this research are based on existing scholars, as Table 1 presents (do Paço, Ferreira, Raposo, Rodrigues, & Dinis, 2011; Usman, 2019). In addition to testing graduates' live commerce intention, some basic information statistics have been included in this study, such as their gender, age, and educational background (including high school or Junior college degree, bachelor's degree and master's or doctoral degree). The article utilised the Likert 7-point scale with a range from the lowest score=1 to the highest score=7 to measure participants' answers.

Table 1. The list of questionnaire contents

Variable	Item	Measurement
Attitude towards developing live commerce (do Paço *et al.*, 2011; Usman, 2019)	AT1	Developing live commerce implies more advantages than disadvantages to me.
	AT2	The live commerce career is attractive to me
	AT3	Being a live commerce entrepreneur would entail great satisfaction for me
Subject norm towards developing live commerce (do Paço *et al.*, 2011; Usman, 2019)	SN1	I will develop live commerce if people of importance to me encourage me to do that.
	SN2	Recommendations from close friends will make me want to try live commerce.
	SN3	The opinions of those who are important to me will affect my decision to develop live commerce.
Perceived control towards developing live commerce (do Paço *et al.*, 2011; Usman, 2019)	PC1	To start live commerce and keep it working would be easy for me.
	PC2	I know the necessary practical details to start live commerce.
	PC3	I can control the creation process of new live commerce.
Intention to develop live commerce (do Paço *et al*., 2011; Usman, 2019)	IN1	I am ready to do anything to be a live commerce entrepreneur.
	IN2	I will make every effort to start and run live commerce.
	IN3	I have the firm intention to start live commerce someday.

Source: adapted from do Paço et al., 2011; Usman, 2019.

Data Collection

In view of the participant's background, this study applied wjx.cn, an online Chinese questionnaire platform, as the data collection platform. It has academic functions and multi-language options, which makes it suitable for Chinese graduates to fill in. To concentrate on the target respondents, many filtering question items are designed before the formal questions, such as participants' age, gender, educational background, and online entrepreneurship interest. Before participants fill in online questionnaires, the invitation letter is presented in advance to help them know the research topic, thus improving the accuracy of questionnaire data. From January 2022 to February 2022, online questionnaires were mainly distributed in Chinese universities and colleges through social media platforms. Four hundred fifty-six responses were received from different provinces, and most of the participants were men between 19 and 30 years old. Among these 456 questionnaires, inap-

propriate responses were deleted, including incomplete answers, the same responses, and the same IP address. Finally, 420 questionnaires were found valid for this study.

Data Analysis

Descriptive Statistics

Among 420 respondents (Table 2), 48.10% were women, and 51.90% – men. 68.10% of them were between 19 and 30 years old, 15.95% – between 31 and 35 years old, and few of them – under 19 or over 35 years old. Regarding participants' educational backgrounds, 35.24% had high school or junior college degrees, 35.48% had bachelor's degree backgrounds, and 29.29% of their educational backgrounds were master's or doctoral degrees.

Table 2. The basic information of respondents (n=420)

Demographic Variables	Category	Frequency	Percentage (%)
Gender	Female	202	48.10%
	Male	218	51.90%
Age	Under 19	54	12.86%
	19-30	286	68.10%
	31-35	67	15.95%
	Over 35	13	3.10%
Educational background	high school or junior college degree	148	35.24%
	bachelor's degree	149	35.48%
	master's or doctoral degree	123	29.29%

Source: own study based on Smart-PLS output, 2022.

To evaluate the research model and test hypotheses, the variance-based structural equation modelling (SEM) and partial least squares (PLS) path modelling were applied in this study. According to Hair *et al*.'s research (2017), PLS-SEM is a causal-predictive approach to SEM, and it can be applied to test a theoretical framework from a prediction perspective. Meanwhile, PLS-SEM has the added advantage of estimating the measurement model and is beneficial for conducting multi-group analysis (Hair, Hollingsworth, Randolph, & Chong, 2017).

Measurement Model

Regarding the reliability test, the study should assess the criteria, including average variance extracted (AVE), composite reliability (CR), and Cronbach Alpha (Henseler, Ringle, & Sarstedt, 2015). Based on requirements proposed by existing scholars, AVE should be higher than 0.50, CR needs to be higher than 0.70, and Cronbach's Alpha should be greater than 0.70. Hence, as Table 3 presents, all data results met the requirements, indicating reasonable reliability. Meanwhile, convergent validity and discriminant validity can be tested through confirmatory factor analysis. As the factor loadings and cross-loadings show in Table 3, each construct's markers' loadings are highly correlated, and the range of factor loadings is from 0.952 to 0.974, which is dramatically greater than 0.707, thus meeting the convergent validity requirement.

The discriminant validity can be evaluated by checking the Fornell-Larcker criterion, which has been widely identified (Afthanorhan, Ghazali, & Rashid, 2021). The AVEs' square root on the diagonals can assess whether the discriminant validity is acceptable (Chin, 1998; Fornell & Larcker, 1981). Specifically, the AVEs' square root on the diagonals in Table 4 is significantly higher than other correlations, supporting the discriminant validity.

Table 3. Assessment of measurement model on loading, CR, AVE, and Cronbach's Alpha

Construct	Item	Loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	AT1	0.974	0.966	0.978	0.937
	AT2	0.962			
	AT3	0.968			
IN	IN1	0.960	0.959	0.973	0.924
	IN2	0.957			
	IN3	0.967			
PC	PC1	0.961	0.955	0.971	0.918
	PC2	0.952			
	PC3	0.962			
SN	SN1	0.953	0.955	0.971	0.918
	SN2	0.962			
	SN3	0.959			

Note. AT= Attitude towards developing live commerce, SN= Subject norm towards developing live commerce, PC= Perceived control towards developing live commerce, IN= Intention to develop live commerce.
Source: own elaboration based on Smart-PLS output, 2022.

Table 4. Discriminant validity for the measurement model according to the Fornell-Larcker criterion

Construct	AT	IN	PC	SN
AT	0.968			
IN	0.957	0.961		
PC	0.952	0.949	0.958	
SN	0.947	0.946	0.949	0.958

Source: own study based on Smart-PLS output, 2022.

Common Method Bias

Because some correlations of the constructs were relatively high, it might cause common method bias. According to Liang *et al*.'s study (2007), the single-factor test and the measured latent-factor test can evaluate the common method bias. Specifically, the average of trait factors explained 91.70% of the overall variance and the standard of method factors explained 1.50% of the overall variance, thus demonstrating common method bias was not serious, and the correlations of the constructs were reasonable in this study (Liang, Saraf, Hu, & Xue, 2007).

Structural Model

To assess each path's significances and the t-statistical test, this study utilised the bootstrapping function on SmartPLS 3.0. According to Table 5, all hypotheses could be supported, because t-statistics results were notably higher than 1.96 (Hair Jr, Hult, Ringle, & Sarstedt, 2016). This means that attitude (β=0.441, t=7.918, p<0.001), subject norm (β=0.288, t=5.780, p<0.001), and perceived control (β=0.255, t=4.403, p<0.001) had positive relationships with graduates' intention to develop live commerce on live streaming platforms, thus indicating that hypothesis 1, hypothesis 2, and hypothesis were supported.

Table 5. Hypotheses testing

Path	Original Sample (O)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Support?
AT -> IN	0.441	0.056	7.918	P<0.001	Yes
PC -> IN	0.288	0.050	5.780	P<0.001	Yes
SN -> IN	0.255	0.058	4.403	P<0.001	Yes

Source: own study based on Smart-PLS output, 2022.

Multi-group comparison

Table 6 shows the differences in path coefficient estimates in three pairs of comparison (high school or junior college degree vs bachelor degree, high school, or junior college degree vs master or doctoral degree, bachelor degree vs master or doctoral degree), and it presents the results of multi-group comparisons. The results suggest that graduates holding master's or doctoral degrees are significantly different from others. Notably, in terms of the relationship between subjective norm and intention, the high school or junior college degree sample was significantly different from the bachelor's degree sample (|diff|=-0.506; p-value=0.013) and the master's or doctoral degree sample (|diff|=-0.830; p-value=0.001), and graduates with bachelor degree sample was significantly different from the master or doctoral degree sample (|diff|=-0.324; p-value=0.035). Several conclusions can be stated while combining these results with the pairwise path coefficients in Table 6. Compared with the high school or junior college background, the subject norm factor exerted a more significant influence on the live commerce intention of graduates with a bachelor's degree. Meanwhile, the subject norm factor exerted a more significant impact on the live commerce intention of graduates with master's or doctoral degrees than others with bachelor's degrees. This means that graduates with a higher degree paid more attention to the subject norm factor.

Table 6. Multi-group comparison test results

Relationship	Comparison	|diff|	p-Value	Decision
AT -> IN	HJ vs BA	-0.221	0.124	Not supported
	HJ vs MD	-0.199	0.283	Not supported
	BA vs MD	0.021	0.918	Not supported
PC -> IN	HJ vs BA	-0.448	0.050	Not supported
	HJ vs MD	-0.303	0.262	Not supported
	BA vs MD	0.145	0.386	Not supported
SN -> IN	HJ vs BA	-0.506	0.013	Supported
	HJ vs MD	-0.830	0.001	Supported
	BA vs MD	-0.324	0.035	Supported

Note. HJ= High school or junior college degree, BA= bachelor's degree, MD= master's or doctoral degree.
Source: own elaboration based on Smart-PLS output, 2022.

RESULTS AND DISCUSSION

Key Findings

Firstly, consistent with previous entrepreneurship studies (Liñán & Rodríguez‐Cohard, 2015; Rueda *et al*., 2015; Sharahiley, 2020), the influencing factors based on the TPB model positively affectED graduates' intention to develop live commerce. This means that – whether for live commerce mode or traditional online entrepreneurship – the influencing factors, including attitude, subject norm, and perceived control play significant roles in individuals' entrepreneurial intention. Meanwhile, unlike prior related research focusing on graduates' age, gender, and cultural background (Ferreras-Garcia *et al*., 2021; Israr & Saleem, 2018; Li & Kang, 2021b), this study analysed graduates' educational backgrounds and made comparisons based on them. Compared with the high school or junior college background, the subject norm factor exerted more influence on live commerce intention for graduates with a bachelor's degree. The subject norm factor exerted a more significant impact on the live commerce intention of graduates with master's or doctoral degrees than others with bachelor's degrees. Hence, graduates with a higher degree will pay more attention to the subject norm factor while making live commerce decisions. Graduates with a master's or doctoral degree paid more attention to the subject norm even if they had controlled more comprehensive and advanced entrepreneurial skills than others. According to entrepreneurial research proposed by Zamrudi and Yulianti (2020), graduates' entrepreneurial knowledge has no strict connection with their entrepreneurial intention, and some of them still lack the confidence to promote entrepreneurship (Zamrudi & Yulianti, 2020). Meanwhile, graduates with higher educational levels

have more opportunities to receive entrepreneurial knowledge and understand related entrepreneurial risks, which leads them to be cautious about uncertainty issues and undertake entrepreneurial pressures (Ferreira, Loiola, & Gondim, 2017). Hence, before they promote live commerce, graduates with higher educational levels could concern more about risks and need their family members' and peers' approval and encouragement. Conversely, graduates with lower educational levels would be unfamiliar with entrepreneurial risks and less influenced by the subject norm.

Theoretical Implications and Practical Implications

Regarding the theoretical implication, the study applied the TPB model to explore graduates' live commerce intentions. Although existing studies applied the TPB to analyse graduates' entrepreneurial motivation (Maes *et al*., 2014; Robledo *et al.*, 2015), few of them identified the new trend of live commerce and explored graduates' attitudes to this new entrepreneurship mode. Unlike online traditional business mode, developing live commerce on live streaming platforms has unique advantages for graduates, such as technical support, flexible workspace, and tax exemption, which entrepreneurial research needs to focus on. Given that live commerce gets popular around the world, it is meaningful to know graduates' live commerce intentions and help them engage in this new trend successfully. Meanwhile, considering graduates with different educational backgrounds could have different opinions about living commerce activities (Zhang *et al*., 2014), this article promotes the multi-group analysis based on a non-parametric approach and makes comparisons according to graduates' educational degree levels, which is ignored by the existing literature. The results prove that the educational background factor can significantly moderate the relationship between the subject norm and individuals' live commerce intention. Therefore, in addition to analysing individuals' age, gender, cultural background, and income level, future studies should also concern graduates' educational backgrounds while discovering their entrepreneurial intention.

Regarding the practical implication, the research results show that related departments, especially educational departments, should focus on graduates' live commerce intention from attitude, subject norm and perceived control aspects, which accords with the traditional entrepreneurship mode. All of these influencing factors positively influence graduates' intention to develop live commerce. Specifically, to increase graduates' online entrepreneurial interest, educational departments should guide graduates' opinions on live commerce, encourage peers' cooperation and enhance graduates' entrepreneurial capabilities. Meanwhile, graduates with a higher education degree will pay more attention to the impact of the subject norm and need to get their family members and peers' approval before developing live commerce. Due to mastering various entrepreneurial knowledge, graduates with master's or doctorate degrees have more chances to comprehensively understand entrepreneurship risks than others with lower educational degrees. This results in them lacking entrepreneurial confidence and relying on peers' emotional support. Hence, regarding graduates with master's or doctoral degrees, educational departments need to focus on cooperation with their family members and peers' group while encouraging them to develop live commerce on live streaming platforms.

Limitations and Future Study

Graduates with different social and cultural backgrounds could have different opinions on live commerce mode. For instance, Eastern entrepreneurs may be more pragmatic, and Westerners may be more entertaining. This means that the data analysis results based on Chinese graduate samples cannot be applied to Western graduates directly. The educational background could have different moderating roles. Hence, future studies should both cover Eastern and Western graduates and make some comparisons between them, aiming to provide specific suggestions for local departments. Meanwhile, although some graduates have the same educational degrees, the educational quality they accepted is different. For instance, graduates from China's eastern regions have more opportunities to receive high-quality education resources, and others from western regions have fewer opportunities to learn advanced entrepreneurial education. Thus, future studies should concern regional difference. Finally, the questionnaire was distributed through social media platforms and we must bear in mind that graduates from less-developed regions could be unfamiliar with online platforms and live commerce mode.

To understand their intention to develop live commerce, future studies should promote offline questionnaires and interview methods.

CONCLUSIONS

Based on the TPB model, attitude, subject norm and perceived control have positive correlations with graduates' intention to develop live commerce, which accords with existing entrepreneurship research results. Meanwhile, this article focuses on the moderating role of educational background and promotes the multi-group analysis based on it, which is ignored by existing studies. Compared with the high school or junior college background, the subject norm factor exerts a bigger influence on live commerce intention of graduates with a bachelor's degree. Meanwhile, the subject norm factor exerted a greater impact on live commerce intention of graduates with master's or doctoral degrees than others with bachelor's degrees. Hence, graduates with a higher degree paid more attention to the subject norm factor while making live commerce decisions. The research results require educational departments to pay much attention to the impact of the subject norm and design specific strategies to enhance graduates' live commerce intention.

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The e-entrepreneurial intention of students: The role of self-efficacy and education

Minh Pham, Bao Quoc Lam, Vi Phuong Tran Le

ABSTRACT

Objective: The goal of this article is to evaluate the relationship between education and e-entrepreneurial intention (EEI) under the mediated effect of outcome expectation and attitude, as well as the positive moderating role of self-efficacy in that relationship.

Research Design & Methods: This research uses quantitative research methods to assess the relationships in the proposed research model. By convenient sampling, data were collected from 406 students studying at universities in Ho Chi Minh City. The research hypotheses were tested by partial least squares structural equation modelling.

Findings: The results have shown that although education has a more decisive influence on students' attitudes towards e-entrepreneurship than outcome expectations, their outcome expectations are more influential on their EEI than attitude. Another remarkable thing is that this article demonstrates the positive moderating role of self-efficacy on the relationship between attitude and EEI.

Implications & Recommendations: This study confirmed that entrepreneurial education is necessary to form EEI. Besides that, universities need to increase students' self-efficacy by equipping them with the skills required to help them have a more positive attitude towards e-entrepreneurship.

Contribution & Value Added: This article proves that the combination of social cognitive theory (SCT) and theory of planned behaviour (TPB) helps to more comprehensively explain e-entrepreneurship, especially discovering the positive moderating role of self-efficacy in explaining the relationships in these two theories.

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INTRODUCTION

Entrepreneurship is a phenomenon of worldwide interest and its influence spans many fields (Cassia *et al.*, 2014). According to Reynolds (2000), promoting entrepreneurship is necessary to improve economic development's driving force (Barrachina Fernández *et al.*, 2021). Recognising this, start-up support organisations and government resources have also increased enormously to optimise specific benefits of operations start-ups (Huang *et al.*, 2022; Colombo & Grilli, 2006). Therefore, developing countries (Viu-Roig & Alvarez-Palau, 2020) or emerging economies (Bakos, 2001; Wach *et al.*, 2018) need to focus on research on entrepreneurship.

E-entrepreneurship is a branch of entrepreneurship (Farooq *et al.*, 2018). With the rapid development of the Internet, e-business is prioritised when individuals or organisations decide to start a business (Sukasame *et al.*, 2008; Tan & Li, 2022). Justifying the above statement, Matlay and Westhead (2007) and Al-Shourbaji and Zogaan (2022) argue that e-entrepreneurship solving problems is more flexible and cost-effective than traditional ones. At the same time, e-business makes it easier for young venturers to reach a broader range of customers (Lu *et al.*, 2021; Abdelfattah *et al.*, 2022). Since then, businesses have

been able to easily penetrate the market and improve their competitiveness (Matlay & Westhead, 2005). As a result, e-entrepreneurship is gradually becoming essential to all economies (Farooq *et al.*, 2018).

Most of the studies on entrepreneurship are based on three aspects, namely entrepreneurial intention, entrepreneurship methods, and entrepreneurship outcomes (Stevenson & Jarillo, 2007). Entrepreneurial intention is considered the core foundation of entrepreneurship behaviour (Kolvereid & Isaksen, 2006), which needs strong attention (Trivedi, 2017), because it is a crucial guideline (Hockerts, 2017) that determines the nature of entrepreneurial behaviour (Krueger & Carsrud, 1993). However, the theoretical system of entrepreneurship generally falls on the 25-35-year-old audience (Ahlstrom & Ding, 2014), but the future central workforce is students. On the other hand, studies on e-entrepreneurial intention (EEI) are even more scarce (Lai & To, 2020). Therefore, according to Tuan and Pham (2022), research on students will help build a potential business force more effectively. Thus, this study focuses on students, because they are robust and qualified human resources with high development potential (Curto *et al.*, 2021).

The theory of planned behaviour (TPB) is broadly applied to describe entrepreneurship behaviour (Al-Jubari, 2019; Lingappa *et al.*, 2020; Lortie & Castogiovanni, 2015). Specifically, TPB was proposed by Ajzen (1991) and applied to entrepreneurial intention studies (Joensuu-Salo *et al.*, 2020). Schlaegel and Koenig (2014) also demonstrated that TPB is suitable for explaining entrepreneurial intention, but some studies show that TPB only focuses on behavioural outcomes and performance (Tuan & Pham, 2022). On the other hand, TPB has not yet explained the process of forming behaviour (Al-Mamary *et al.*, 2020), while González-Cutre *et al.* (2014) also pointed out the lack of TPB in the relationship between subjective and contextual factors.

In contrast, social cognitive theory (SCT) shows the association between the individual and the environment (Henley *et al.*, 2017). In other words, the interaction process between subjective and objective factors is shown more clearly in SCT (Chien-chi *et al.*, 2020). In addition, SCT complements TPB as it explains changing behavioural intentions (Chien-Chi *et al.*, 2020). Therefore, the parallel application of these two theories in the research will more comprehensively explain the process of forming and developing entrepreneurial intentions (Wang *et al.*, 2018). That is why this study combines theories of TPB and SCT, thereby comprehensively examining the process of forming entrepreneurial intentions.

Besides, it is argued that self-efficacy and perceived behavioural control are different concepts (Tsai *et al.*, 2016). In contrast, Ajzen (2001) has confirmed their equivalent role (Mair & Noboa, 2006). Agreeing with the view of Ajzen (2001), Tiwari *et al.* (2017) and Wach and Bilan (2021) pointed out the similarity between self-efficacy and perceived behavioural control. Likewise, self-efficacy is a solid predictive indicator influencing entrepreneurial intention (Liu *et al.*, 2019). The positive effect of self-efficacy towards entrepreneurial intention (both direct and indirect) is also supported in many contexts (Hsu *et al.*, 2019; Şahin *et al.*, 2019; Elnadi & Gheith, 2021; Wardana *et al.*, 2021). However, e-entrepreneurship differs from traditional entrepreneurship, because the activities depend entirely on digital platforms (Halbusi *et al.*, 2022), so studying the context of e-entrepreneurship is needed to help better understand online relationships (Lai & To, 2020). Therefore, the article examines self-efficacy's role in the online environment as the crux of the intersection between the contexts of TPB and SCT.

Structurally, the article is divided into five parts. The first part will present the research problem. Part two will present the theoretical basis and the proposed research model. The research method will be shown in the third part. Part four will discuss the results of the study. Part five will present the basis for the management conclusions and implications.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

E-entrepreneurial Intention (EEI)

E-entrepreneurship is establishing a new business that partially or fully operates on the Internet (Gundry & Kickul, 2006; Kollmann, 2006; Millman *et al.*, 2009). Shinnar *et al.* (2018) define e-entrepreneurship as creating new business activities based on Internet resources to sell products or services on the e-commerce system. Zhao *et al.* (2010) argue that EEI is the intention to start a new business activity based on

the Internet, meaning to own an online company. Generally, EEI has not been developed but is determined mainly by entrepreneurial intention (Batool *et al.*, 2015; Abdelfattah *et al.*, 2022), but most studies apply the definition of Zhao *et al.* (2010) because of its comprehensiveness and generality.

E-entrepreneurship is effective, because it enhances communication between stakeholders and makes the operation process faster than traditional (Abdelfattah *et al.*, 2022). Thus, depending on technological change, e-entrepreneurship has helped more and more different activities in enterprises operate more efficiently (Al-Mamary & Alraja, 2022). Therefore, the number of studies in this field is increasing (Chung *et al.*, 2016). Despite this, research on e-entrepreneurship has not been comprehensively conducted in emerging economies (Lai & To, 2020).

Social Cognitive Theory (SCT)

Bandura developed the SCT in 1986. The social cognitive theory argues that individual, behavioural, and environmental factors influence each other (Bandura, 1986). This theory explains that individuals produce different results with the same environmental factors because they possess different characteristics (Wood & Bandura, 1989). Two key features in the model of this theory are self-efficacy and outcome expectation. This theory is applied in the study of behavioural intention (Boudreaux *et al.*, 2019) and entrepreneurial intention (Boutaky & Sahib Eddine, 2022).

Soomro and Shah (2022) state that becoming an entrepreneur is a way for individuals to express their need for achievement. It is considered an expression of outcome expectation when the individuals intend the results they will receive after performing the behaviour. In other words, outcome expectation is an individual's imagination and subjective assessment of the effects of their behaviour (Lent & Brown, 2008), which is a belief about content, a thing, or a phenomenon, that can occur at the end of the behaviour (Lent & Brown, 2013).

Pfeifer *et al.* (2016) point out that outcome expectation strongly influences entrepreneurial intention. In particular, positive expectations of financial gain, independence, or security, vigorously promote their intention to become entrepreneurs (Carter *et al.*, 2003). This factor satisfies personal expectations, in which the main goal is profit (Christopoulos & Vogl, 2015). Besides, e-business helps to simplify procedures, save costs and quickly enter the market (Sukasame *et al.*, 2008). Thus, it encourages businessmen, especially new venturers, to enter the e-commerce market (Matlay & Westhead, 2005). Finally, Segal *et al.* (2002) and Blaese *et al.* (2021) successfully demonstrated the positive impact of outcome expectation on entrepreneurship intention. Since the EEI is an extension of entrepreneurial intention, the hypotheses of the two concepts can be used interchangeably. Thus, we hypothesise:

H1: Outcome expectations positively affect e-entrepreneurial intention (EEI).

Theory of Planned Behaviour (TPB)

Entrepreneurial intention and behaviour are considered to be among the most challenging concepts in the group of behavioural intentions (MacMillan & Katz, 1992). One of the most successfully used theories to explain entrepreneurial intention is the TPB proposed by Ajzen in 1991 (Batool *et al.*, 2015; Wach & Wojciechowski, 2016). According to Ernst (2011), TPB is a fundamental theory widely applied to many studies of intention in many fields, supported by many scholars both academically and experimentally (Van Gelderen *et al.*, 2008).

The content of TPB argues that subjective norms, perceived behavioural control, and attitude are the three factors that influence and explain intention. Attitude is often applied in entrepreneurial research (Wardana *et al.*, 2020). Liu *et al.* (2019) reveal that attitude is an individual's subjective perception of himself, people, things, phenomena, etc., which is a positive or negative evaluation of behaviour and the possible consequences of the behaviour (Abdelfattah *et al.*, 2022). From another perspective, Mitchell *et al.* (2002) consider that attitudes towards entrepreneurial behaviour predict adaptability, capacity, and action in the business process. It is confirmed through many studies that attitude is a vital explanatory factor for entrepreneurial intention (Liu *et al.*, 2019) and is an essential indicator of the degree of entrepreneurial behaviour (Bell & Bell, 2016; Fragoso *et al.*, 2020; Jena, 2020; Liu *et al.*, 2019; Rosique-Blasco *et al.*, 2018).

Surprisingly, the relationship between attitude towards e-entrepreneurship and EEI is of little interest to scientists. Even Lai and To (2020) demonstrated that this relationship is not statistically significant. In contrast, Al-Mamary and Alraja (2022) argue that attitude has the most decisive impact on entrepreneurial intention when viewed from the perspective of digital entrepreneurship. These conflicting results suggest evaluating the relationship between attitude and EEI in the new context. The above argument is the basis of the following hypothesis:

H2: Attitude positively affects e-entrepreneurial intention (EEI).

Entrepreneurial Education

Entrepreneurial education develops attitudes, behaviours, and capacities that people can use in their careers as an entrepreneur (Ndofirepi, 2020). Entrepreneurship education is a form of vocational education for students (Fu & Cheng, 2022). Aamir *et al.* (2019) think it is the formal transfer of business knowledge by teaching. Through this, learners are equipped with mindsets, attitudes, and skills to become entrepreneurs (Fayolle & Gailly, 2015). Studies show that people who undergo entrepreneurship education can better identify and take hold of business opportunities (Zhang *et al.*, 2014). Besides, learners are also more aware of how to start a new business and risk management (Cheng *et al.*, 2009).

Entrepreneurial education creates a hypothetical or actual environment, allowing students to experience specific activities related to entrepreneurship behaviour (Wardana *et al.*, 2020). Entrepreneurship education equips students with an entrepreneur's knowledge, skills (Liu *et al.*, 2019), attitude, behaviour, and mindset (Wardana *et al.*, 2020). Through course training, students can make certain judgments about business plans, projects, or strategies (McMullen & Shepherd, 2006). In other words, entrepreneurship education builds awareness of the outcomes of entrepreneurial behaviour. Pfeifer *et al.* (2016) have successfully demonstrated the positive effect of entrepreneurial education as a contextual factor promoting outcome expectations.

Packham *et al.* (2010) examined the influence of entrepreneurial education on students' attitudes in many contexts. According to Liñán (2008), entrepreneurial education creates practical activities such as direct enterprise experience and tutoring from successful entrepreneurs (Wardana *et al.*, 2020). The positive relationship between entrepreneurial education and attitude is also proven by Pfeifer *et al.* (2016) and Wardana *et al.* (2020) and is supported by Lindberg *et al.* (2017), Wach and Wojciechowski (2016), and Wardana *et al.* (2021). Despite this, research on entrepreneurial education in the context of e-entrepreneurship has not received enough attention (Lai & To, 2020). Research on this relationship is rarely done in some Asian countries (Hoang *et al.*, 2020; Lai & To, 2020). The impact of entrepreneurial education in shaping students' entrepreneurial intentions in general and on the electronic environment, in particular, has not been well studied in Vietnam (Nguyen & Nguyen, 2023). Therefore, the following hypotheses are proposed to understand the impact of entrepreneurial education on attitude and outcome expectation in the context of EEI.

H3: Entrepreneurial education positively affects outcome expectations.

H4: Entrepreneurial education positively affects attitude.

Self-efficacy

Self-efficacy is a critical component of SCT. It is the belief in one's ability to organise and carry out the necessary actions to reach the target (Bandura, 1997). In other words, self-efficacy is confidence in oneself when possessing the necessary skills to perform a behaviour (Liu *et al.*, 2019). Self-efficacy is a factor of great interest in studies on entrepreneurial intention (Pihie & Bagheri, 2013). Through the above definition, it can be understood that self-efficacy is faith in a person's capabilities to own, operate, and manage a business (Santos & Liguori, 2020). Elnadi and Gheith (2021) argue that higher entrepreneurial self-efficacy promotes the individual's ability to adapt and face risks, thereby achieving success in the entrepreneurial process. Batool *et al.* (2015) also argue that self-efficacy in e-entrepreneurship plays an equally important role. Previous studies have also shown that self-efficacy has a mediating role in the relationship between components of previous theories (Batool *et al.*, 2015). However, research on the moderating role of self-efficacy in the formation of e-entrepreneurial intention has not been interesting.

Thus, self-efficacy is essential for looking for business opportunities (Drnovšek *et al.*, 2010) and creating new ideas (Zhao *et al.*, 2010). Besides, much research has demonstrated a strong positive connection between self-efficacy and entrepreneurial intention (Santos & Liguori, 2020; Wilson *et al.*, 2007; Shinnar *et al.*, 2018). Based on SCT, self-efficacy predicts and explains expectations about the outcome of behaviour (Bandura, 1986). When individuals are confident that they can achieve something, their outcome expectations also become stronger (Liguori *et al.*, 2020). In other words, self-efficacy and outcome expectations have a positive relationship (Lent *et al.*, 1994). Besides, Farashah (2015) argues that self-efficacy through outcome expectations enhances entrepreneurial intention, and outcome expectations are also strongly promoted in this relationship (Pfeifer *et al.*, 2016).

Self-efficacy is the self-assessment of the compatibility of skills with an individual's behaviour, while attitude is the evaluation process associated with those beliefs (Tiwari *et al.*, 2017). For example, suppose an individual believes they possess a wide range of abilities (knowledge, skills, experience) in a field; hence, they are likely to perform well in behaviours related to that domain (Ernst, 2011). Piperopoulos and Dimov (2015) and Wardana *et al.* (2020) also support a positive relationship between self-efficacy and attitude toward entrepreneurial intention because when individuals possess confidence, they are willing to take risks (Pihie & Bagheri, 2013). In other words, self-efficacy leads to positive feelings in entrepreneurship (Liñán, 2008). From the presented evidence, the research proposes the last hypotheses:

H5: Self-efficacy positively moderates the relationship between outcome expectations and e-entrepreneurial intention (EEI).

H6: Self-efficacy positively moderates the relationship between attitude and e-entrepreneurial intention (EEI).

The research model is presented in Figure 1 based on the stated research hypotheses.

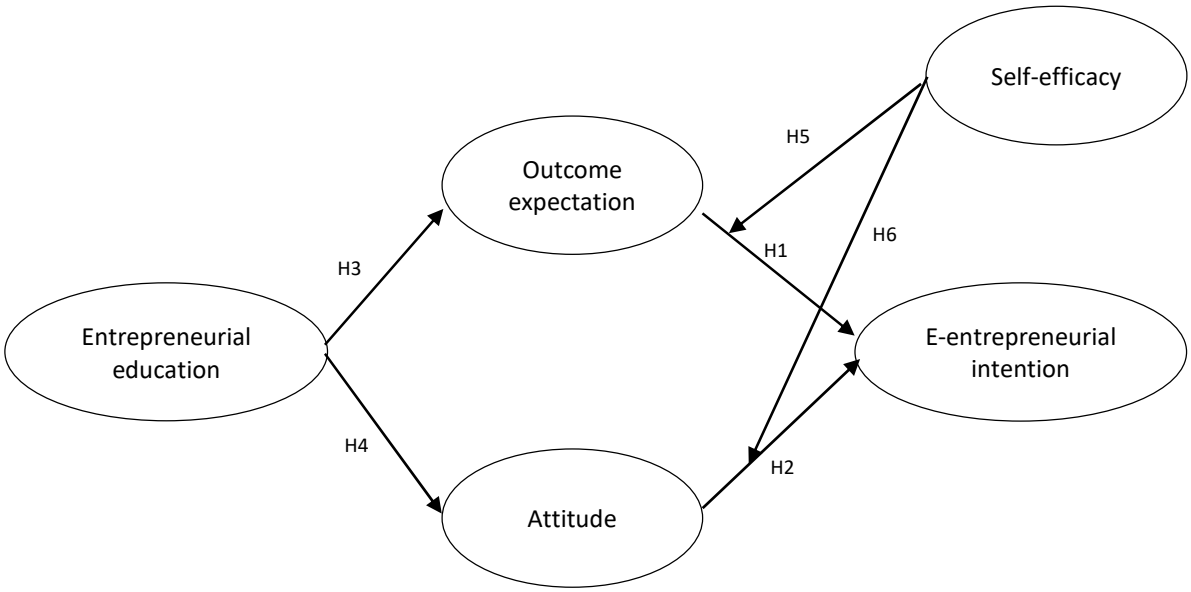

Figure 1. Conceptual framework
Source: own elaboration.

RESEARCH METHODOLOGY

The Google Form platform collects survey data from respondents through social media. Because the subject of the study was bachelor students, or Gen Z in general, who have an extremely high degree of proximity to the Internet (Priporas *et al.,* 2020), this method was reasonable for efficiently aggregating data. The survey was built with a 5-point Likert scale: '1 = strongly disagree' and '5 = strongly agree' Surveys were valid when respondents provided information that they had studied entrepreneurship courses at the university. In Table 1, the survey obtained 406 valid questionnaires, 137 men (33.7%) and 269 women (66.3%).

Table 1. Sample description

Variables	Categories	Frequency	Percentage (%)
Year of birth	1999	38	9.4
	2000	44	10.8
	2001	70	17.3
	2002	249	61.3
	2003	5	1.2
Major	Economic – Administration	237	58.4
	Social Sciences – Humanities	86	21.2
	Technology – Engineering	83	20.4
Gender	Male	137	33.7
	Female	269	66.3

Source: own study.

The research inherited the scales from previous studies. In detail, the study used a scale inherited from Wardana *et al.* (2020) with three observed variables for the concept of entrepreneurship education and four observed variables for attitudes towards entrepreneurship. Next, four observed variables were combined from two studies by Farashah (2015) and Blaese *et al.* (2021) to measure the concept of outcome expectations. Finally, a 6-variable scale for self-efficacy and five observed variables for EEI were used from the work of Jeong and Choi (2017). The content of these scales was changed to fit the research context in Vietnam.

Collected data were examined by partial least squares structural equation modelling (PLS-SEM) technique with SmartPLS 3 software. The PLS-SEM analyses a small sample size without proving that the data set achieves normal distribution (Dijkstra & Henseler, 2015). The examination process was separated into two main phases: model and structural measurement assessment (Hair *et al*., 2019). In the first stage, the indicators to assess the scale's reliability and the data validity were tested. Then, when the indicators were satisfactory, stage two was conducted to test the relationships in the research model.

RESULTS AND DISCUSSIONS

Model Measurement Assessment

The scale needs to satisfy the necessary conditions for measurement verification. Firstly, Cronbach's α (CA) and composite reliability (CR) indices need greater than 0.7 for the scale to reach the required reliability (Hair *et al.,* 2014). The next metric, convergent validity, is measured by average variance extracted (AVE), and outer loadings (Henseler *et al.*, 2015) are more significant than 0.5, and outer loading is more significant than 0.7 (Hair *et al.,* 2017). Finally, with the criterion of Hair *et al.* (2011), the variance inflation factor (VIF) needs to be no more than 5 to ensure data does not appear multicollinear. The results in Table 2 show that the above indicators were satisfied.

Table 2. Data validity and multicollinearity

Factor	Observed Variables	Outer loadings	VIF
Entrepreneurial education (EDU)	*CA = 0.875, CR = 0.923, AVE = 0.800*		
	The university develops my skills in e-entrepreneurship.	0.871	2.744
	The university provides basic knowledge about e-entrepreneurship.	0.898	2.243
	The university helps get creative ideas for e-entrepreneurship.	0.914	2.298
Attitude (ATT)	*CA = 0.832, CR = 0.889, AVE = 0.666*		
	E-entrepreneurship brings a lot of interesting	0.751	1.490
	I choose E-entrepreneurship over another career	0.837	2.035
	E-entrepreneurship gives me unique satisfaction	0.830	1.901
	I will start my e-entrepreneurship as soon as I qualify	0.844	2.012

Factor	Observed Variables	Outer loadings	VIF
Outcome Expectations (OUT)	*CA = 0.840, CR = 0.893, AVE = 0.677*		
	E-entrepreneurship will help me become an independent person	0.795	1.684
	E-entrepreneurship will help me improve my income	0.795	1.662
	E-entrepreneurship gives me higher status	0.849	2.356
	E-entrepreneurship helps me to be respected by others	0.850	2.421
Self-efficacy (SEF)	*CA = 0.933, CR = 0.947, AVE = 0.750*		
	I am confident in e-entrepreneurship	0.878	3.172
	I can control the creation process of e-entrepreneurship	0.874	3.056
	I know the necessary practical details for e-entrepreneurship	0.860	2.725
	I would have a high probability of succeeding in e-entrepreneurship	0.867	3.068
	E-entrepreneurship would be easy for me.	0.875	3.305
	I can become an e-entrepreneur when I want	0.841	2.373
E-entrepreneurial Intention (EEI)	*CA = 0.855, CR = 0.896, AVE = 0.633*		
	My professional goal is e-entrepreneurship	0.780	1.610
	I will do my best to start an e-business	0.803	1.858
	I am committed to running an e-venture in the future	0.782	1.873
	I have highly thought of initiating an e-venture	0.775	1.790
	I have a solid intention to start an e-business someday	0.836	2.208

Source: own study.

The inter-correlations of a concept need to be less than the square root of the AVE of that concept to satisfy the discriminant validity condition (Henseler *et al*., 2015). The result revealed that the scales met the requirements (Table 3). This means that the scales used in the article were satisfactory.

Table 3. Discriminant validity

Variables	ATT	EEI	EDU	OUT	SEF
Attitude (ATT)	**0.816**	–	–	–	–
E-entrepreneurial intention (EEI)	0.354	**0.796**	–	–	–
Entrepreneurial education (EDU)	0.565	0.270	**0.894**	–	–
Outcome expectations (OUT)	0.588	0.381	0.509	**0.823**	–
Self-efficacy (SEF)	0.647	0.375	0.582	0.668	**0.866**

Source: own study.

Structural Measurement Assessment

Both R^2 and Q^2 are indicators used by many studies to prove the good of the model. Firstly, the R^2 index is 'a valuable tool in evaluating the quality of a PLS model' (Hair *et al*., 2014). More specifically, R^2 measures the independent variable's explanatory level to the dependent variable in the research model (Hair *et al.*, 2011). Next, the blindfolding technique tests the cross-validated redundancy with the Q^2 index. Since the R^2 does not represent the model's predictive power, the Q^2 is used to measure this (Ringle *et al*., 2012). The larger the Q^2 index, the more accurate the model's prediction (Hair *et al*., 2014). In Table 4, the results show that both of the above indicators were acceptable.

Table 4. Coefficient of determination (R^2) and the out-of-sample predictive power (Q^2)

Variables	R^2 Adjusted	Q^2
Attitude	0.320	0.211
Outcome expectations	0.259	0.172
E-entrepreneurial intention	0.171	0.103

Source: own study.

Common method bias is a phenomenon compelled by common variation generated by the sampling method. To ensure this phenomenon does not affect the research results, Kock (2017) proposes to evaluate the inner VIF index of the concepts in the model. If the inner VIFs are less than 3.3, the

common method bias is considered to have no effect (Kock, 2017). The results in Table 5 confirm this when the most extensive inner VIF index was 2.272.

Table 5. Common method bias (with inner VIFs)

Variables	Attitude	EEI	Outcome Expectation
Attitude	–	1.989	–
E-entrepreneurial intention (EEI)	–	–	–
Entrepreneurial education (EDU)	1.000	–	1.000
Outcome Expectation	–	2.212	–
Self-Efficacy	–	2.272	–
Self-Efficacy x Outcome Expectation	–	1.763	–
Self-Efficacy x Attitude	–	1.756	–

Source: own study.

PLS-SEM is a non-parametric method. Therefore, bootstrapping technology is used to verify the significance of the hypotheses and effects. Hair *et al*. (2011) state that the minimum number of samples for the bootstrap test should be 5000. The results are shown in Table 6. According to the analysis, outcome expectation was essential to EEI (β=0.187). Related studies also demonstrated the critical influence of outcome expectations on forming entrepreneurial intention (Jeong & Choi, 2017). Next, Table 6 presents that attitude positively influences EEI (β=0.140). This result is supported by studies on entrepreneurial intention, such as Ferreira *et al*. (2022), Maheshwari and Kha (2022), and Yasir *et al*. (2022). Specifically, the data shows that the more students feel interested in e-business, the stronger their intention to e-entrepreneurship will become (Batool *et al*., 2015).

Table 6. Hypothesis testing

Hypothesis	β	Standard deviation	T-value	P-value	Results
Attitude→E-entrepreneurial intention	0.140	0.071	1.968	0.049	Accepted
Entrepreneurial education→Attitude	0.565	0.045	12.637	0.000	Accepted
Entrepreneurial education→Outcome expectations	0.509	0.039	13.182	0.000	Accepted
Self-efficacy moderated Attitude→E-entrepreneurial intention	0.117	0.047	2.519	0.012	Accepted
Self-efficacy moderated Outcome expectations→E-entrepreneurial intention	0.074	0.057	1.306	0.192	Rejected
Outcome expectations→E-entrepreneurial intention	0.187	0.074	2.508	0.012	Accepted

Source: own study.

Entrepreneurial education positively impacts students' expected outcomes, attitudes, and EEI. In more detail, entrepreneurial education strongly contributes to students' positive attitudes (β=0.565). This result is similar to the findings of Wardana *et al*. (2020). Specifically, after undergoing entrepreneurial education, students can form their attitudes, which is the basis for promoting EEIs (Wardana *et al*., 2021). In addition, individuals experiencing entrepreneurial education can build outcome expectations of e-entrepreneurial behaviour more effectively (β=0.509). Through activities in e-entrepreneurship training, individuals can visualise the possible outcomes of e-entrepreneurial behaviour (Liñán, 2008).

The role of self-efficacy in moderating the relationship between attitude and EEI was supported (p=0.012, β=0.117). When individuals are confident in their abilities, their EEI also becomes stronger (Liu *et al*., 2019). At the same time, one's subjective estimate of the success of e-entrepreneurial behaviour also became more positive. From there, it can enhance students' positive attitudes toward the EEI. This result is consistent with the current context of Vietnam. Specifically, entrepreneurship among Vietnamese students is gradually becoming a trend (Yang, 2019). Therefore, equipping entrepreneurship skills is also considered indispensable. At the same time, e-entrepreneurial is considered less risky and more straightforward to enter than traditional methods (Al Omoush *et al*., 2018). Thus, it can be assumed that EEI will be less risky, increasing self-efficacy, and ultimately increasing the EEI.

Last, self-efficacy is a vital concept in explaining outcome expectations (Lent *et al*., 1994) as well as entrepreneurial intention (Neneh, 2022). However, the hypothesis of moderating self-efficacy on the relationship between outcome expectations and EEI was rejected (p=0.192>0.05). Vietnam's culture respects the community and does not overemphasise the power of the individual. Therefore, Vietnamese students often do not have self-efficacy when talking about the outcomes they can achieve in the future. Subsequent studies must examine and interpret this unexpected result in multiple contexts to better understand this moderating relationship's influence.

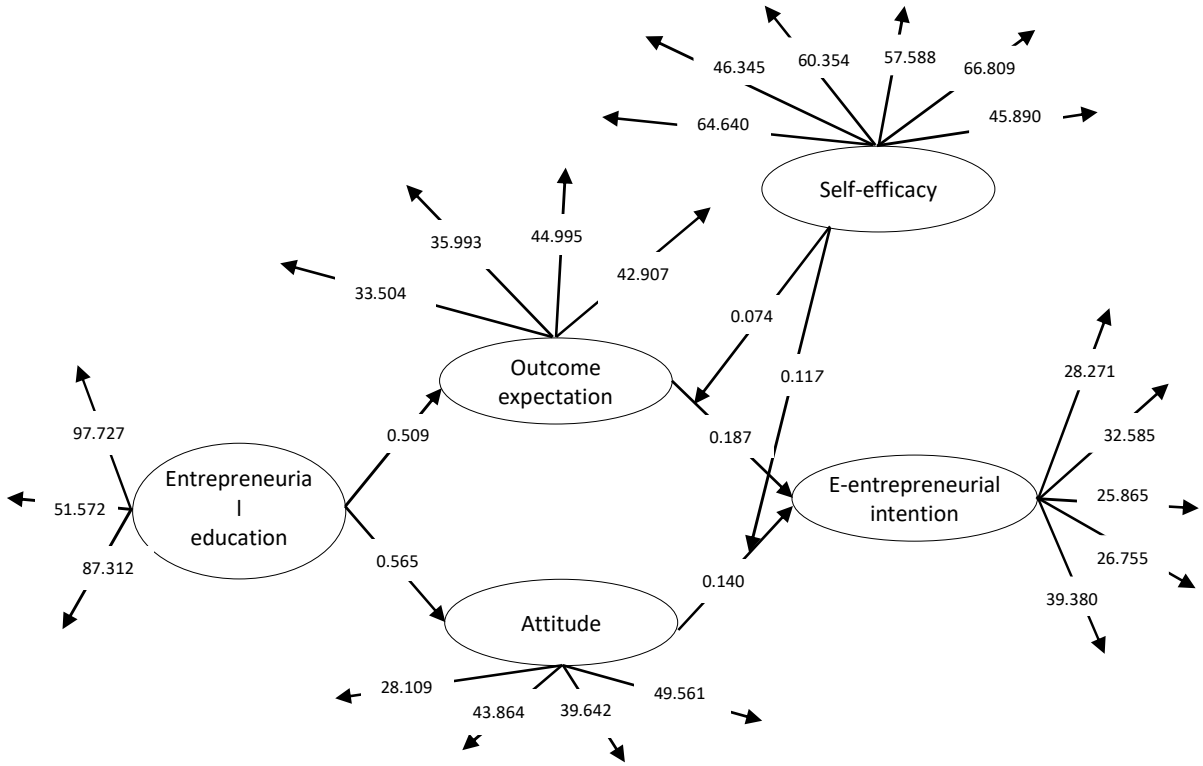

Figure 2. Analysis results
Source: own elaboration.

CONCLUSIONS

Our research results highlighted that entrepreneurship education strongly impacts students' intention to be entrepreneurial. According to Wach and Wojciechowski (2016), building an appropriate education system to stimulate entrepreneurship plays an important role in the economy. Therefore, universities must focus on combining theoretical equipment and practical student skills. In addition to transmitting existing knowledge, universities also need to pay attention to creating activities that stimulate creative thinking in students.

Outcome expectations directly influence the formation of EEI. Universities need to understand students' expectations of e-entrepreneurship. It is the basis for effective expectation management (Wardana *et al*., 2020). Besides, attitude also predicts EEI. Specifically, most respondents confirmed that they would have the e-entrepreneurial starting as soon as they had the opportunity. Therefore, universities must strengthen connections with businesses and organisations that support start-ups so that students are more aware of e-entrepreneurship and the benefits of this behaviour.

In this study, self-efficacy was considered the critical point of the intersection of SCT and TPB. Moreover, this study also identified a moderating role of self-efficacy in the formation of e-entrepreneurial intention, in addition to other roles discovered in previous studies such as direct effects (Alzamel *et al.*, 2020) or mediate effects (Batool *et al.*, 2015). This shows that to improve students'

attitudes towards e-entrepreneurship, the university needs to help students to have strong self-efficacy. Starting an e-business is not easy (Mahajan & Venkatesh, 2000), thus, universities must better prepare learners with the knowledge and expertise to control their EEIs. In addition, students must be helped to realise their abilities truly. Therefore, universities must combine theory and practice for students to use their skills more effectively.

The article examined the relationship between entrepreneurial education, outcome expectations, attitudes, and self-efficacy towards EEI. The research results contribute to an incomplete theoretical system of e-entrepreneurial meaning. Besides, universities can apply research results to promote EEI among students. Although there were essential contributions in both practice and theory, the research still faces certain limitations. Firstly, the scope of the study was confined to Ho Chi Minh City, leading to a decrease in representativeness. Besides, the study was not able to test for differences in cultural factors (Wardana *et al*., 2021) or geographical factors (Hatak *et al.,* 2015).

Secondly, the direct relationship between entrepreneurial education and EEI was not examined. Entrepreneurial education is considered the predictor of entrepreneurial intention (Zhang *et al*., 2014). Its role is also demonstrated by Soomro and Shah (2022). Therefore, future studies should also consider this relationship. Thirdly, the relationship between working environment factors and each person's individuality was not clearly shown. Environmental factors in research on entrepreneurial intention are often considered perceived social support (Neneh, 2022) or institutional environment (Díaz-Casero *et al*., 2012). Future studies may consider testing a better research model that combines subjective and contextual factors. Finally, the survey used the convenience sampling method for collecting data, so the common variance bias may happen, and whether the participant was correct or not was not checked. Further studies should use probabilistic sampling methods to improve the test's reliability.

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Eco-innovation in the European Union: Challenges for catching-up economies

Agnieszka Hajdukiewicz, Bożena Pera

ABSTRACT

Objective: The objective of the article is to examine the eco-innovation performance of the EU countries measured by the Eco-Innovation Index and identify the key areas for improvement for the EU members with relatively low scores.

Research Design & Methods: The research methods include the literature study, the analysis of documents, and the comparative analysis of statistical data collected from the eco-innovation scoreboard database with the use of descriptive statistics, correlation index, and cluster analysis. The comparative analysis covered selected eco-innovation indicators and sub-indicators for nine catching-up economies compared to the leading countries and the EU average.

Findings: The results show that despite the fact that almost all economies from the group of catching-up eco-innovators made progress in terms of their overall eco-innovation performance, albeit they were unable to significantly reduce the innovation gap between them, and the leading countries and their classification based on relative results remained unchanged in the recent decade. This suggests that more effort, focused especially on specific thematic areas, is needed for these countries to make bigger progress and to move up to the average eco-innovation performers and even to the leading eco-innovators. The strongest correlation between the value of the Eco-Innovation Index and the value of a given subindex suggests that the main areas for improvement are: total R&D personnel and researchers, eco-innovation-related patents, energy productivity and implementation of sustainable products among SMEs, but all of the areas covered by subsequent subindexes need attention.

Implications & Recommendations: Taking into consideration the fact that eco-innovations are important tools for achieving sustainable development goals, the results of the study may provide important guidance for policy-makers in the area of innovation policy and sustainable development, especially in economies classified as 'catching up with eco-innovation.'

Contribution & Value Added: By focusing on the eco-innovation gap between the countries leading in this respect and those catching up, we have identified the key areas that require significant improvement, looking from the perspective of countries currently achieving relatively weak results in individual dimensions of eco-innovation and striving to improve their innovation performance.

Article type:	research article
Keywords:	eco-innovation; Eco-Innovation Index; the European Union; catching-up eco-innovators; eco-innovation inputs; eco-innovation activities; environmental protection
JEL codes:	O30, Q01, P47

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INTRODUCTION

Innovation is the main and increasing source of growth and development for national and regional economies. A specific type of innovation, which is eco-innovation, currently plays a key role in transforming societies towards sustainable development, combining reduced negative impact on the environment with a positive impact on the economy and society (European Commission, 2011; Piwowar-

Sulej & Podsiadły, 2022). Innovation in general and eco-innovation, in particular, contribute to the achievement of Agenda 2030 Sustainable Development Goals, not only by being one of the three aspects of sustainable development (together with infrastructure and industry) explicitly mentioned the SDG 9, but also through providing scientific and technological solutions to the challenges posed by other SDGs (United Nations, 2015). At the same time, many researchers point to the link between innovation and the competitiveness of economies, arguing that innovations are a way to enhance competitiveness, as they enable enterprises to adapt quickly to the pace of the technological change and to market trends (Ervits, 2020; Wach & Głodowska, 2022; Apostu & Gigauri, 2023), in order to gain a competitive advantage and increase competitiveness (Ciocanel & Pavelescu, 2015; Sułkowski & Stopczyński, 2018; Naglova *et al.*, 2017). Eco-innovation, as one of the leading areas of innovation, is an important path to increasing the competitiveness of economies and ensuring more sustainable development (Chmielewska & Sławiński, 2021; Richterova *et al*., 2021a; Urbaniec, 2015; Doyle & Perez-Alaniz, 2017). Therefore, the issue of eco-innovation has aroused great interest in recent years and is often taken up by researchers and taken into account by politicians in their decision-making processes.

Eco-innovation potential must be addressed at the global, regional, national, and local levels, it is also at the heart of the European Union's policies. In order to properly shape the policy in this area, it is necessary to measure the level of innovation, while taking into account its various determinants. Measuring multiple dimensions of eco-innovation performance of the EU countries using the methodology of Eco-Innovation Index (EII), allows us to better understand its key trends of eco-innovation and main drivers. It helps to build up a better picture of the necessary framework conditions creating eco-innovation. It also reveals the gap between the leading eco-innovators and the countries lagging behind in terms of eco-innovativeness (Al-Ajlani *et al*., 2021), which may be a starting point for the latter to achieve improvement in this area.

The objective of the article is to examine the eco-innovation performance of the EU countries measured by the Eco-Innovation Index and identify the key areas for improvement for the EU member states classified as 'catching up with eco-innovation.'

Taking into account various aspects of eco-innovation activity, we formulated the following research questions:

RQ1: What are the latest results of eco-innovation performance in the catching-up EU countries in comparison with the EU average and with the European countries leading in terms of eco-innovation?

RQ2: Does the gap between leading and catching-up countries in terms of eco-innovation tend to narrow or increase?

RQ3: In what areas of eco-innovation performance have the catching-up countries achieved relative improvement in recent years, and in what areas do they need more effort to make progress?

By attempting to provide answers to the above questions, our study was expected to contribute to the research problem, through focusing on the specific problems of countries with a lower level of eco-innovativeness and revealing the scale of the challenges, but also the opportunities for these countries related to creating conditions for the development of eco-innovations. We believe that the results of the study may provide important guidance for policymakers in the area of innovation policy and sustainable development, especially in economies that strive to improve innovation performance. It should also contribute to a better understanding of the role of innovation, and in particular eco-innovation in ensuring sustainable development, by business and broader society.

LITERATURE REVIEW

Eco-innovations contribute to mitigating the negative effects of economic growth on the environment, thus playing a crucial role in building a sustainable economy. The concept of eco-innovation addresses a reduction in negative environmental impacts and the more efficient use of resources (Horbach, 2019; Urbaniec, 2018). Eco-innovation can be considered a category of innovation, located at the junction of innovation policy and environmental protection policy, combining innovation and sustainable devel-

opment (Barbieri *et al*., 2016; Horbach & Reif, 2018; Richterová *et al.,* 2021b; Androniceanu & Sabie, 2022). At the same time, eco-innovation is an integral part of the concept of eco-entrepreneurship, allowing enterprises to generate revenue by solving environmental problems.

One of the first definitions of eco-innovation was proposed by Fussler and James (1996), for whom it is 'new products and processes which provide customer and business value but significantly decrease environmental impacts' (as cited in James, 1997, p. 53). Any such innovation contributes to sustainable development by commercially applying knowledge to engender direct or indirect environmental improvements.

Rennings (2000) broadly defines eco-innovation as '[a]ll efforts from relevant actors that introduce, develop, and apply new ideas, behaviours, products and processes and contribute to reducing environmental burdens or ecologically specified sustainability targets' (p. 322). According to the author, the distinctive feature of eco-innovation as compared to innovation in general is a concern about the direction and content of progress, in particular concern about whether innovation leads to the mitigation or resolution of an environmental problem (Musaev *et al*., 2023; Tran, 2022).

Andersen (2008) argues that eco-innovations are 'innovations which are able to attract green rents on the market' (p. 5). For Kainrath (2011) eco-innovation is one of the three subconcepts of ecopreneurship, along with eco-opportunities and eco-commitment. An ecopreneurial rent arises from the exploitation of an eco-opportunity, often through creating and implementing eco-innovations. The eco-commited ecopreneur, who first seizes a new opportunity, not only achieves entrepreneurial rents because of the lack of competition, but also alleviates an environmental burden (Dean & McMullen, 2007).

Eco-innovation can also be understood more comprehensively as an entrepreneurial procedure, covering the stage of product design and integrated management throughout its life cycle, which affects pro-ecological modernization of the economy and society by taking into account environmental problems and laws when developing products and the related processes (Kemp & Pearson, 2007; Sobczak, Głuszczuk, & Raszkowski, 2022). Environmental innovation leads to integrated solutions whose aim is to reduce resource and energy inputs while improving the quality of a product or service.

Due to their importance in ensuring sustainable development (Kowalska & Bieniek, 2022), issues related to eco-innovation are of interest to both EU institutions and international organisations. The EU's *Competitiveness and Innovation Framework Programme 2007-2013* (CIP), announced in 2007, defines eco-innovation as 'any form of innovation aiming at significant and demonstrable progress towards the goal of sustainable development, through reducing impacts on the environment or achieving a more efficient and responsible use of resources, including energy (European Parliament & Council, 2006, p. 17).

There are many ways to create innovations, including ecological innovations. The basic types of eco-innovation distinguished in the literature include:

– product innovation: the creation or implementation of new or significantly improved products (goods and services) with the main aim to reduce negative environmental impacts. This goal can be achieved, for example, by minimising material intensity throughout the product life cycle, increasing the possibility of repairing or remanufacturing products, increasing the share of recyclable materials, etc.;

– process innovation: the use of more environmentally friendly production methods, including methods of product delivery. It can lead to the reduction of negative impacts on the environment through, *e.g.,* cutting down the emission of pollutants like greenhouse gases (GHGs) that cause climate change, the reduction of electricity consumption, noise, or the use of materials and raw materials;

– organisational innovation: implementation of new organisational structures, advanced management techniques or new or substantially changed corporate strategic orientations to manage the environmental aspects of processes and products.

– marketing innovation: new marketing activities involving significant changes in product positioning, promotion, distribution, or pricing policy in accordance with the principles of green

marketing. The overarching goal in this case is to look for ways to encourage customers to purchase, use, or implement eco-innovations (Sarkar, 2013; Nnaji & Igbuku, 2019).

A broad approach to the eco-innovation concept was proposed by Kemp and Pearson (2007). The authors understand innovation as assimilation or exploitation of a product, production process, service or management or business method that it is novel to the firm or user and argue that eco-innovation includes not only innovation aimed at reducing environmental impacts, but also cases where innovation leads to a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use), without this being an explicit aim. In that sense, general innovations which have positive environmental effects are also counted as eco-innovations. Similarly, according to Sarkar (2013), eco-innovations can be divided into two categories: environmental innovations and non-environmental innovations. In terms of sustainable development, environmental innovations have gained particular importance.

Scarpellini, Valero-Gil, and Portillo-Tarragona (2016) provided an overview of different contributions to the theoretical background of eco-innovations. The researchers assumed that the eco-innovation can be defined taking into account various research perspectives: methodology and measurement, business strategy and firms' setting approach, and innovative projects.

An extended typology of eco-innovation has been proposed by Andersen (2008), which reflects the diverse roles of eco-innovation in 'greening' the market. On this basis, the author distinguishes five types of eco-innovation: (i) add-on eco-innovations; (ii) integrated eco-innovations; (iii) alternative product eco-innovations; (iv) macro-organisational eco-innovations; (v) general-purpose eco-innovations.

Obviously, eco-innovation includes not only the latest technological developments that can make a significant contribution to sustainable development, but also all environmentally friendly ideas and innovations of a non-technological nature (Hazarika & Zhang, 2019; Arranz *et al*., 2020; Zaušková & Rezníčková, 2020).

An organisation characterised by eco-innovation can create and implement innovation, taking into account macro and microenvironment factors and trends and internal organisational determinants (Rodríguez-Rebés, Navío-Marco, & Ibar-Alonso, 2021). Companies can be eco-innovative and pursue sustainable development goals in various ways. They can undertake activities aimed at making profit from pro-environmental activities, such as recycling and waste disposal, contaminated land reclamation, pollution control, water management, environmental consulting services, or organic farming. This is the business model specific to green entrepreneurs who have high environmental awareness and strong eco-commitment and often operate in the sector of environmental protection. They can often exploit eco-opportunities that others don't see or perceive as marginal or uninteresting and this can lead to more radical innovations. However, companies from other sectors can also exploit eco-opportunities by introducing eco-innovations. Thus, whilst striving for better eco-efficiency of goods produced or services offered, they are simultaneously focused on reducing the use of environmental resources or reducing their negative impact on the environment. The activities of this group can also contribute significantly and at the same time profitably to sustainable development goals. This is also the case when the motive for their eco-investment activity is only the pursuit of compliance with the provisions of environmental law or principles, or the desire to minimize costs that may be caused by the deterioration of the company's image, which may be arising from disregarding environmental concerns (Kainrath, 2011).

The improvement of innovation performance of companies leads to increasing of national competitiveness (Ciocanel & Pavelescu, 2015; Świadek *et al.,* 2022) and to ensuring progress towards sustainable development. At a European level, investing in eco-innovation is considered essential to ensure Europe's global leadership in creating a resource-efficient society. The EU's 8th Environment Action Programme represents the determination of the EU to accelerate the green transition and it also includes a framework of 34 'enabling conditions' for achieving the European Green Deal's objectives, with the Eco-Innovation Index (measuring Member States' performance in terms of eco-innovation compared to EU average (EU = 100) and trend) being one of them (European Commission, 2022a, p. 7).

Eco-innovation is considered a powerful instrument to protect the environment with a positive impact on the economy and society and is at the core of various European policies. At the same time, a

number of studies reveal a clear divergence in the European Union, in terms of overall innovation performance and eco-innovation performance of its member states (Sobczak, Głuszczuk, & Raszkowski, 2022; Al-Ajlani *et al*., 2021; Ostraszewska & Tylec, 2019). To a great extent, performance factors, like business innovations and business sophistication depend on institutional environment for innovations development, including eco-innovations support within social responsibility programs (Oliinyk *et al.,* 2023). The positive effect of the responsible institutional surrounding can be observed in support of eco-innovations in certain business activities, like social entrepreneurship (Okuneviciute Neverauskiene & Pranskeviciute, 2021) or agriculture with the attempts to mitigate the environmental threats (Piwowar, 2020). Based on the eco-innovation performance of the EU countries measured by the Eco-Innovation Index, the EU member states were divided into three equally sized performance groups: the Eco-Innovation Leaders (the top-9 EU countries), the average eco-innovation performers (the 10th to 18th ranked countries), and the countries catching-up with eco-innovation (the 19th to 27th ranked countries) (European Commission, 2022b). There is a commitment in the European Union towards reducing the persistent innovation gap between the eco-innovation leaders and the countries catching-up with eco-innovation. Unlocking excellence in countries lagging behind can boost competitiveness and increase the rate of economic growth in the entire European Union (Andronicean & Georgescu, 2023). However, this requires greater involvement both at the level of the EU and individual Member States and the use of special measures. It also requires continuous monitoring of progress on eco-innovation performance as well as improvement of methods for measuring eco-innovativeness and identifying areas requiring improvement, which is an important and current task for researchers dealing with this subject.

RESEARCH METHODOLOGY

The objective of the study was to examine the eco-innovation performance of the EU countries measured by the Eco-Innovation Index and identify the key areas for improvement for the EU members with a relatively low score.

The quantitative approach was applied to examine the mentioned problem and provide answers to research questions. The analysis was based on statistical data collected from the Eco-innovation Scoreboard and European Innovation Scoreboard databases. The spatial scope of the research covered all EU Member States, although the analysis focused primarily on the category of nine countries 'catching up with eco-innovation,' which include Bulgaria, Croatia, Cyprus, Hungary, Lithuania, Malta, Poland, Romania, and Slovakia. The analysis period covered the period from 2012 (the end of the financial crisis in the EU) to 2021 (the last year of availability of data before the EII structure changes). The addressed gap between the studied groups of countries needs to be observed over a long-term period.

We used descriptive statistics, Pearson correlation coefficient, Euclidean distance, and Ward's agglomerative hierarchical clustering method to achieve the article's goal. Descriptive statistics were applied to characterize the featured groups of EU countries and indicate the existing disparities between them and their intra-group variation. We adopted the division of countries into groups proposed by the European Commission and conducted analysis based on their performance recorded in the European eco-innovation scoreboard 2021. Euclidean distance was used to determine the gap between the EU-27 average score, EU Eco-Innovation Leaders group and the catching-up countries. To track the progress, compare the results of Member States, and classify them according to their achievements in terms of eco-innovation, the value of the summary Eco-Innovation Index and its 16 sub-indicators aggregated in five composite indicators were analysed. The thematic areas include: 1) eco-innovation inputs; 2) eco-innovation activities; 3) eco-innovation outputs; 4) eco-innovation resource efficiency outcomes; 5) eco-innovation socio-economic outcomes (Table 1).

In order to identify factors that can reduce the gap between the eco-innovation performance between the catching-up countries and the rest of the EU, special attention was paid to data on two indicators that are more related to base conditions and efforts (rather than to results) of eco-innovation:

- Eco-innovation inputs that comprise investments (financial or human resources) aiming to trigger eco-innovation activities;

– Eco-innovation activities include indicators to monitor the scope and scale of eco-innovation efforts and activities undertaken by companies.

Table 1. The indicators and sub-indicators of the summary Eco-Innovation Index

Composite Indicator	Subindicator
1. Eco-innovation inputs	1.1. Government's environmental and energy R&D appropriations and outlays
	1.2. Total R&D personnel and researchers
	1.3. Total value of green early-stage investments
2. Eco-innovation activities	2.1. Implementation of resource efficiency actions among SMEs
	2.2. Implementation of sustainable products among SMEs
	2.3. Number of ISO 14001 certificates
3. Eco-innovation outputs	3.1. Eco-innovation-related patents
	3.2. Eco-innovation-related academic publications
	3.3. Eco-innovation-related media coverage
4. Resource efficiency outcomes	4.1. Material productivity
	4.2. Water productivity
	4.3. Energy productivity
	4.4. GHG (Greenhouse gases) emissions productivity
5. Socio-economic outcomes	5.1. Exports of environmental goods and service sector
	5.2. Employment in environmental protection and resource management activities
	5.3. Value added in environmental protection and resource management activities

Source: European Commission 2022.

The compound average change for each catching-up innovator was calculated for both selected composite indicators. Our benchmarks were: average EU-27 score and the results of the eco-innovation leaders. We also used Ward's hierarchical agglomerative clustering method to identify among all EU-27 groups of countries that are similar in the score of the sub-indices of the Eco-innovation inputs and Eco-innovation activities (Mongi *et al.,* 2019). Applying this method can provide more relevant results and information about dissimilarities and relations between the analysed objects (Kula & Ünlü, 2019). Then the Pearson correlation analysis was applied. This coefficient is known as the best method of measuring the statistical relationship, or association between two variables. We applied the Pearson correlation analysis to examine the direction of the relationship and magnitude of the correlation between certain indicators and sub-indicators of Eco-innovation and Summary Innovation Indexes. It makes it possible to identify the challenges and drivers for national policies in the EU Member States. We have included European Innovation Index and the Eco-Innovation Index, as both indicators are linked in terms of achievement of long-term sustainability and indicate the relative strengths and weaknesses of particular EU countries striving for improvement in their innovation systems.

RESULTS AND DISCUSSION

Adopting the division of the EU Member States into three equally sized groups (segments) in terms of their green innovation performance, we analysed their intragroup variation and intergroup differentiation according to the value of the Eco-Innovation Index in 2012-2021.

The results of the calculation of descriptive statistics point to the moderate shifts in Eco-Innovation Indexes for both the EU and the selected groups: leader countries, average-performance countries, and catching-up countries. Analysing the changes in values of the mean for the considered groups of countries, the improvement in the situation in eco-innovation can be recorded in the study period. There was no increase in the average value of the EII between 2016 and 2017 in any of the surveyed country groups. The lack of progress in the EII was also noticed in the EU-catching-up countries between 2018 and 2020. The most homogenous group consisted of EU-average performance countries, unlike the most heterogeneous group was EU-catching up countries. However, since 2018 there has

Table 2. Eco-Innovation Index of EU-27 and by country groups in 2012-2021

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
EU-27										
Mean	0.389	0.394	0.408	0.414	0.424	0.424	0.433	0.441	0.447	0.462
Median	0.359	0.376	0.396	0.391	0.408	0.421	0.431	0.430	0.456	0.468
Minimum	0.132	0.129	0.140	0.149	0.141	0.144	0.179	0.184	0.207	0.216
Maximum	0.639	0.649	0.695	0.686	0.697	0.674	0.673	0.709	0.701	0.734
Lower (First) Quartile	0.284	0.291	0.303	0.312	0.327	0.332	0.342	0.343	0.335	0.351
Upper (Third) Quartile	0.473	0.474	0.483	0.482	0.496	0.496	0.497	0.519	0.535	0.546
Range	0.507	0.521	0.555	0.537	0.557	0.530	0.495	0.525	0.494	0.518
Standard Deviation	0.135	0.139	0.143	0.138	0.137	0.136	0.131	0.134	0.136	0.135
Coefficient of variation (%)	34.81	35.35	34.97	33.35	32.31	32.05	30.31	30.42	30.33	29.23
Skewness	0.454	0.445	0.530	0.451	0.302	0.316	0.337	0.389	0.186	0.128
EU eco-innovation leaders group										
Mean	0.544	0.555	0.573	0.569	0.576	0.575	0.580	0.593	0.598	0.611
Median	0.586	0.588	0.597	0.597	0.595	0.605	0.607	0.607	0.606	0.611
Minimum	0.416	0.445	0.457	0.450	0.464	0.456	0.462	0.472	0.509	0.535
Maximum	0.639	0.649	0.695	0.686	0.697	0.674	0.673	0.709	0.701	0.734
Lower (First) Quartile	0.473	0.474	0.483	0.482	0.496	0.496	0.497	0.519	0.535	0.547
Upper (Third) Quartile	0.624	0.642	0.662	0.660	0.645	0.652	0.660	0.667	0.657	0.647
Range	0.223	0.204	0.238	0.237	0.233	0.217	0.211	0.237	0.193	0.199
Standard Deviation	0.088	0.087	0.095	0.093	0.088	0.088	0.083	0.084	0.071	0.069
Coefficient of variation (%)	16.14	15.65	16.55	16.31	15.26	15.36	14.30	14.20	11.93	11.30
Skewness	-0.324	-0.158	0.020	0.046	0.008	-0.148	-0.278	-0.024	0.025	0.488
EU average eco-innovation performers group										
Mean	0.361	0.368	0.375	0.389	0.405	0.404	0.416	0.423	0.444	0.463
Median	0.359	0.376	0.396	0.391	0.408	0.421	0.431	0.430	0.456	0.468
Minimum	0.284	0.298	0.297	0.317	0.327	0.332	0.342	0.363	0.371	0.389
Maximum	0.430	0.424	0.439	0.455	0.464	0.463	0.477	0.483	0.515	0.533
Lower (First) Quartile	0.339	0.341	0.340	0.355	0.382	0.353	0.389	0.398	0.413	0.439
Upper (Third) Quartile	0.397	0.397	0.403	0.430	0.440	0.444	0.435	0.447	0.468	0.487
Range	0.147	0.125	0.143	0.139	0.137	0.131	0.135	0.120	0.143	0.144
Standard Deviation	0.043	0.040	0.046	0.049	0.043	0.049	0.046	0.039	0.047	0.043
Coefficient of variation (%)	12.01	10.86	12.26	12.60	10.73	12.14	11.14	9.10	10.57	9.26
Skewness	-0.145	-0.346	-0.377	0.030	-0.415	-0.334	-0.274	-0.248	-0.194	-0.205
EU catching-up countries										
Mean	0.262	0.260	0.278	0.284	0.291	0.294	0.304	0.307	0.299	0.313
Median	0.282	0.259	0.298	0.296	0.298	0.299	0.315	0.330	0.300	0.305
Minimum	0.132	0.129	0.140	0.149	0.141	0.144	0.179	0.184	0.207	0.216
Maximum	0.357	0.347	0.361	0.372	0.369	0.370	0.368	0.368	0.364	0.378
Lower (First) Quartile	0.237	0.246	0.236	0.255	0.258	0.259	0.277	0.271	0.281	0.288
Upper (Third) Quartile	0.285	0.291	0.312	0.312	0.338	0.332	0.350	0.343	0.335	0.351
Range	0.225	0.219	0.221	0.223	0.228	0.226	0.189	0.184	0.158	0.162
Standard Deviation	0.064	0.062	0.066	0.066	0.072	0.070	0.060	0.057	0.049	0.052
Coefficient of variation (%)	24.38	23.71	23.91	23.37	24.62	23.75	19.82	18.71	16.42	16.61
Skewness	-0.776	-1.027	-1.055	-0.813	-1.057	-1.197	-1.057	-1.302	-0.503	-0.530

Source: own study.

been a significant diversity reduction in the presented group of countries. The diversity of the EU-27 was on the average level and also decreased over the study time. Moreover, at least half of the countries in this group had an EII value of 0.282 in 2012, peaking at 0.330 in 2019 and slightly lower at 0.305 in 2021. In comparison, in the case of countries with average performance, at least half of the countries within this group achieved an EII value of 0.359 in 2012 and 0.468 in 2021. For one in four countries

classified in the catching-up group, the EII value was at or below 0.237 in 2012 and 0.288 in 2021. In addition, in the analysed group of countries, only 25% achieved an EII value at or above 0.285 in 2012, which increased to 0.351 in 2021. Except for 2014 and 2017-2019, when 6 out of 9 countries recorded EII values above the group average, five countries obtained higher than average group values in the remaining years. A similar direction of asymmetry was recorded for EU-average performance countries (except in 2015) and in 2012-2013 and 2017-2019 for EU leaders (Table 2).

Figure 1 shows that the Eco-innovation Index values of individual countries that are catching up with eco-innovation were characterized by high volatility in the analysed period, with most of them improving their eco-innovation performance. Lithuania, Cyprus, Hungary, and Bulgaria recorded the biggest improvement between 2012 and 2020. The smallest increase was observed in the case of Malta and Slovakia (Figure 1). The only country in this category and the only member of the EU for which a decrease in eco-innovation performance was identified was Romania, whose results have been deteriorating since 2017. Lithuania and Croatia achieved the best results among the countries of this group in recent years, although their EII values were still less than 80% of the EU average.

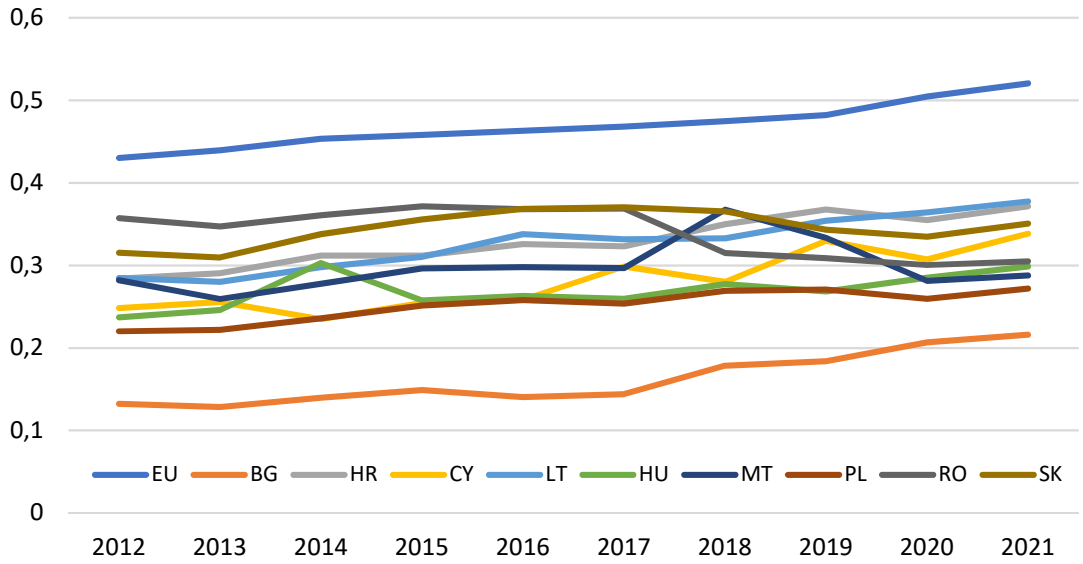

Figure 1. The value of the Summary Eco-Innovation Index*
for selected (catching-up) countries and the EU in the years 2012-2021

Note: for each year, the Eco-Innovation Index is calculated as the unweighted average of the re-scaled scores for all indicators where all indicators receive the same weight. The maximum re-scaled score is thus equal to 1 and the minimum re-scaled score is equal to 0. For positive and negative outliers, the re-scaled score is equal to 1 or 0, respectively.
Source: own elaboration based on the Eco-Innovation Index Database 2021.

Despite the improvement of the EII index by almost all catching-up countries, they did not manage to significantly reduce the distance to the other selected groups of countries. This proves more action is required to bridge the existing gap between this group and the other EU members. The achieved results correspond to the studies of Ostraszewska and Tylec (2019), Lesáková and Laco (2020), and Sobczak *et al*. (2021).

Figure 2 shows the identified gap between the catching-up countries and the eco-innovation leaders and the distance to the average EU-27 in terms of the Summary Eco-innovation index in 2012-2021.

In the study period, there were year-to-year changes in the value of the gap between the catching-up countries and the average value for EU-27 countries and eco-innovation leaders. However, it is not easy to state explicitly that the gap was decreasing. Determining the gap with the leading innovators revealed that Bulgaria, Croatia, Cyprus, and Lithuania recorded a slight gap narrowing in 2021 compared to 2012. Croatia and Lithuania were the countries with recognized narrowest gap to eco-innovation leaders among catching-up countries. The five remaining countries recorded the gap increase. The analysis shows that Bulgaria recorded the largest gap. Romania recorded the largest deterioration in the value of

EII throughout the studied period. Poland, Malta, and Hungary also recorded unfavourable changes, indicating a slight increase in the existing gap compared to the EU leader innovators. A modest narrowing of the spread between the catching-up countries as a whole group to the reference group of countries could be found. Only slightly different results were obtained by determining the gap between the EU average and the catching-up countries. Only three countries (Croatia, Cyprus, and Lithuania) recorded that the gap marginally narrowed comparing 2021 with 2012. The remaining six countries (Bulgaria, Hungary, Malta, Poland, Slovakia and Romania) increased their distance to the EU average (Figure 2).

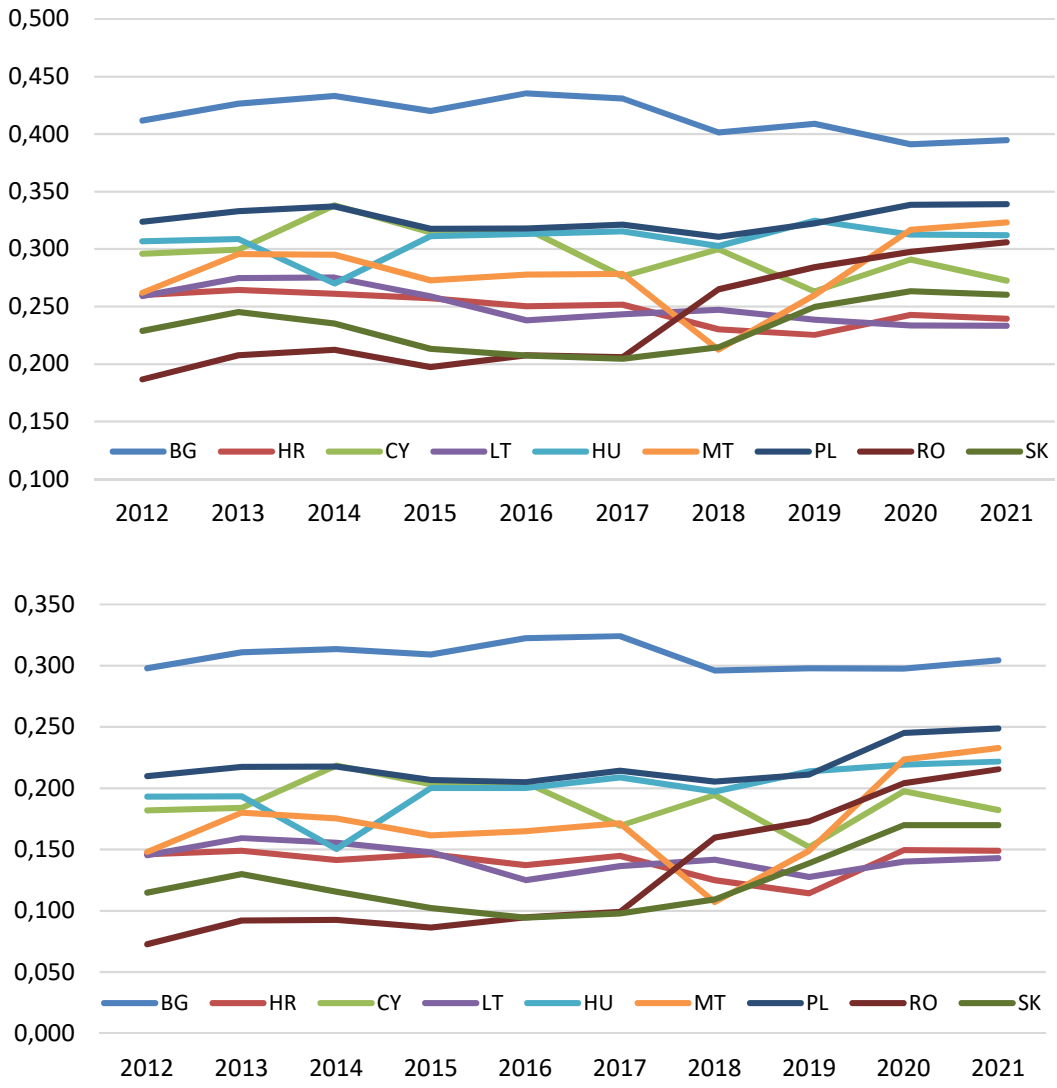

Figure 2. The gap between the catching-up countries and innovation leaders and average EU-27 in 2012-2021
Source: own elaboration based on the Eco-Innovation Index 2021 Database.

Taking into account five composite indicators, the analysis revealed that the largest gap between the results of the analysed countries, the EU average and eco-innovation leaders was in the case of Eco-Innovation Inputs. On the other hand, the narrowest gap was recorded between the catching-up countries and the EU-27 and eco-innovation leaders with respect to eco-innovation activities. A relatively small gap was identified between the study group of countries and the EU-27 average value in socio-economic outcomes (Figure 3).

We decided to take a closer look at two out the above-mentioned composite indicators, namely eco-innovation inputs and eco-innovation activities, because in our opinion the dimensions they cover seem to be of key importance for creating favourable conditions for the development of innovation in

the long term, which is particularly important for catching-up countries whose environmental protection sectors are not very developed. Their improvement should translate into better results of eco-innovation in the future. Within the composite eco-innovation inputs, the biggest difference between the analysed countries and the EU average was observed in two subindexes: 1.1. Governments environmental and energy R&D appropriations and outlays, 1.2. Total R&D personnel and researchers. The gap between the EU average as well as Eco-Innovation leaders and catching-up innovators significantly increased for the first subindex between 2012 and 2021 (Figure 4). Our results are generally in line with Horbach (2016). The eco-innovations of catching-up economies compared to eco-innovation leaders ('rich' Western European countries) are characterized among others by lower level of R&D input and the dependence on the technology transfer from the higher developed countries.

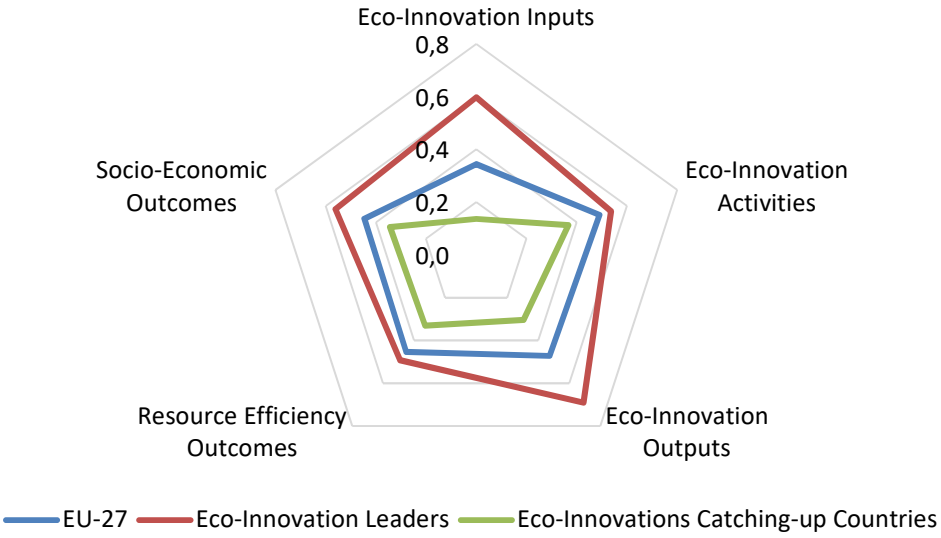

Figure 3. Composite indicators: A comparison of the EU-27, eco-Innovation leaders and catching-up innovators (based on the average value for the analysed period of 2012-2021)

Source: own elaboration based on the Eco-Innovation Index 2021 Database.

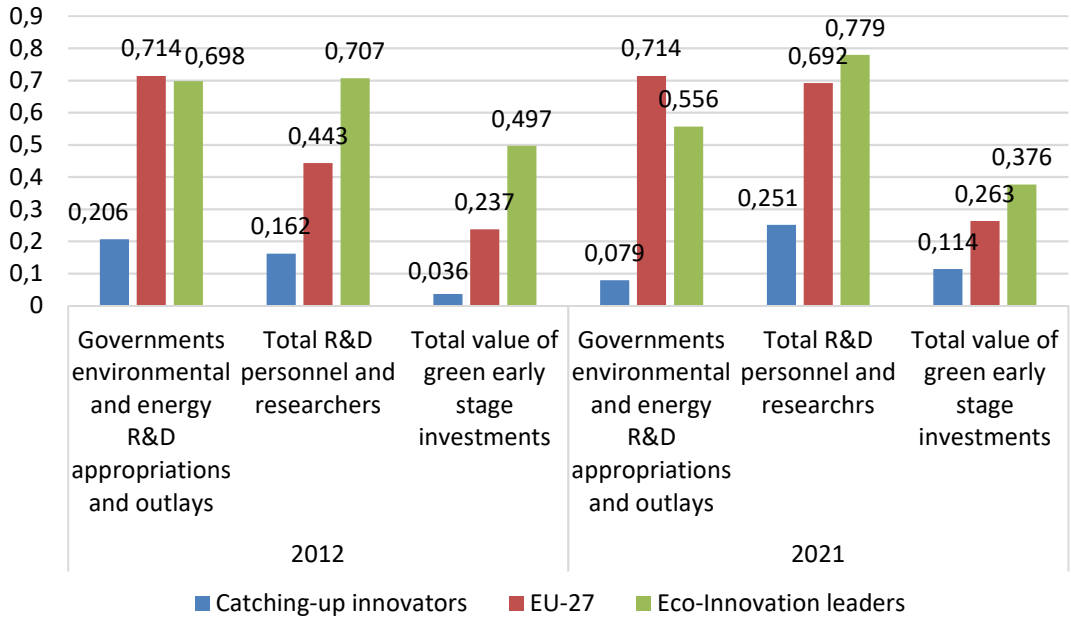

Figure 4. Eco-innovation performance of the catching-up countries in comparison with the eco-innovation leaders and EU-27 average by eco-innovation inputs sub-indicators in 2012 and 2021 (normalized values)

Source: own elaboration based on the Eco-Innovation Index 2021 Database.

Four of nine countries in the analysed group (Malta, Poland, Romania, and Slovakia) recorded a deterioration in the level of eco-innovation inputs in 2012-2021. The most undesirable changes were experienced in Romania where eco-innovation and transparency of the administrative process were visibly affected (Androniceanu, 2021). The largest improvement of this indicator occurred in the case of Cyprus. With the exception of Croatia and Hungary, for which positive changes were recorded for governments' environmental and energy R&D appropriations and outlays, a negative growth rate was seen for the rest of the countries in the study group that allocated public funds to environmental R&D. In terms of the total personnel and researchers there was a particularly positive rate of changes. Almost all the analysed countries (with exceptional of Malta and Lithuania) reported improvement in this area, *i.e.* an increase in research staff and personnel. The positive growth rate of the research personnel and researchers, as well as the value of green early investments, were achievements of almost the entire group of catching-up countries. In the case of investment, a negative rate of change was recorded for Slovakia. For the remaining countries (Bulgaria, Cyprus, and Malta), it was not possible to determine the direction of developments in this area. Comparing the differences between the catching-up group of countries and eco-innovation leaders, it could be noted that the negative changes were more turbulent and positive ones – with a higher dynamic – occurred in the study group of countries. Moreover, they did not move in the same direction in both country groups, *e.g.* early green-stage investments. The catching-up countries were characterized by a highly positive direction of change, while the eco-innovation leader countries recorded negative growth in this area. The reasons for these different patterns can be found in the different stages of market development, with more mature environmental markets in the leading countries (Table 3).

Table 3. Compound annual change in the eco-innovation inputs indicator in the catching-up countries in 2012-2021 (in%)*

Country	EU	EU_{EIL}	BG	HR	CY	LT	HU	MT	PL	RO	SK
CAC_{EIIn}	1.39	-1.18	5.26	6.78	21.46	1.59	7.35	-1.78	-3.26	-10.03	-2.01
$CAC_{1.1}$	0.00	-2.51	-	41.42	-	-7.41	8.01	-	-5.63	-14.28	-7.41
$CAC_{1.2}$	3.46	1.08	9.61	5.65	21.46	-0.40	6.81	-1.78	13.67	2.51	1.01
$CAC_{1.3}$	1.15	-3.06	-	8.55	-	12.33	8.24	-	14.00	0.29	-0.07

Note: CAC_{11} – the sub-indices were on 0 levels for the whole research period for countries BG, CY, MT. The calculation for HR was based on data from three consecutive years; CAC_{13} – the value of sub-indices for BG, CY, MT sub-indices were on 0 levels for the whole research period. The calculations for RO and SK were based on data from two consecutive years.
Source: own elaboration based on the Eco-Innovation Index 2021 Database.

Ward's hierarchical clustering method was applied to compare the level of components and similarities of the eco-innovation inputs indicator across countries. We focus only on the results obtained by the catching-up innovators. The analysed countries belonged to three clusters in 2012 and 2021. In 2012, the countries with the lowest levels of sub-indexes formed a separate cluster (Malta, Croatia, Cyprus, and Bulgaria). Poland and Romania achieved relatively similar results to Italy, Slovenia, and the Czech Republic (classified as average-performance countries). This group was characterized by a relatively high level of the governments environmental and energy R&D appropriations and outlays and low levels of the other two measures (total R&D personnel and researchers and total value of green early-stage investments). Lithuania, Slovakia and Hungary, formed a cluster together with the Netherlands and Austria (both countries are Eco-Innovation leaders). These countries were distinguished by an average level of the governments environmental and energy R&D appropriations and outlays and total R&D personnel and researchers and slightly lower total value of green early-stage investments. In 2021, there was a deterioration in the level of governments environmental and energy R&D appropriations and outlays and improvements in performance for total R&D personnel and researchers and total value of green early-stage investments, so seven of nine catching-up countries formed one cluster. Still, their achievements were the weakest with respect to these indicators. Hungary only created a cluster with countries classified as eco-innovation average innovators (Portugal, Italy, and the Czech Republic) and leaders (Spain). In these countries, the level of environmental and energy R&D appro-

priations and outlays and total R&D personnel and researchers remained at the average values compared to other EU-27 members. The green early-stage investment measure remained at a relatively low level in this group of countries. Similarly to Hungary, Lithuania formed a two-entity group with Estonia only. Both countries achieved relatively high value in the green early-stage investment but average level of total R&D personnel. Weaknesses for countries included a very low level of the governments' environmental and energy R&D appropriations and outlays (Table 4).

Table 4. Segmentation of the EU countries by eco-innovation inputs in 2012 and 2021

2012	2021
Cluster 1: {EE, SE, FR, ES, DE}	Cluster 1: {**SK,** LV, **RO**, **MT**, **CY, PL**, **HR**, **BG**}
Cluster 2: {LU, FI, DK}	Cluster 2: {EL, SI, FR, DE, SE, FI, NL, DK}
Cluster 3: {**MT**,**HR**, **CY**, **BG**}	Cluster 3: {**HU**, ES, PT, IT, CZ}
Cluster 4: {**RO**, **PL**, SI, IT, CZ}	Cluster 4: {**LT**, EE}
Cluster 5:{NL PT, **LT**, **SK**, LV, **HU**, EL,IE, AT, BE}	Cluster 5: {LU, IE, AT, BE]

Source: own elaboration based on the Eco-Innovation Index 2021 Database.

Subsequently, the analysis of the EU eco-innovation performance with respect to the second composite indicator of eco-innovation activities was carried out. The value of the implementation of resource efficiency actions among SMEs and the implementation of sustainable products among SMEs decreased in 2021 compared to 2012. The catching-up countries stood out in terms of the number of received ISO 14001 certificates on the environmental management system. Their results were better than the EU-27 average and eco-innovation leaders in this regard (Figure 5).

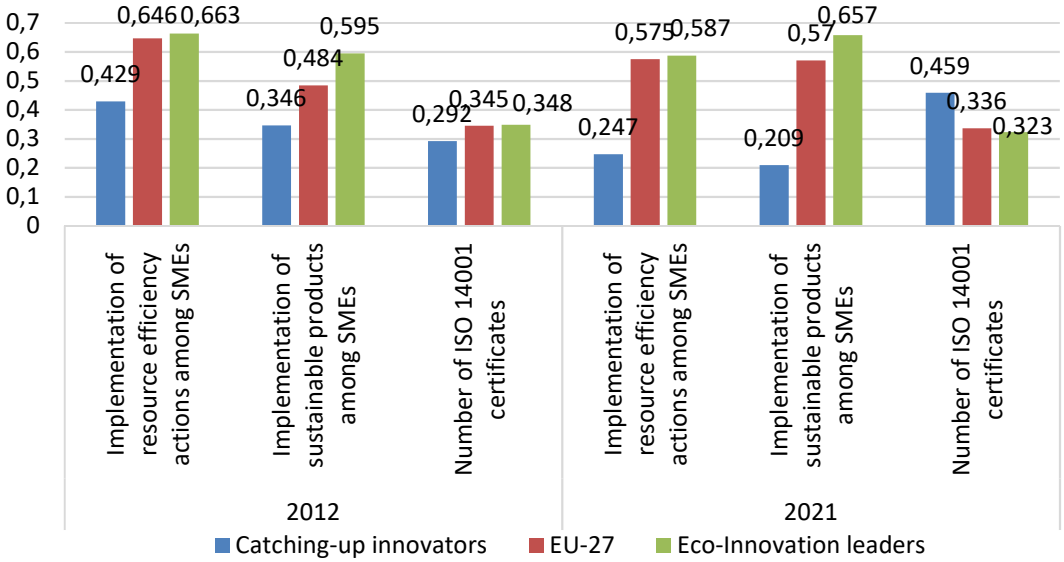

Figure 5. Eco-innovation performance of the catching-up countries in comparison with the eco-innovation leaders and EU-27 average by eco-innovation activities sub-indicators in 2012 and 2021 (normalized values)

Source: own elaboration based on the Eco-Innovation Index 2021 Database.

Five out of nine catching-up innovators experienced a significant improvement with respect to the indicator of Eco-Innovation Activities compared to the score achieved by the EU-27. The rate of change was relatively high, from min. 1.03% in the case of Poland to the max. 4.00% for Croatia. The efforts in the implementation of resource efficiency in Croatian economy were also presented in the study by Harc (2019). On the other hand, performance deterioration in the second dimension of the Eco-Innovation Index occurred for four countries. The largest decreases in the compound annual growth rate were recorded for Romania (-11,2%) and Lithuania (approximately -6%). Malta and Slovakia also recorded negative growth in this indicator. Only Cyprus and Croatia recorded a positive growth rate for the implementation of resource efficiency actions among SMEs. Poland and Hungary experienced a

positive growth rate for the second sub-index regarding the implementation of sustainable products among SMEs. In contrast the strengths of all catching-up countries, with the exception of Romania, was a relatively high score in terms of the number of ISO 14001 certificates. Very similar conclusions about the direction of change in narrowing the gap can be drawn for Malta, Poland, Cyprus, Croatia, Bulgaria, Slovakia, Hungary, and Lithuania (Table 5).

Table 5. Compound annual change of the eco-innovation activities composite indicator in 2012-2021 (in%)

Country	EU	EU_{EIL}	BG	HR	CY	LT	HU	MT	PL	RO	SK
CAC_{EIA}	0.04	0.00	2.94	4.00	1.37	-6.00	1.18	-4.37	1.03	-11.18	-3.09
$CAC_{2.1.}$	-1.29	-1.35	-14.45	0.93	8.52	-5.31	-4.45	-2.78	-1.83	-26.02	-9.09
$CAC_{2.2.}$	1.83	1.11	-3.32	-1.17	-12.52	-14.77	2.48	-10.13	1.14	-19.72	-6.08
$CAC_{2.3}$	-0.29	-0.80	10.91	15.77	20.37	2.43	4.94	52.07	22.44	-5.21	5.75

Source: own elaboration based on the Eco-Innovation Index 2021 Database.

As in the case of the composite eco-innovation inputs indicator, the analysis of the sub-indices for catching-up countries carried out using Ward's clustering method enabled the identification of similarities in terms of the achieved results. The catching-up countries were assigned to four of the five distinguished bundles. Hungary, Lithuania, Romania, Cyprus, and Bulgaria formed the largest group with three average-performance countries (Italy, Estonia, and Slovenia). The value of all sub-indexes: implementation of resource efficiency actions among SMEs, implementation of sustainable products among SMEs, and the number of certificates of ISO 14001 on environmental management systems were at the average level for all these countries. The performance in terms of eco-innovation activities put these countries on par with the selected leader innovators, such as Greece, Luxembourg, and Germany. In 2012, Slovakia was in the cluster with four countries ranked as eco-innovation leaders with respect to this indicator. Malta was assigned to a cluster with France (one of the leader countries) and Portugal and Belgium (average-performance countries). The affiliation of countries to the distinguished clusters in 2021 was significantly different compared to 2012. The catching-up countries belonged to three out of the five clusters. Romania, Lithuania, Cyprus, and Bulgaria formed a group together with Estonia (ranked to average-performance country). The results achieved by Slovakia, Hungary, and Croatia were relatively close to the objects classified as average-performance countries (Finland, Slovenia, and Italy). Moreover, Poland and Malta also formed a cluster with an average eco-innovation performance (Latvia and Greece) (Table 6).

Table 6. Segmentation of the EU countries by eco-innovation activities in 2012 and 2021

2012	2021
Cluster 1: {ES, SE, CZ}	Cluster 1: {EE, **RO**, **LT**, **CY**, **BG**}
Cluster 2: {**HU**, **LT**, **RO**, IT, EE, SI, **CY**, **BG**}	Cluster 2: {PT, AT, FR, SE, ES, IE, CZ}
Cluster 3: {LV, **HR**, **PL**, EL, LU, DE}	Cluster 3: {**SK**, **HU**, FI, SI, IT, **HR**}
Cluster 4: {**SK**, NL, IE, FI, AT, DK}	Cluster 4: {**PL**, **MT**, LV, EL}
Cluster 5: {PT, FR, BE, **MT**}	Cluster 5: {LU, DK, NL, DE, BE}

Source: own elaboration based on the Eco-Innovation Index 2021 Database.

The conducted analysis occurred in two dimensions of the eco-innovation index and revealed considerable variation among the Catching up economies. Croatia achieved the best results of all countries in the catching-up innovators in both dimensions and its gap between each group of countries was decreased. Nevertheless, all catching-up countries should focus more on activities and undertakings directed to narrow the existing gap not only on the general level, but on regulations and activities enabled the implementation of the tools and support the development of eco-innovativeness. Moreover, identifying determinants of eco-innovation can help policy-makers to develop and implement instruments which are effective and efficient in mitigating the existing gap between the leaders and catching-up countries (del Rio, Penasco, & Romero-Jordan, 2016).

The strongest correlation between the Eco-innovation Index value and the value of a given subindex was observed in the case of total R&D personnel and researchers, eco-innovation-related patents, energy productivity. This could indicate that these are the key areas for improvement for the catching-up countries, as they are more related to eco-innovation performance than others, thus requiring special attention. However, policies at EU-level and national level should also take into account other areas of eco-innovation where progress is required. Especially those related to ensuring appropriate conditions for the development of eco-innovation (composite indicators 1 and 2 with their sub-indicators). Other dimensions of eco-innovation, related to the results of innovative activity, are also crucial, because they directly determine getting economic, ecological, and social benefits from eco-innovation, and thus contribute to the increase in the competitiveness of enterprises and national economies. They can also contribute to the achievement of sustainable development goals. The improvement in those dimensions of eco-innovation, which are related to ensuring appropriate conditions for its further development, seems to be of particular importance (composite indicators 1 and 2 with their sub-indicators). Other dimensions of eco-innovation, related to the results of innovative activity, are also very important, because they directly determine the achievement of benefits from eco-innovation, of an economic, social and ecological nature, and thus contribute to the increase in the competitiveness of enterprises and national economies and to achieve the goals of sustainable development (Martin & McNeill, 2013). However, without ensuring proper input conditions for achieving progress in the field of eco-innovation, good outcomes are difficult or even impossible to obtain. For each of the catching-up countries, the most urgent actions should be identified and further research should discover the sources of existing limitations of their eco-innovation.

Table 7. The value of Pearson's correlation coefficient (r) between the EII indicators and the summary innovation indexes (EII, SII), 2012 and 2021

Subindicator	EII		SII	
	2012	2021	2012	2021
1.1. Governments environmental and energy R&D appropriations and outlays (% of GDP)	0.637***	0.564***	0.464**	0.398**
1.2. Total R&D personnel and researchers (% of total employment)	0.879***	0.842***	0.859***	0.801***
1.3. Total value of green early-stage investments (USD/capita)	0.786***	0.564***	0.724***	0.612***
2.1. Implementation of resource efficiency actions among SMEs (Score)	0.431**	0.531***	0.272	0.482**
2.2. Implementation of sustainable products among SMEs (% of surveyed firms)	0.464**	0.685***	0.493***	0.469**
2.3. Number of ISO 14001 certificates (per mln population)	0.212	-0.183	-0.041	-0.195
3.1. Eco-innovation-related patents (per mln population)	0.810***	0.783***	0.823***	0.771***
3.2. Eco-innovation-related academic publications (per mln population)	0.676***	0.543***	0.676***	0.470**
3.3. Eco-innovation-related media coverage (per mln population)	0.623***	0.657***	0.659***	0.537***
4.1. Material productivity (GDP/Domestic Material Consumption)	0.296	0.441**	0.431**	0.430**
4.2. Water productivity (GDP/total freshwater abstraction)	0.194	-0.005	0.134	0.024
4.3. Energy productivity (GDP/gross inland energy consumption)	0.627***	0.745***	0.630***	0.603***
4.4. GHG (Greenhouse gases) emissions productivity (CO2e/GDP)	0.495***	0.560***	0.434**	0.376*
5.1. Exports of environmental goods and service sector (% of total exports)	0.699***	0.562***	0.284	0.260
5.2. Employment in environmental protection and resource management activities (% of the workforce)	0.566***	0.520***	0.276	0.318
5.3. Value added in environmental protection and resource management activities (% of GDP)	0.052	0.450**	-0.233	0.249
Summary Eco-Innovation Index	1	1	0.780***	0.794***

Note: statistical significance: *** p<0.01; ** p<0.05; *p<0.1

Source: own elaboration based on the Eco-Innovation Index 2021 and European Innovation Index 2021 Database.

There was also a strong positive relationship between the Eco-Innovation Index and the Summary Innovation Index (SII), which is the main measurement tool for the research of innovation performance

of EU Member States and their innovation systems. In the case of EII sub-indicators, the highest positive correlation was recorded for: total R&D personnel and researchers, eco-innovation-related patents, the total value of green early-stage investments, and energy productivity. It is not surprising that countries that achieve good results in terms of overall innovation, measured by the SII, are also among the top countries in terms of eco-innovation, measured by EII. On the other hand, those that lag behind in overall innovation perform relatively poorly also in terms of eco-innovation. Therefore, it appears that the development of eco-innovation calls for a more integrated policy framework, including a combination of environmental, technology, innovation, and development policies and specific measures that can be implemented to promote innovation in general, and eco-innovation in particular and mitigate the barriers to innovation, considering different barriers and eco-innovation types (Del Río, Carrillo-Hermosilla, & Konnola, 2010). The eco-innovation interrelation with the other innovation was also confirmed by Arranz *et al*. (2020). The authors also highlighted the dual nature of eco-innovation as a performance and as innovation capabilities.

Figure 6 shows the strong correlation between both summary indexes, also indicating distribution of the countries based of the value of EIS and EII.

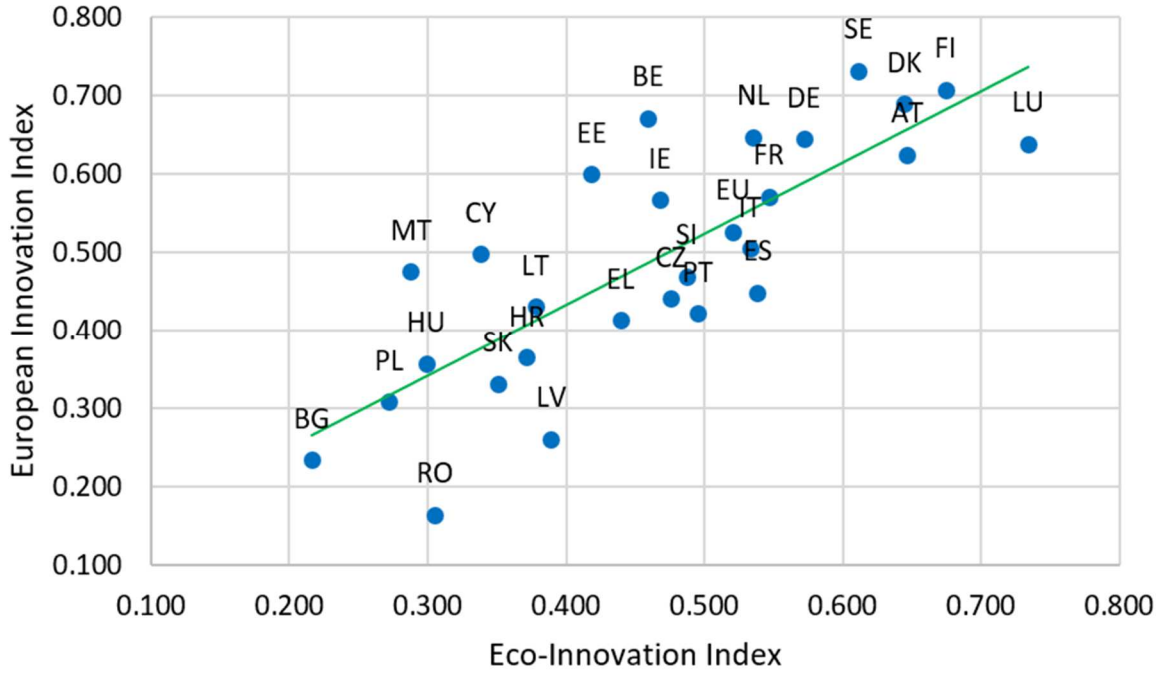

Figure 6. Comparison of the Eco-Innovation Index and the European Innovation Scoreboard by EU country (average value, 2021; normalised scores)

Source: own elaboration based on the Eco-Innovation Index 2021 and the European Innovation Index 2021 Database.

CONCLUSIONS

Eco-innovation helps the EU countries optimize their growth potential while addressing our common challenges such as climate change, resource scarcity, and declining biodiversity, thus contributing to the achievement of sustainable development goals. Eco-innovation is at the heart of various European Union's and national policies, but member countries' performance varies significantly in this regard. The study based on the Eco-Innovation Index methodology revealed that the group of countries with relatively poor innovation scores, catching up with eco-innovation, failed to significantly reduce the innovation gap to the leading countries and to get closer to the EU average, even if they made progress in several dimensions of eco-innovativeness.

This shows only partial effectiveness of pro-innovation policies in these countries and indicates the need to take action to close the innovation gap, which would allow these countries to improve their competitive position and increase the effectiveness of the implementation of sustainable development

goals and tasks. The study helped to identify areas in which improvement may allow for faster progress and upgrade to a higher category of the average eco-innovation performers and even to the leading eco-innovators. It showed that, taking into account five composite indicators, the largest gap between the results of the analysed countries, the EU average and eco-innovation leaders was in eco-innovation inputs. Investment in R&D appears to be the key area for improvements for the catching-up eco-innovators. In two of the sub-indicators of eco-innovation inputs: governments environmental and energy R&D appropriations and outlays, total R&D personnel, the biggest distance to the leaders was recorded. A stronger commitment from national governments to eco-innovation in the countries catching up with eco-innovation, is an important factor in ensuring that the positive trend in the EII index is continued in future. Moreover, the existence of strong pro-environmentally oriented SMEs can contribute to better eco-innovation performance in future. Other key drivers include eco-innovation-related patents, energy productivity and implementation of sustainable products among SMEs, which are strongly correlated with the summary EII index. However, policymakers for sustainable development should ensure that all dimensions of eco-entrepreneurship are integrated into the pursuit of the SDGs. There is a strong positive relationship between the Eco-Innovation Index and the Summary Innovation Index (SII), which indicates that eco-innovation is related to the overall innovativeness of the economy and requires the provision of conditions conducive to the development of innovation.

The limitations of our study lie mainly in its narrow scope. Using the EII index methodology, we focused exclusively on the areas of eco-innovation covered by this indicator and we conducted detailed analyses only for eco-innovation inputs and eco-innovation activities. Further research should be carried out to identify the sources of the existing barriers to eco-innovation as well as drivers of implementing a pro-environmental strategy in SMEs from an entrepreneur's perspective. Taking into consideration the fact, that eco-innovations are important instruments for achieving sustainable development goals, the results of the study may provide important guidance for policy-makers in the area of innovation policy and sustainable development, especially in economies classified as catching-up with eco-innovation. The study should also contribute to a better understanding of the role of innovation, and in particular eco-innovation in ensuring sustainable development, by business and broader society.

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The importance of grit and its influence on female entrepreneurs

Aviva Aronovitch, Carmine Gibaldi

ABSTRACT

Objective: This study aims to provide a deeper understanding of the connection between grit and its impact on female entrepreneurs.

Research Design & Methods: A qualitative research study was conducted among female entrepreneurs from different industries and life stages. The theoretical framework by Bandura of self-efficacy was used to guide and inform the study.

Findings: The key finding among all of the participants was the importance of grit, which according to them, made the ultimate difference in their success. Grit is an important construct that we should scrutinize, because it was demonstrated to have profound effects on the respondents. The narrative surrounding female entrepreneurs is often presented in regards to the challenges they face. However, it is necessary to comprehend the element regarding how women continue to be resilient in the face of adversity across every step of the entrepreneurial life-cycle from experiencing gender bias, juggling their personal lives, and professional responsibilities. There is evidence that proves the impact of grit on personal and professional endeavors, most notably entrepreneurs.

Implications & Recommendations: Further research is recommended given the importance of the study and the impact female entrepreneurs have on the global economy.

Contribution & Value Added: This study aimed to further validate the importance of this research and analyze whether when you possess grit you are able to demonstrate passion and perseverance towards your long-term goals and follow through despite adversity and setbacks. Demonstration of a North American lens and the feedback from women from different industries and life stages positively demonstrated the impact that grit had on their entrepreneurial endeavors and entrepreneurial success.

Article type: research article

Keywords: female entrepreneur; grit; entrepreneurship perseverance

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INTRODUCTION

Women-run businesses are steadily growing all over the world, which in turn contributes to the growth of many national economies as they are one of the fastest-growing segments. Women entrepreneurs are individuals or a group of women who originate, initiate, and operate a business enterprise. The World Bank has researched studies which show the impact and importance of female entrepreneurs, which have significantly contributed to economic growth, poverty decline, and job creation for both themselves and others. However, women often face social constraints which can limit and hinder their entrepreneurial endeavors and in turn restrain their growth and success due to limitations that are out of their control. The research study in question was conducted amongst a group of female entrepreneurs who were interviewed regarding their entrepreneurial journey and what they believed to be the factors which contributed to their success. The main finding amongst all of the respondents was the

correlation between grit and their entrepreneurial success. Grit can be defined as the perseverance and passion to achieve long-term goals. Often times grit is described as someone's mental toughness. Duckworth *et al.* (2010) suggest that grit is often a strong predictor of success and ability to reach goals. The correlation between female entrepreneurs and the impact of grit is significant. It is important to study it further in order to validate the importance of mindset, the ability to accept challenges as a form of redirection, and not wavering at the sight of adversity. The following paper outlines the impact of grit on female entrepreneurs, the relevant literature surrounding the importance of female entrepreneurs, the theory of self-efficacy, and the significance of further studies on this topic to enhance the current research. The objective of this study was to understand what role grit played in the participants process of becoming a female entrepreneur and how it affected their professional endeavors. The conducted study was a qualitative research study and direct interviews were conducted amongst female entrepreneurs from different industries and life stages which afforded the opportunity to understand the impact which grit possesses on individuals irrespective of the industry in which they operate and their age.

According to Huang *et al.* (2022), the continuous growth in female entrepreneurial activities is encouraging and can improve their personal development, reduce unemployment, and improve the quality of women's social life. Female entrepreneurs are one of the largest untapped resources of the economy in its current state. More women are continuing to pursue advanced education to enhance their knowledge, diversify their background, and gain greater experiences for themselves as well as other female entrepreneurs. Huang *et al.* (2022) further discovered the importance of innovativeness in correlation to self-efficacy, which was the theoretical framework used in this research study. These findings further demonstrate the importance of self-efficacy, as it can positively impact confidence, success chance, and understanding of their abilities in the long-term entrepreneurial endeavors.

LITERATURE REVIEW

While companies continue to suggest that they are committed to advancing more women into leadership, women continue to be vastly underrepresented across the boards at all levels of management. *Harvard Business Review* published an article which demonstrates that women scored higher than men in most leadership skills, however, we continue to have an absence of women within higher positions of leadership and power (Zenger & Folkman, 2019). Women are often overlooked for promotions, pay increases, and leadership potential. In part, due to not being promoted, women are left without higher earning potential and leadership roles as opposed to their counterparts (Shue, 2021). These findings further demonstrate why women tend to leave their professional careers and pursue entrepreneurial endeavors thanks to which they can control their schedule and wages and become leaders. There is a need to better understand, first, why women scored greater in terms of leadership but still continue to underperform in the workforce which results in a greater number of women focusing their efforts on developing their own endeavors and, second, what the success factors for these women truly are.

The following study utilized Bandura's theory of self-efficacy (1997) as a lens to further understand respondents' understanding of themselves and their abilities. It is commonly recognized that entrepreneurial self-efficacy can play a substantial role in understanding whether individuals choose to pursue entrepreneurial careers or act in accordance with entrepreneurial behavior (Judge & Bono, 2001). While research has looked at the idea of self-efficacy to further understand its effects, some studies have agreed that self-efficacy is area specific. For example, it could be directed towards certain behaviors or outcomes such as career or specific tasks which are consistent with Bandura's theory of self-efficacy. Entrepreneurship involves taking risks, ambiguity, creativeness and governance, nevertheless it also requires perseverance and passion. For all of these factors entrepreneurial self-efficacy is highly important and relevant (Miao, Qian, & Ma, 2017).

Grit can be rationalized as a positive non-cognitive trait which is based on an individual's perseverance of effort combined with the passion for a long-term goal or end state. To simplify, grit is the tendency to pursue long-term challenging goals with perseverance and passion. Fundamentally, grit is

courage to complete a task irrespective of the circumstances or challenges that an individual may encounter or face along their journey (Duckworth *et al.,* 2010). Caroline Miller (2017) wrote a book on what it means to 'get grit.' According to Miller, grit has several components, however, she suggested that at the root of grit is 'ikagai' which is the Japanese term for 'what I wake up for,' in other words, one's purpose for getting up in the morning and the reason to continue pursuing your endeavors. Duckworth (2010) singled out grit as the underlying reason why some people are able to succeed, and goes on to suggest that the necessary traits for developing grit, are courage, tenacity, and focus as well as mental toughness. Duckworth cites the work of Dweck (2007), a Stanford psychologist, who suggests that success can be influenced by how we think about ourselves and our abilities and explains how having a growth mindset is one of the key components to grit and becoming grittier as Duckworth (2010) describes. Individuals who possess a growth mindset have the ability to learn, develop, and achieve success. This practice demonstrates that the idea of failure to someone with a growth mindset, is looked upon as feedback rather than a setback and not a judgement of their potential and value, they do not take their failure as a personal rejection but rather a learning opportunity.

Contrary to what people might believe, Duckworth's research on grit within academia and professional success suggested that success does not solely depend on talent, but rather on focus and passion and perseverance towards goals. This further demonstrates that IQ is not a determining factor for their success. Duckworth's study further validates the importance of grit, its importance for women and their professional endeavors, and why it is unquestionably indispensable to those hoping to accomplish their goals and achieve success in their endeavors. Duckworth has focused much of her research on the fact that having a high IQ does not equate to automatic success and ability to perform well, but rather perseverance and hard work are some of the defining components of grit and something which everyone can work toward.

This study aims to uncover the journey of female entrepreneurs from different life stages and industries and what they deemed to be the underlying factors which contributed towards their entrepreneurial success. Undoubtedly, grit was one of the main research findings and the one finding which seemed to resonate the most among all of the participants. This study adopted a qualitative approach to further aid the understanding of the participants' responses and a narrative research approach was followed, as it was important to have the ability to delve deeper into the participants' responses and their journey towards their entrepreneurial endeavors. Many of the common attributes linked to success are creativity, emotional intelligence, charisma, as well as self-confidence and their link to their performance (Duckworth *et al.*, 2007). Duckworth identified the ability to deal with adverse conditions such as grit which she explained as 'working strenuously towards challenges, maintaining effort and interest over years despite failure, adversity and plateaus in progress' (Duckworth 2007, p. 1087). Duckworth's research hypothesized how the act of grit positively correlates to high achievement of success. This is not a novel finding by Duckworth, but rather many qualitative research studies going back over 100 years have found that there is evidence which suggested that grit and talent are equally correlated to high performance (Bloom, 1985; Galton, 1869; 1892).

Dweck (2008; 2009; 2010) found that grit helps individuals learn and grow, while those who lack the ability to handle adverse situations have more difficulties learning and growing. Duckworth *et al.* (2007) state that 'whereas disappointment or boredom signals to others that it is time to change trajectory and cut losses, the gritty individual stays the course' (Duckworth, 2007, p. 1088). This further suggests that the grittier the individual, the greater ability they have to endure setbacks and accept the challenges within their professional endeavors and will see their goals through, rather than look for an alternative opportunity. They do not view their setbacks as final rejections but rather redirections for something else.

The research questions which guided the study was 'How do female entrepreneurs across different industries and life stages describe their journey towards entrepreneurship and the key factors which they believe have contributed to their entrepreneurial success?' And, 'What does their personal journey reveal about the influences which have informed their entrepreneurial development?'

Bandura's (1997) theory of self-efficacy was used as the foundation for the study, entrepreneurial self-efficacy was used as a lens through which we viewed and understood the study and its research

findings and further recognized the research investigation of the journey of female entrepreneurs. According to Bandura's theory of self-efficacy, one's belief in their ability to influence events has a greater ability to affect one's life and ultimately can alter the way these events are experienced. Self-efficacy is fundamentally the optimistic belief in oneself, one's competencies and chances of accomplishing a goal or task and producing a favorable outcome (Bandura, 1997). Bandura's theory of self-efficacy (1997) was chosen as the theoretical framework to guide this study partially because our belief in ourselves first and foremost has shown to have an impact on our success and that if we have the ability to believe in ourselves we have a greater chance of success, as we are in control of our thoughts, ideas, and because we are able to control our mindset to think more positively we find ourselves in a position that is more favorable for us.

RESEARCH METHODOLOGY

The methodology followed during the study was a narrative research approach. The narrative approach was chosen for the study, because everyone has different experiences and interactions in their day-to-day lives, as well as with themselves and all of these interactions are woven together which creates unique experiences that can become meaningful on an individual level. These experiences can become meaningful through a story, such as a narrative. This is also an important component of the analysis for the interviews, as sharing the participants' stories offered a more personal viewpoint thanks to which others can relate to the issue on a more meaningful and deeper level.

The research study adopted a qualitative approach to help better understand the experience of the participants in greater detail. Qualitative research was chosen for the study, because it tends to yield a more meaningful response when shared with others and creates meaning and uses the researcher as the primary instrument for the study. The data collection and analysis process adopted, first, an inductive approach to help draw conclusions by beginning with a specific idea and then more general data, and second, a deductive approach, which helps to further develop a hypothesis based on an existing theory. This approach was central to the study, as the participants were all female entrepreneurs and their experiences and personal stories guided and developed the findings for the data collection process, as each of their experiences was unique to them.

The interview questions from the study consisted of a complete overview of the participants' personal and professional journey through entrepreneurship and a detailed recollection of their motivation(s), relationships as well as their goals, which helped guide their undertakings. Many of the questions had follow-up questions based on the responses received, which offered richer details and opened up the floor for a continuous dialogue amongst the participants.

Participant selection and participant access

The target population for conducting the interviews were female entrepreneurs from a multitude of different industries. Criterion sampling was used for this study, there was no specific age requirement for the participants of this study. However, the individuals selected for interviewing purposes were:

- female entrepreneurs;
- who owned and operated an established business which has been sustainable for a minimum of three years.

Maximum variation sampling was used for the purposes of this study to ensure there was a range of different female entrepreneurs that would provide unique and different perspectives for the study and optimistically allow for better results.

Nine female entrepreneurs were chosen for the study and the selection process followed the snowball sampling method which was used along with maximum variation to identify and recruit participants.

Participants were recruited for this study by the researcher via direct email. The researcher communicated in writing the purpose of the study and the participation criterion. The study met Northeastern University's Institutional Requirements and protocols for protection of human subjects. The

consent forms explained the overall objectives of the study and the participants' right to refuse to participate or withdraw at any time during the study's duration. To preserve the participants' anonymity, pseudonyms were used throughout the study.

The data from the study was collected via recording software. Analytic memos were maintained during each read-through of the transcripts to record and obtain initial impressions of the data. The researcher identified themes across the interviews and reviewed any significant statements from each of the interviews. Partially because the focus of the study is grounded in theory with a focus on entrepreneurial self-efficacy and because this may have significantly influenced these participants, an inductive and a deductive analysis approach was conducted as an imperative component of the study. The intention behind following an inductive analysis for this study was to allow the themes to naturally emerge. Furthermore, a deductive approach was also followed within this study as it allowed the researcher to begin with a theory, which was entrepreneurial self-efficacy and once the data was collected and analyzed it provided greater insights and understanding of how this theory played a role for the participants as the inductive findings were mapped back to the elements identified in the theoretical framework of self-efficacy (Bandura, 1997). Once the theme of entrepreneurial self-efficacy was found to be present among the participants, the next theme which became clear was grit – which is linked to Duckworth's work on the subject – and how it can demonstrate a certain type of attitude and level of persistence which was demonstrated by the participants and their desires to follow through with their entrepreneurial endeavors.

The diagram demonstrates the impact of social support, financial support, entrepreneurial knowledge, and achievement orientation which is part of Bandura's theory of self-efficacy along with the idea of one's success as well as being able to envision it, in conjunction with having support and the understanding of your abilities promotes the opportunity for an increased chance of success most notably within entrepreneurship.

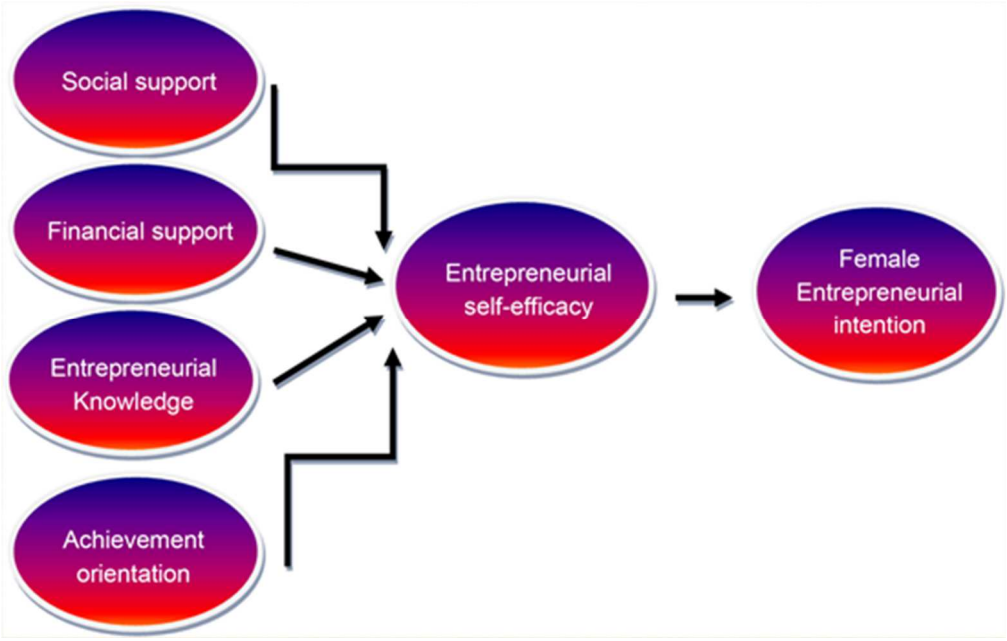

Figure 1. Entrepreneurial self-efficacy and the correlation to female entrepreneurial intention
Source: Aronovitch (2020).

All of the participants of the study identified themselves as independent female entrepreneurs. The participants represented a diverse age group, from twenty-nine to sixty-five years of age from varied backgrounds. The industries involved in the study were consulting, retail, health and wellness, cosmetics, and art. Reference Table 1 provides a brief overview of each of the participants within this study and provides a snapshot of their field of work, industry, age, race, and experience.

Table 1. Summary of participant profiles

Participant Pseudonyms	Industry	Age	Formal Industry Training	Race	Current Position	Number of years in Business
Meryl	Business consulting	56 years of age	Yes	Latino	Owner and operator of a business consulting firm	10 years
Maya	Restauranteur	33 years of age	Yes	Asian	Owner of multiple restaurants/food group brands	8 years
Karly	Cosmetic industry/PR	37 years of age	Yes (PR industry experience)	White	Owner of cosmetics brand and PR firm	10 years (PR) 5 years (cosmetics)
Joanna	Retail	31 years of age	Yes	White	Independent boutique owner	4 years
Valery	Health and wellness	29 years of age	No	White	Health and wellness coach/Business owner	5 years
Rosie	Cosmetics	65 years of age	Yes	White	Brand owner	5 years
Audrey	Art	44 years of age	No (self-taught)	White	Artist/gallery owner	20 years
Tara	Nutrition	46 years of age	Yes	White	Brand owner/private practice	18 years
Kara	Retail	40's	No	White	CEO/designer	17 years

Source: Aronovitch (2020).

RESULTS AND DISCUSSION

This research finding was relevant among the study participants as well: when things did not work out for the participants, they often used those setbacks as learning opportunities to grow and reflect and remind themselves how much they were willing to persist to achieve their goals. Their rejections did not signal that they should give up but were rather a reminder that more had to be done to achieve what they were working towards. One of the entrepreneurs, who was interviewed for the study, Kara (formal interview communication, 4 April, 2020) shared the following words regarding the process and dealing with setbacks.

> There are always going to be challenges and you just have to keep going, you have to keep on moving forward and you have to know that is the acceptable part of the process. And that is a normal course of the process. And if you are not pushing the boundaries and the limits, if everything is working, that means you are not trying hard enough and you are not pushing the limits. In my opinion, you need to keep on asking for more and striving for more.

Kara did not begin her career doing what she presently does, which is running a multimillion-dollar retail company. She began her career in financial public relations and walked away from that world after being at the top of her organization. Due to personal circumstances, she felt the need to pivot to something which would bring her more joy, freedom, and control over her own work environment.

Grit is not a quality that is exclusive to professional endeavors. We can find it in numerous scenarios and circumstances, such as education. Hochanadel and Finamore's (2015) research on adversity in education suggested that 'grit in education is how one can achieve long-term goals by overcoming obstacles and challenges.' This was an additional significant finding within my study which demonstrated that the participants of the study were fueled by crisis and necessity within their own personal and professional lives, which undoubtedly led them towards their entrepreneurial journey. Part of that drive was rooted in grit and the ability to persist through their setbacks and reframe them as learning opportunities to further enhance their opportunities for greater success. One of the participants of the study, Audrey (formal interview communication, 4 April, 2020) who is a world-renowned artist, discussed at length how she overcame her obstacles, even the internal ones.

> Having that little inner voice that was constantly like, you can do this, even if the phone was not ringing and the doorbell was not ringing and the email was not dinging, it was like, creating artwork, building inventory, understanding the process. The more that I work, the more prolific that I am, the more opportunities I have to sell, the better I get at being able to put my thoughts onto these canvases and put them out there for my career.

This further verified the prominence of grit and those who possess this characteristic, versus those who might not. Audrey was able to view her circumstances, failures, and obstacles as a way to keep working towards her goal and not to dwell on what was not currently happening for her. While her success was definitely not overnight as she had worked for close to twenty years before she found real success, the work is never done, she continuously strives for more and yearns to become bigger and bigger, as long as she is working towards her goals. This study sought to examine both professional and personal influences which may have contributed to the success of the female participants within the study. The narratives which emerged through the interviews from the participants offer insights into some of the factors and influences which these women believe have shaped their careers, confidence, and even their success as independent female entrepreneurs.

Discussion

Large-scale surveys which have been conducted within the framework of the Programme for the International Assessment of Adult Competencies (PIAAC) often centered their research on cognitive skills to determine academic and career success. These research findings can also hold weight within the corporate world, as those individuals who possess grit will have the tenacity to handle setbacks and misfortune and ultimately have the ability to persist. This focus has often been condoned and demonstrated by the results of large-scale studies, such as those conducted within the framework of PIAAC (Hanushek *et al.*, 2015) and through meta-analyses which have confirmed that cognitive skills are powerful indicators of income and job performance (Hernstein & Murray, 1994).

However, many research studies found that educational performance and accomplishments, and cognitive skills are not the sole or even the most important predictor of performance and potential success. This framework draws increased attention to the importance of human capital and the term 'socio-emotional skills' or 'non-cognitive skills' (Gutman & Schoon, 2016; Heckman & Kautz, 2012). The previous phrase surrounding the terms 'our socio-emotional skills' and 'non-cognitive skills' was introduced by Bowles and Gintis (1976) and it explains the ability to control impulses, cooperate with others, and pursue long-term goals. From a vantage point, these abilities can be seen as resources which may aid in an effort to avoid disruptions or distractions in the pursuit of goals or help to achieve greater career success (DeYoung, 2013). Ng *et al.* (2005) found that skills such as achievement orientation are qualifications of one's professional success as they can be resources for competing within the job market. Similarly, Mueller *et al.* (2017) suggest that grit further facilitates drive and interest in goals, which can be the key factor for accomplishing career goals and becoming successful. These findings revealed that while grit is an important component factor for success, it is not a trait which is equally as beneficial for all individuals, but rather the association between grit and career success were somewhat diminished by individual characteristics.

The most notable finding from the research conducted by Danner *et al.* (2020) was the correlation between grit and education and the suggestion that a high level of grit may compensate for a low level of education. This research suggests that non-cognitive skills not only directly produce economic and social returns but also have the propensity to compensate for the lack of other types of relevant factors for success, such as education. The research found that the study by Danner *et al.* (2020) suggested that non-cognitive skills, such as the characteristic of grit may be a prime example for developing and changing inequality and disadvantages, which further makes grit an even more attractive trait for lifelong learning practices. Dweck's (2010) research also found that a student's success may be dependent on qualities such as perseverance, grit, and tenacity. This study remarkably found that grit is not mutually beneficial for all individuals, but rather the associations between grit and career success were moderated by individual characteristics. Most significantly, the interaction between grit and education

suggested that an increased level of grit may compensate for a low level of education. This study found that while non-cognitive skills can yield positive economic returns and social impact, they also may compensate for a lack of other areas, such as education.

Further research suggested that particular traits like conscientiousness – which refers to the disposition for one to be organized and productive – and grit – which is perseverance and passion for their long-term goals (Duckworth, 2016) – have shown to produce greater economic and social returns over and above cognitive abilities and skills. Based on the research findings, this further demonstrates that those who possess high levels of grit should be more inclined to work harder, be able to adjust and cope with greater setbacks and remain focused on their goals and as a result of these pursuits would ultimately be more successful. This was evident in the study on female entrepreneurs and grit correlation, as the participants of the study demonstrated their desire to pursue their long-term goals despite the setbacks.

There exist numerous studies on the benefits of grit, however, many of these studies focused exclusively on North America, and they demonstrated that there are strong associations between grit and success. These studies were conducted on smaller scales, so it remains uncertain whether the association of grit with success and performance are consistent or if it may vary across different countries. The importance of why this might be of relevance is that often in the United States people tend to become enamored when they hear about someone's "rags to riches" story, however, across different countries where there might be unfavorable job conditions and high unemployment rates there may be fewer opportunities for individuals which may affect their goals and their abilities towards their employment and personal and professional goals. Aside from the environment and job market conditions, the correlation between grit and professional success might still depend on an individual's characteristics. This in turn suggests that grit might not be beneficial to everyone's professional success on an equal scale (Danner *et al.,* 2019). The study conducted by Danner *et al.* (2019) corroborated that there is a correlation between grit and career success. The study found that the presence of grit can predict income and job satisfaction better than cognitive skills, education, and other sociodemographic factors. However, they subsequently found that within their study, grit was not a characteristic which had a one size fits all approach, but rather, its role in shaping career success, depended largely on characteristics, such as desire for educational attainment, contextual factors, and the labor market conditions (Danner *et al.*, 2019).

In more recent studies, grit has been linked to professional success, specifically in the case of entrepreneurs. Some of the traits which have been studied and correlated to a successful entrepreneur are self-efficacy, risk-taking, independent autonomy and in more recent studies the importance of grit. Achievement orientation, goals, and self-efficacy have widely been studied and researched (analyzed), however, grit has often been understudied, especially with regard to personality traits and its correlation to greater entrepreneurship practices. People tend to wonder what makes certain individuals succeed as opposed to others who do not succeed. What is it that these individuals possess which might offer them increased academic or professional success? Do they have an advantage? The question remains as to what it is that makes those who succeed different from others and how do you possess as well as obtain grit?

A real-world example of an individual who has experienced the key benefits of grit and its effects on career success was Audrey, who participated in the initial study that began this research (formal interview communication, 4 April 2020). Audrey described the importance of her struggles as an artist and looking back upon them now and how the setbacks and failures she experienced were not just learning opportunities, but rather they were experiences and moments that formed her into the artist and woman she is today. Audrey described her setbacks as experiences which tested her both personally and professionally. However, she recounted how it was in those moments when she was reminded why she was working so hard and how it was these particular moments when she was able to turn those failures and setbacks into fuel to continue fighting and working towards what she wanted for herself. Audrey often described those moments of defeat as lessons which taught her how much she was willing to sacrifice for her goals, desires, and ultimate happiness.

Audrey explained numerous factors which she believed contributed to her success, most notably she described her setbacks as not only challenges, which shaped who she is as a female artist, but she explained how those setbacks were reminders of how much she was willing to sacrifice and work for the life she envisioned for herself, even as a young girl growing up in a small town in Alabama. Audrey had the aptitude to reframe her setbacks as opportunities to learn and grow and ignite a fire within her which proceeded to encourage her to work harder and continue to believe in herself, even if things were not working out, for Audrey that was not a good enough reason to give up, in retrospect, it was in those moments which Audrey described as reminders for how bad she was willing to struggle and work for her dreams. Audrey used the phrase 'the hotter the fire, the stronger the steel' in respect to herself and the struggles she experienced and how when things did not go as planned, it brought more encouragement, passion and drive rather than feelings of failure and defeat. This is not to suggest that Audrey did not experience the feeling of being sad or unmotivated, she most certainly did, the difference was that she allowed those feelings to be there, and once they passed, Audrey asked herself what good did it do for her feeling sad and sorry for herself, and then she decided that if this was something she wanted she would have to get back up and try again, because it was often in those moments that Audrey found her greatest strength and inspiration for her work. As Duckworth *et al.* (2007) suggested people who have greater amounts of grit tend to be more determined in terms of trying to overcome and persist through obstacles. These individuals also have the tendency to persist in maintaining interest to achieve their goals, irrespective of their failures, lack of support or setbacks (Arslan *et al.,* 2013). This strongly aligns with what Audrey had described for herself, namely that her mindset was not a fixed mindset but a growth mindset that did not allow her setbacks to deter her from future success.

While no one truly knows what their exact journey entails or what their success looks like, as individuals, we try to have an idea of what we want to achieve and what success means to us. However, being able to leverage setbacks, mishaps, and struggles in a way to further encourage and drive goals is an important component of grit. Being able to decipher a setback and reframe it as an opportunity for success is a key factor in what can set someone's success and failures apart, as demonstrated by Audrey. Her constant drive for success was part of what encouraged her to understand what she had to endure and work through to obtain her success and what she credits for much of her achievements today. Audrey is an example of the importance of grit and how to persist through setbacks and have the know-how and foresight to realize that a setback is not a termination, but rather a redirection for something else, something which may be even better for your future if you are willing to give it a try.

What was most unexpected from the study conducted in relation to the theory of self-efficacy and role models is that the research studies conducted have demonstrated that there is a positive influence of self-efficacy as a role model can inform someone's belief system and help them with their decision making to encourage them to become successful and allow them to envision their success (Auken *et al.,* 2006). A role model is effectively someone who can provide an individual with a visualization of a positive experience or demonstrate an outcome of someone following a career path or choice with which the individual might also want to follow or try to emulate. By envisioning this, the individual has a greater influence to learn and build their self-esteem. This demonstrates how role models can help build confidence, self-efficacy, greater direction, and help inform more positive decision-making (Auken *et al.,* 2006). What was most surprising about this study was that none of these participants had a role model with which they could identify with. While each of the participants had mentioned seeing their parent(s) or their spouse become successful on their own and by working hard, none of them had a person in a specific field or someone with whom they hoped to emulate to follow a similar path, but rather they decided to forge their own path and create their own success independently with very little direction or guidance from outside sources. Ultimately, they were able to succeed and flourish as independent female entrepreneurs.

The question remains as to what makes someone possess more grit over another and what does it truly mean to possess grit? According to Duckworth and Quinn (2009), grit is a stable characteristic, like one's personality which can influence an individual's attitude and behaviors and how they might choose to act and react to situations. Wolters and Hussain (2015) conducted a study on university students, which demonstrated how grittier students tend to adopt motivational strategies and a more

self-regulated learning strategy, such as one which values the learning process and encourages self-efficacy. Partially due to the fact that these students have the ability to adopt more positive orientations goals, such as the mastery of their experiences versus performance approach goals, this study suggested that grit and its effects tended to be greater in respect to mastery goals as opposed to approach goals. The findings of the study conducted by Alhadabi and Karpinski (2019) further demonstrated that academic journey is often not easy and many students will endure obstacles and setbacks which can negatively impact academic progress. The study by Alhadabi and Karpinski (2019) demonstrated that personal qualities such as grit and self-efficacy can help oppose such negative impacts. Furthermore, those particular qualities can indirectly influence achievement orientation goals and greater academic performance. Thus, finding ways to establish and promote enhanced learning environments which promote grit and self-efficacy can be a valuable addition to academic performance as well as future endeavors. This study demonstrated the importance of grit and its place in academic career and its ability to contribute to greater success, especially at the university level.

The same can be said for professional corporate environments. Having the tools and skillset to demonstrate ways to maintain human capital, especially in times of uncertainty is an important component of a successful cultural environment. Goldman Sachs is one example of an organization which invested the resources in changing their culture to retain talents through developing ways to further understand what is important for their employees. This refers especially to millennials within their organizations, because it has been found that they find compensation, flexibility, mentoring, and social belonging important (Crowe, 2016). This is an important step in the direction for organizations to better equip themselves with the understanding of what their employees require and what they deem to be of importance, as it is relevant to be able to assist those within their organization and it offers them the ability to cater to their employees. Organizations have the ability to better equip themselves with this information by being cognizant of what their human capital requires to advance and thus contribute to the company's development. Obtaining the proper resources and tools to equip their staff requires an understanding of grit, what it entails, what is needed to establish better cultural practices and how they can retain talents who possess the trait of grit.

One of the prominent findings in the literature regarding female entrepreneurs is the importance of imposter syndrome. The imposter phenomenon is defined as the predisposition of individuals to attribute their achievements to fluke or even fraudulence rather than their own determination and hard work (Clance & Imes, 1978). Imposter syndrome and imposter fears can impair career, because it makes individuals unable to recognize their potential (Neureiter & Traut-Mattasuch, 2016). While this was not something which was found within this research study, it was prevalent in many studies relating to female entrepreneurship. These findings seemed to conflict with this study as the idea of imposter fears or imposter syndrome was rarely mentioned throughout the interviews with the nine participants. While imposter syndrome was not as prevalent in the study as one might imagine when studying female entrepreneurs and grit, the findings demonstrated that the women of the study possessed a high level of grit and resiliency, because when one might experience a setback there is often a moment of self-doubt and the mindset which leads people to believe that they themselves might be the problem. The importance of female entrepreneurship at both the individual and organizational levels is rather significant, as having greater number of women occupy positions of power and obtain more opportunities to start their own businesses is central for economic development and is widely recognized (Meunier *et al.*, 2017). However, until women are provided with the same opportunities and confidence in themselves, their abilities may continue to be stagnant in their professional roles and continue to be one of the most underutilized resources for the economy.

As it has been shown by the previous research and the study conducted, when individuals do not have the proper mindset to understand how to develop and move forward, which Dweck (2007) calls the growth mindset, they also have the tendency to internalize their setbacks and blame themselves, which often leaves the individual paralyzed and unable to move forward towards their goals. Dweck (2007) completed a study on adolescent children. Among them, those who were told that they had not met their goals *yet,* felt that they had the opportunity to learn and grow and believed they still had the

chance to be successful with their current endeavor. However, those that were told otherwise automatically believed that they were not meant for this type of work and gave up. This fixed versus growth mindset is something which is very impactful especially as an adult, most notable for women, especially those hoping to become entrepreneurs.

Wedell-Wedellsberg (2020) explained that 'resilience is the most fundamental quality for navigating through chaos.' Being able to navigate failure and setbacks and having the ability to comprehend and learn from the experience is part of the growth mindset (Dweck, 2007) and describes someone who possesses not only resiliency, but also a tremendous amount of grit. While most respondents stated that they experienced fear and self-doubt on numerous occasions, it did not prevent them from successfully moving forward on their path towards entrepreneurship. Karly, who is a female founder of a cosmetics brand stated the following:

> I feel like we always come up with reasons for why it cannot be done, especially when you are younger in your career, you often say things like, they are better suited for it because of this. I do not have 'this,' or I do not have this education, but what I realize as we keep going is that you have got all these people and they are just people and they just had the balls to do it and go for it. But I think that is half the battle, that is way more than half the battle, because to start you just have to go for it and show up.

Karly's understanding of negative self-talk and a negative belief system is an additional way which demonstrates grit. While we might often have moments of doubt or uncertainty and we might even believe that there truly are people out there who are better equipped at the job you want, it should not deter us from going for it full force but rather allow us to realize that there is no other reason standing in our way than just ourselves. These women demonstrated that their setbacks defined them and it encouraged them and made them hungrier for their success.

At this point, it has become evident that possessing the characteristics of grit is beneficial to professional success and education. Conversely, after much research conducted on grit and how it has positive effects on people, specifically entrepreneurs, one might ask how can grit be measured? One way to begin is to measure perseverance, on the grit scale as well as creativity, as it will focus on the production of uncommon ideas (Duckworth *et al.*, 2007). Part of the reason why these two factors go hand in hand is that we have learned that grit is part of perseverance and the desire to pursue long-term goals and as such, fits into the concept of investing towards unusual ideas despite challenges. Duckworth reported a two-factor structure, consisting of interest and perseverance of one's effort for the scale (Duckworth *et al.*, 2007). The grit scale has often been utilized extensively in research in education as a predictor of novice teachers' effectiveness (Robertson-Kraft & Duckworth, 2014) as well as a predictor of psychological well-being (Salles, Cohen, & Mueller, 2014). The two-factor structure process of the grit scale is an important depiction of how one can go about understanding how to measure grit, as theoretically grit is a combination of interest and effort and to measure grit both factors should be included. The research conducted demonstrates that it is important to measure perseverance, which is integral in understanding creativity. An additional way to further understand this it so utilize the investment theory of creativity (Sternberg & Lubart, 1996) which includes both creative ideation as well as perseverance.

While it is fair to say that women are doing their part to better themselves in terms of their professional development, working towards advanced degrees, and striving for promotions within their organizations, they are still vastly underrepresented and organizations are not providing enough support, guidance, and leadership to enhance their visibility at the top. Contrary to what we have been told, women are staying in the workforce at the same rate as men, and more women are choosing a path towards entrepreneurship to pursue their desire to create and follow their passions. Grit is a characteristic which one can possess or – as Duckworth (2007) suggests –can be learned and thus become grittier and more resilient depending on experiences. Harvard Business review recently published a study on how to lead team and one of the most important findings was the importance of having individuals who possess a high degree of resiliency as they tend to prevail in difficult situations

in part because they are able to view their setbacks as temporary and changeable (Wedell-Wedellsborg, 2020). Wedell-Wedellsborg (2020) suggest that when people are able to view things as changable and not permanent, it leaves them thinking 'it will go away sometime, it can be curbed, and I can do something about it' (Wedell-Wedellsborg, 2020). This mindset allows people to act in a way which provides logic and understanding of their situation and shows how they might be able to address it thanks to which they are able to focus on the setback and adjust accordingly. This is connected with the research conducted by Duckworth (2007) and her work on grit and ability to become grittier, based on their experiences and how failure can impact future experiences, as well as their understanding to achieve success based on setbacks and failures.

There are opportunities to conduct future research on both the impact of grit and entrepreneurship as a whole, most notably amongst women, as grit is a topic which has garnered a substantial amount of research over the last few years and it has become increasingly more prominent amongst researchers. There is room to further analyze in a larger sample size study if grit is correlated to entrepreneurial intention. There is also a great opportunity to replicate this study outside North America and look at other parts of the world to see if there are any correlations with the findings from the study discussed within this research.

CONCLUSIONS

Duckworth (2007) suggested that grit is one's perseverance and passion for long-term goals, which demonstrates the significance of possessing grit, specifically the grit of female entrepreneurs and their desire to succeed and advance within their professional endeavors. Women play a central role in today's economy and often times they are the most vulnerable. However, they can also be the strongest and most willing to face challenges head-on and adapt, especially right now in a world that is facing unsurmountable changes and a way of working that many have never had to experience before. This research amongst the entrepreneurs from different industries and life stages is impactful, because the participants were from all different walks of life, different age groups, and different industries ranging from art through medicine and entertainment to finance. All of them had unique and inspiring stories that they shared and the underlying theme amongst these entrepreneurs was the undeniable desire to succeed irrespective of their setbacks, failures, and constant disappointments. None of these factors affected their ability to believe in themselves and their ability. The setbacks were disappointing and made them question their abilities. However, it is evident that their growth mindset and their undeniable grit were key components of their continued success. The research has further demonstrated the impact this research has on other women; those who are aspiring leaders, entrepreneurs, intrapreneurs, and those hoping to break barriers within their own professional endeavors. The limitation of the study is the number of women who participated as not all the findings may apply to all women outside the sample. There are opportunities for greater research to sample a larger number of women and see if similar themes come up and learn if there are similarities between certain age groups, industries, and life stages.

Some of the most successful entrepreneurs of our time have often shared their failures and their significance in becoming successful, because as a society we tend to focus on accomplishments and not the journey it took. We often overlook the tenacity and drive which allowed those individuals to keep moving forward and persisting to pursue their goals. Grit is earned, it is learned through the ups and downs of journey and setbacks, it helps define you, and what you want to accomplish. The research demonstrated that those who experience failure, often succeed greater in life. Steve Jobs is a noticeable example of someone who experienced failure and setbacks and despite all of it, he continued to persist and pursue his passions and is one of the most famous entrepreneurs of our time. Everyone has experienced the feeling of failure at some point or will inevitably and the ultimate feeling of wanting to give up, whether it be in their personal or professional life but the difference between those who keep going and those who do not is their grit and the ability to persist through all of it, the good and the bad.

What is most relevant to understand from Duckworth's research on grit is that each of us has the ability to control our own formula for success. We can decide how much effort and time we are willing

to put into what we hope to accomplish. While there may be individuals who are born with enhanced intelligence and perhaps even more fortunate, grit is the singular fundamental element which we can learn. We simply must ask what we want to accomplish and how much time and energy we are willing to invest to attain it. While this tends to sound as something which can be easily accomplished, it is important to note that it is no. It takes time to understand and learn grit and as demonstrated by the participants of the study, it is sometimes a life's journey and could take decades. Developing grit and understanding and accepting failure as a learning opportunity is something which takes time and patience. Learning grit and developing it is hard, however, we should not give up due to failure. Perseverance is the opposite of fear and it can make all the difference in achieving goals.

The women of the study demonstrated that this particular mindset, which is formally called the growth mindset by Carol Dweck (2006), allowed them to understand that their failures were not permanent or personal, but rather they acknowledged that these experiences were lessons which allowed them to reassess, grow, and rebuild to continue working towards their goals. We often hear people say that it is not about how you fall, but how you pick yourself back up. The development is often found at the crossroads we encounter, it is simply not how you fail, but how you try and try again until you succeed knowing that those failures shaped your success and provided the lessons to accomplish success.

The information in this paper demonstrated is important, especially for women and those hoping to advance professionally within an entrepreneurial endeavor. Organizations and women need to hear about other women who have had setbacks and challenges and hear about the stories that not only showcase success and achievements but those that demonstrate challenges, failures, and hardships that many people experience irrespective of their background. This allows people to see themselves in others' experiences and journeys. While not everyone has a mentor or someone who they feel they can rely on for guidance and support, it is important to acknowledge that reading about other people's stories of success, while going through setbacks or similar challenges may enhance someone's grit and even their perseverance towards their own personal and professional goals.

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Determinants of export activities in Ukrainian regions in the pre-conflict and the first-stage conflict periods

Elena Horská, Serhiy Moroz, Jozef Palkovič

ABSTRACT

Objective: The article aims to explore the impact of main factors on the export dynamics of Ukrainian regions in the pre-conflict and conflict periods.

Research Design & Methods: The article investigates the relationship between the regional export performance and main factors influencing its development in Ukraine, based on regional data of the State Statistics Service of Ukraine and the National Bank of Ukraine for 2003-2019. The article focuses on the analysis of export dynamics in Ukraine. Moreover, the analysis investigated the impact of the war conflict on the export development, which was estimated as the change in the level of export. It was evaluated using the differential intercept dummy variable, as well as the change in the slope coefficient, the extent and significance of which were assessed employing slope dummy variables for every explanatory factor. The analysis was performed for coastal, non-coastal regions, and the country level separately. The modelling procedure included all standard methods for panel data analysis. Based on its results, the one-way fixed effects model was selected as the most suitable for the performed analysis.

Findings: The obtained results confirmed that the export dynamics in coastal and non-coastal regions was affected by the spread of the war conflict to a different extent. This was expected due to the closer location of coastal regions to the war zone. This disparity was especially seen because of significantly different relationships between exports and imports in coastal and non-coastal regions, which deepened even further during the conflict period. Another interesting finding was the decrease of the production's influence on exports in coastal regions in the conflict period, which was strongly linked with the spread of the conflict.

Implications & Recommendations: We suggest that the decline of the industry's impact on export trade was a consequence of the war in Ukraine. Thus, new priorities should be identified in terms of the development of Ukrainian industry to minimize the negative influence of the conflict on this economic sector, enhance the quality of manufactured goods, and improve the access of the country's companies to international markets. In this context, it is important to continue Ukraine's further integration with the European Union and to deepen industrial cooperation with the EU, the USA, and other countries. Taking into account the existing situation in the country, the mechanism for attraction of foreign direct investment should be also improved.

Contribution & Value Added: The novelty of our article is that the influence of industry on exports of Ukrainian regions was investigated, considering coastal and non-coastal regions in the pre-conflict and conflict periods separately. The article contributes to the development of the theory and practice, because it enhances the understanding of how the conflict impacts relationship between the selected determinants and regional export activities. The change of the export dynamics in coastal and non-coastal regions can be used as the case study for comparison of regions which are more (coastal) and less (non-coastal) affected by the war conflict.

Article type: research article
Keywords: Ukraine; export; regional development; conflict; war
JEL codes: F14, L60, R11

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INTRODUCTION

Industry plays an important role in the economic development of Ukraine. It satisfies country's needs in raw materials and finished products, creates job positions for local residents, and provides a significant share of the country's export earnings. In regard to industry, the following activities were considered in our research: (i) mining and quarrying, (ii) manufacturing, and (iii) electricity, gas, steam, and air conditioning supply.

Russia launched its military aggression against Ukraine in 2014. It annexed Crimea and occupied parts of Donetsk and Luhansk oblasts. Since February 2022, Russia has started a full-scale war in the country. It caused the significant damage to the Ukrainian population and economy, including the industrial sector (Vasyltsiv *et al.,* 2022; Fiszeder & Małecka, 2022). Therefore, the important task is the recovery of this economic sector with the maintenance of existing export channels and expansion to new markets. Thus, it is necessary to adapt the industry to existing economic conditions.

There is a lack of publications on the effect of industry, foreign direct investment (FDI), or other factors on the export performance of Ukrainian regions. Moreover, it is important to investigate how the war conflict influences relationship between the chosen determinants and regional export activities. That is why we decided to prepare this article and explore the impact of selected indicators on export trade of Ukraine's regions. Two periods were examined: the pre-conflict period (2003-2013) and the conflict period (2014-2019). Furthermore, we evaluated how the location proximity of Ukrainian oblasts to seas and seaports affects export activities of regions. Due to this research direction, we explored two categories of oblasts, namely coastal regions and non-coastal regions. In our study, a 'coastal region' means a region, which borders the sea. Based on received results, we compared these two categories of regions and characterized the influence of location proximity on regional trade performance.

The novelty of our article is that the influence of the industry on export trade of Ukrainian regions was investigated considering coastal and non-coastal regions in the pre-conflict and conflict periods separately. The article contributes to the development of the theory and practice, because it enhances the understanding of how the war conflict impacts relationship between the selected determinants and regional export activities. In this field, there is a lack of studies devoted to Ukraine, because most of published articles focus on the conflict's impacts on other countries or groups of countries. This is especially the case for export and factors affecting it. Besides, all similar research articles investigate export trade only in peace conditions. The aim of the article was to explore the impact of main factors on export dynamics of Ukrainian regions in the pre-conflict and conflict periods. To estimate relationship and effects between export activities, their explanatory factors, and the war conflict, the panel model was estimated for coastal and non-coastal regions separately. The impact of conflict was included in the model as dummy variables.

The article is organized as follows: in the section literature, we will review contains publications related to the impact of the industrial sector on export activities of different countries, including Ukraine, as well as hypotheses development. In the section research methodology, we will describe the used data, variables, and statistical models. Main findings of our research will be presented in the section results and discussion. The section conclusions will present a general overview of obtained results, policy implications, research limitations, and suggestions for future research directions.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

There are various publications on the industrial sector and its impact on export activities at the national and regional levels. These studies were carried out for countries with different economic characteristics (Pini & Tchorek, 2022). For instance, Ndubuisi and Owusu (2022) explore the influence of trust, measured as the development of informal contracting institutions, on the export performance, using the industry-level data of 71 countries. Employing the generalized difference-in-difference method, it was discovered that countries with the higher trust levels have the significant rise of production and export of higher-quality product, compared to countries, which have insufficient informal institutions. Zhylinska *et al.*

(2020) investigate relationships between gross domestic product (GDP) per capita, manufacturing value added, and terms of trade adjustment, calculating their annual percentage growth in 51 countries with predominantly manufacturing exports. Using the vector autoregression model, positive interactions are found between these indicators. However, their levels differ substantially among the indicators.

Maciejewski and Wach (2019) estimate the impact of the intensity of production factors on the export structure of the EU countries. Based on the gravity model, the authors confirmed that trade liberalization and the development of high-tech industries have the positive effect on international trade of EU member states. Moreover, the authors revealed that the memberships in the EU and European Monetary Union are important for export trade activities. However, the research findings showed that resources of production factors do not affect the export structure of EU countries. Using the Bayesian model averaging framework, Bierut and Dybka (2021) examine factors that influence manufactures' exports in the EU countries. As a result of the study, the direct and indirect types of impact on export trade were revealed. The researchers argue that the main reason of export differences is connected with technological factors. Kordalska and Olczyk (2014) investigate how the export competitiveness is affected by the competitiveness of processing industries of EU countries, applying the spatial panel analysis. The research findings showed that the manufacturing sector has a substantial effect on EU export competitiveness. It also determined that factors which affect exports and the ratio of exports to imports are not the same, excluding foreign demand and unit labour costs.

Studnicka *et al.* (2019) consider how European regional trade agreements affect European export patterns. Utilizing a simple fixed effects estimation approach, the authors identified that the influence of these agreements on the total exports and intensive margin is mostly insignificant. Their effect was positive in the case of extensive margin only. At the same time, the authors identified that deeper trade agreements do not have the significant impact on European exports. Employing standard panel unit root tests, Stöllinger and Holzner (2017) studied the influence of state aid on manufacturing export competitiveness in the EU countries. The research results showed that, at least in the short-run, subsidies have a positive impact on value added exports of the manufacturing sector of EU-15. Though, this impact is not found for new EU Member states. Doulos *et al.* (2020) evaluated the effect of internal devaluation on industrial exports competitiveness, using as an example the state of trade relations between Greece and Portugal. Applying the export volume and export price equations, the authors found that the internal devaluation by itself is not a sufficient measure to promote exports and enhance competitiveness of Greek manufactured products on international markets. Moreover, the important factor is that compared with Greece, Portugal has a better business environment which stimulates the attraction of FDI and ensures the country's economic growth based on the development of export activities.

Stojčić *et al.* (2012) explore the approaches on export competitiveness of manufactured products from Slovenia and Croatia in the EU-15 market. Based on the dynamic panel analysis, the authors identified that these countries have different competitiveness patterns. While Slovenian manufactures focus on the quality of export products, Croatian producers still give attention to labour costs as the major trade factor. Under these circumstances, the growth possibilities of export activities are quite limited, especially for Croatia. Using the synthetic control method, Stojčić *et al.* (2018) analyse the impact of trade liberalization on export competitiveness of new member states of the European Union. It is identified that trade liberalization has a favourable impact on the countries' manufacturing export performance, structure, and quality (the few other studies confirmed the same results e.g. Vološin *et al.*, 2011; Svatoš & Smutka, 2012; Smutka *et al.*, 2015; Náglova *et al.*, 2017). Though, this influence is less significant for countries which received preferential access to EU markets later, including Slovenia and Croatia. Besides, its largest effect is seen for high technology-intensive industries. Salamaga (2020) investigate the effect of innovation on the export competitiveness of industries with different levels of technological development in Central and Eastern European countries, applying the dynamic panel models. The study results showed that while there is a significant positive impact of innovation on export competitiveness of industries with the high and medium-high technological levels, it is not found in industries with the low level of technological advancement.

Sato *et al.* (2020) propose the usage of the industry-specific real effective exchange rate to estimate export competitiveness of selected Asian countries. Based on the static common-correlated effects estimator and cross-sectionally augmented distributed lag estimator, the authors analyse the influence of real effective exchange rate appreciation on industrial exports. The obtained results confirmed the decline of unfavourable impact of real effective exchange rate on the countries' export performance. The authors argue that this situation could be linked to further development of global value chains and the strengthening of economic ties and regional integration between Asian economies. Using several statistical models (the system general methods of moments, ordinary least squares and three-stage least squares approaches), Fu *et al.* (2012) assess the impact of China's manufactured export on export prices from countries with the various levels of economic development. The researchers revealed the existence of close price competition between Chinese export products and traded products from middle-income countries, as well as between China and high-income countries in regard to low-technology products. At the same time, the authors confirmed that China's exports affect low-income countries in another way, namely: not through price competition, but through market expansion. The findings also showed that the growth of China's export competitiveness is observed in different types of markets because the country pays more attention not to price characteristics, but to the quality and variety of products. Anwar and Sun (2018) investigated the influence of foreign direct investment on the industry export quality in China. Employing the seemingly unrelated regression approach, the authors proved that the presence of foreign industrial firms has a positive and statistically significant effect on the country's industrial export quality. The results also indicated that due to FDI, the growth of industry average wage leads to the substantial increase in the export quality both directly and indirectly. Li *et al.* (2021) research the effect of China's relaxation of FDI regulation on the industry's export sophistication. The authors found that FDI liberalization has a favourable impact on export sophistication for manufacturing industries as a result of the export share growth of foreign-invested companies and processing trade firms. However, the study did not confirm that this liberalization affects the product quality positively.

There are some publications devoted to regional industrial activities and their effects on export trade. Applying the modified Balassa's revealed comparative advantage index and regression analysis, Piekkola (2018) explores the impact of various factors related to knowledge investment on export growth of Finnish regions. The study findings showed that the effect of elements of intangible capital investments on the export performance is not homogeneous. The most active role is played by research and development (R&D), which contributes substantially to the export growth and enhancement of trade balance. The influence of tangible investments on export activities has its own specific features depending on the distribution of capital investment growth. That is why it is necessary to elaborate a new policy that could ensure competitiveness and export growth of the country's industrial sector. Andersson and Johansson (2010) investigate how accessibility to human capital affects export trade in Swedish municipalities, using the cross-regional regression model. The results confirmed that regions with a high level of human capital are more specialized in terms of industry structures and have greater export diversification. Cross-regional variations in human capital lead to the growth of extensive margin. Human capital endowment also has an effect on intensive margin causing higher prices of export products.

Based on the panel model with fixed-effects, the random effect model, and the pooled ordinary least squares model, Jakšić *et al.* (2019) explore the influence of FDI and labour productivity on the development of manufacturing export sector of Croatian regions. The authors found that while this sector has an important role in the internationalization of Croatia's economy, its export activities do not promote macroeconomic convergence of the country due to the lack of domestic demand effect and low labour productivity. Moreover, the authors discovered that FDI flows have a negative impact on manufacturing exports because they are mainly oriented towards the service sector. Stojčić *et al.* (2014) analyse the effect of regional factors on export competitiveness of Croatian manufacturing companies. Using the spatial Durbin model, the authors revealed that regional concentration of exporting firms affects unfavourably the export intensity of manufacturing exporters in neighbouring regions. Moreover, the significant inter-regional development gap in terms of export intensity was

observed between the strongest and weakest Croatia's regions. In addition, the positive impact of factors that are considered as drivers of regional competitiveness (innovation potential, urbanization, and localization economies) was only partly proved.

Employing a dynamic gravity approach, Nsiah *et al.* (2012) evaluate the influence of various factors on manufacturing export performance from US states to chosen Asian countries. Research outcomes showed that well-defined legal systems and good infrastructure have a positive effect on state's exports. On the contrary, high levels of union density, corporate tax rates, pollution abatement cost, and employment density affect the state's manufacturing trade exports negatively. Yoshida (2013) gives attention to specific features of intra-industry trade between Japanese prefectures and Korea, applying the Grubel-Lloyd index and regression models. The research results revealed that the increase of sub-regional intra-industry trade is encouraged by the introduction of new kinds of export products. At the same time, intra-industry trade is negatively affected by the growth of export trade values. Tang and Zhang (2016) estimate how manufactured exports in Chinese regions are impacted by absorptive capacity and foreign direct investment, concentrating on three indicators: export capacity, intensity, and quality. The authors found absorptive capacity to be an important factor which promotes the export growth of manufacturing sectors, because FDI along has only a limited influence on the export performance. Moreover, the authors identified that absorptive capacity is substantially linked with effective FDI policy and high-quality infrastructure. Besides, they argue that a higher positive impact of FDI on the sector's export quality is seen in the case of appropriate investment in human capital and R&D.

There is a limited number of empirical studies on the effect of industry on Ukraine's export trade. For instance, Cieslik *et al.* (2015) examine factors that influence export performance of Ukrainian firms, using data from the survey on the manufacturing and services sectors. Based on the probit regressions, the authors determined that the probability of firm's export activities increases with the growth of the productivity level and the enhancement of other firm-level characteristics, including the firm size, firm internationalization, and innovativeness. Reggiani and Shevtsova (2018) consider the role of industry technology intensity and export destination in export-related productivity benefits of Ukrainian manufacturing firms, using the OLS regression with firm-clustered standard errors. The researchers identify that while exporters in high technology sectors have stable long-term productivity growth in advanced markets, firms in low-technology sectors get only short-term productivity enhancements which are not linked to the export destination. To some extent, these consequences for low-technology firms may be linked with the high level of illegal activity in this sector which, in turn, leads to negative social consequences (Mishchuk *et al.*, 2018; Androniceanu *et al.*, 2022) and appropriate results for public finance (Shkolnyk *et al*., 2020). However, the links between FDI and the shadow economy are strong and interrelated (Tiutiunyk *et al*., 2022).

We found only two publications, in which export and other indicators are examined in the periods before and during the conflict in Ukraine. Horská *et al.* (2019) investigate relationships between the chosen indicators of Ukrainian regions (export of goods per capita, foreign direct investment per capita, and the average resident population) and gross regional product per capita in the pre-conflict period (2010) and conflict period (2015). Employing the multiple linear econometric model, the authors revealed that gross regional product has positive correlation with foreign direct investment and export of goods in both periods, while the demographic indicator does not have any impact on the variable. Rovný *et al.* (2021) studied how the demographic structure of the population affects the selected economic indicators (export of goods per capita, gross regional product per capita, and others) of Ukrainian coastal regions in the pre-conflict period (2004-2013) and conflict period (2014-2018). Using Pearson's correlation coefficient, the authors determined that the military conflict has a negative effect on the demographic structure, which in turn hampers the economic development of the country's coastal regions.

The aim of our article is to explore the impact of main factors on export dynamics of Ukrainian regions in the pre-conflict and conflict periods. During the conflict period (2014-2019), coastal regions were mostly located closer to the war zone, compared to non-coastal regions. Due to this reason and based on previous empirical studies, in particular by Jakšić *et al.* (2019), Horská *et al.*

(2019), Lee and Fernando (2020), Rovný *et al.* (2021), Anwar and Sun (2018), and Tang and Zhang (2016), we will verify the following research hypotheses:

H1: Output per employee has a significant positive impact on the export development in both the pre-conflict and conflict periods.

H2: Output per employee has a lower positive impact on the export level in coastal regions in comparison to non-coastal regions.

H3: Foreign direct investment has a substantial positive effect on the export performance during the pre-conflict and conflict periods.

H4: Foreign direct investment has a lower positive influence on the export level in coastal regions in comparison to non-coastal regions.

RESEARCH METHODOLOGY

During the preparation of the article, Ukrainian regional data for 2003-2019 were employed, based on publications and the website of State Statistics Service of Ukraine (www.ukrstat.gov.ua). Since 2014, data on the Autonomous Republic of Crimea and Sevastopol (city) were not available because of Russia's annexation of these administrative regions. That is why they were not investigated in the article. Thus, our article is based on the data for 25 Ukrainian administrative regions. Regarding foreign direct investment, data from the State Statistics Service of Ukraine for 2003-2014 and National Bank of Ukraine for 2015-2019 (www.bank.gov.ua) were used in this publication. Besides, the analysis was carried out to assess how the location proximity of Ukrainian regions to seas and seaports impacted export trade. Due to this reason, the coastal regions (Donetsk, Kherson, Mykolayiv, Odesa, and Zaporizhzhya oblasts) and non-coastal regions were investigated separately. Data were processed to the panel which was used as the input for mathematical-statistical tools. The analysis was performed in the software SAS Studio 3.8 Enterprise edition.

The selection of variables for investigation of regional export dynamics was based on the model originally proposed by Jakšić *et al.* (2019), in which the dependent variable was the share of export in gross regional product (GRP) and the matrix of regressors consisted of gross value added (GVA), foreign direct investment, productivity, the share of import of goods in GRP and the share of manufacturing in regional gross value added. The share of manufacturing in regional gross value added was also evaluated as the significant factor influencing export by Zhylinska *et al.* (2020). The list of variables with their description can be found in Table 1.

Table 1. List of variables with their description

Variable name	Description	Source of data	Role
ExpShareonGRP	Share of export in gross regional product – the quantitative variable expressed in %	State Statistics Service of Ukraine	Dependent variable
GVA	Gross value added – the quantitative variable measured in millions of USD	State Statistics Service of Ukraine	Explanatory variable
FDI	Inward foreign direct investment – the quantitative variable measured in millions of USD	State Statistics Service of Ukraine, National Bank of Ukraine	Explanatory variable
OurperEmp	Output per employee – the quantitative variable used as an approximation of productivity measured in USD	State Statistics Service of Ukraine	Explanatory variable
ImpShareonGRP	Share of import in gross regional product – the quantitative variable expressed in %	State Statistics Service of Ukraine	Explanatory variable
GVA_industry	Share of industry in regional gross value added – the quantitative variable expressed in %	State Statistics Service of Ukraine	Explanatory variable

Source: own study.

The values of some indicators were available in Ukrainian hryvnias. To better analyse these indicators, their values were recalculated to US dollars (USD), using information from the National Bank of Ukraine on the annual average official exchange rate between the currencies. In order to improve the prediction ability and to include export dynamics into the model, the lagged value of the dependent variable ExpShareonGRP was also used as the explanatory variable as suggested by Jakšić *et al.* (2019).

The impact of conflict was included in the model with dummy variables. They were created automatically by the software based on the qualitative variable period which could take two values for the conflict period and pre-conflict period. This led to creation of two dummy variables for the mentioned periods, which took values 0 or 1. These two dummy variables could not be employed together to prevent perfect multicollinearity, but their usage was optimized by the software, according to the current model and variable properties. The inclusion of dummy variables was more efficient than the separate estimation of two models in order to save degrees of freedom. Models were estimated for the entire panel dataset and for coastal and non-coastal regions separately. In order to remedy bias caused by possible heteroscedasticity or autocorrelation, robust standard errors were applied. The pooled regression model, one-way random effects model and one-way fixed effects model were considered for the analysis.

Verification of estimated fixed effect models included the F-test for no fixed effects, which compared the pooled regression model with the fixed effect model. A low p-value indicated rejection of the null hypothesis, and that the pooled regression model is adequate in favour of the fixed effects model. For the random effects model, the presence of individual effects was tested employing the Breusch-Pagan test for random effects, which compares the performance of pooled regression with the random effects model. In this case, the low p-value indicated rejection of the null hypothesis, and that the pooled regression model is adequate in favour of the random effects model.

The decision between the fixed and random effects models was based on the test suggested by Hausman (see Matuszewska-Pierzynka, 2021). The test examines differences between coefficients estimated from the fixed effects and random effects models. The low p-value counts against the null hypothesis that fixed and random effects estimates do not differ substantially, and random effects estimates are consistent in favour of the alternative hypothesis to prefer the model with fixed effects. The threshold value for the decision about the hypothesis was the significance level of 0.05. When the result of the Hausman test suggested that both models are consistent, the explanatory ability of both models and the type of data was also considered. In the case of the long panel dataset, the decision was made in favour of the fixed effects model as stated in Gujarati (2011).

Based on the above-mentioned test results, one-way fixed effects models were selected as the most appropriate. Models were estimated in the following form:

$$Y_{it} = \alpha_0 + \sum_{j=1}^{m} \beta_j X_{it} + \sum_{k=1}^{d} \gamma_k D_{it} + \sum_{j=1}^{m} \delta_j X_{it} D_{it} + \varepsilon_{it} \quad (1)$$

where:

i - number of cross-sectional units, $i = 1,2, \dots, n$;
t - number of time periods, $t = 1,2, \dots, T$;
j - number of explanatory factors, $j = 1,2, \dots, m$;
k - number of intercept differential dummies, $k = 1,2, \dots, d$;
α_0 - Intercept;
β_j - estimated parameters for explanatory factors, slope coefficients measuring the effect of explanatory variables on the dependent variable;
γ_k - estimated parameters for differential intercept dummies that evaluate the difference between the intercept of the model in the pre-war period and war period. Results can be found for the periods before and during the conflict, only one value is estimated, and its significance measures the difference between intercepts of models in two periods
δ_j - estimated parameters for differential slope dummies, which evaluate the difference in slope between the periods before and during the conflict
Y_{it} - dependent variable *ExpShareonGRP*

X_{it} - explanatory variables: *ExpShareonGRPi$_{t-1}$, GVA, FDI, OutperEmp, ImpShareonGRP, GVA_industry*

D_{it} - dummy variables denoting the periods before and during the conflict, two possible variables, only one can be used in the estimated model, the usage of these variables was optimized by the software in order to avoid the collinearity problem and to get the best performing model;

$X_{it}D_{it}$ - differential slope dummies, the product of explanatory factors and dummy variables, the estimated parameter of one dummy for the explanatory variable evaluates the difference in slope between periods, sometimes they could be estimated parameters for two dummies instead of slope (β_j) for the explanatory factor, which measures the influence of the factor in two periods separately

ε_{it} - random error.

The article includes only the final models with the highest prediction ability, which were selected from nine finally optimized panel models. These models were validated and used to verify previously formulated research hypotheses.

RESULTS AND DISCUSSION

The article investigates the relationship between the export performance and main factors influencing its development in Ukraine. Figure 1 presents the comparison of the share of export and the share of import in the country's GDP. The export's share in GDP exceeded the import's share for almost the entire investigated period. The war conflict with Russia started in 2014 and the significant decline of the share of import was observed in this period. In 2015, the share of export was higher than the share of import. The performed analysis investigated not only the influence of selected factors on the share of export but also the effect of the war conflict on the export's development, considering the pre-conflict and conflict periods. Panel models were estimated for coastal and non-coastal region separately, in which the impact of selected factors on the export's share was expected to be different.

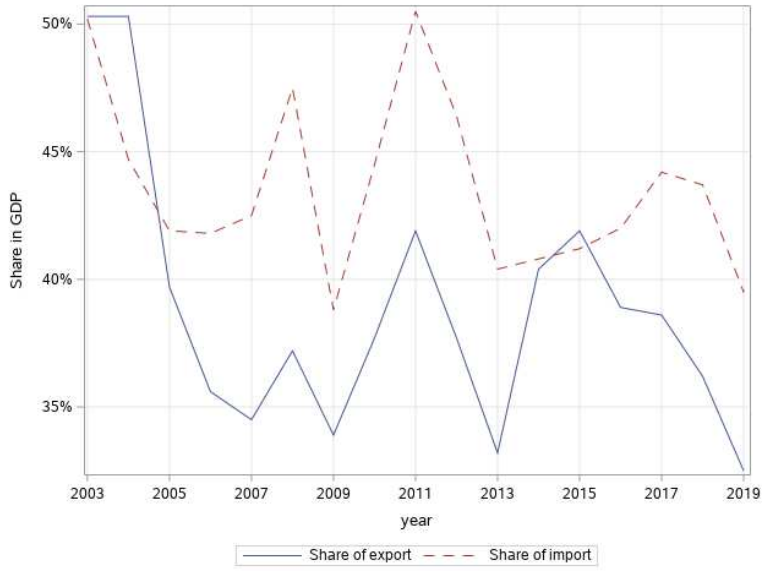

Figure 1. Share of export and share of import in Ukraine's GDP in the years 2003-2019
Source: own elaboration based on data from the State Statistics Service of Ukraine.

From all analysed factors, which could influence export performance substantially, the share of industry in gross value added was considered as the most important indicator. Figure 2 shows relationship between the share of industry in gross value added and the shares of export and import in gross regional product. It is obvious that there was no substantial relationship between both pairs of variables over the whole period. Only some partial significant relationships could be found in the

case of several regions or groups of regions, or some periods. The Figures are very similar in the case of both export and import trade.

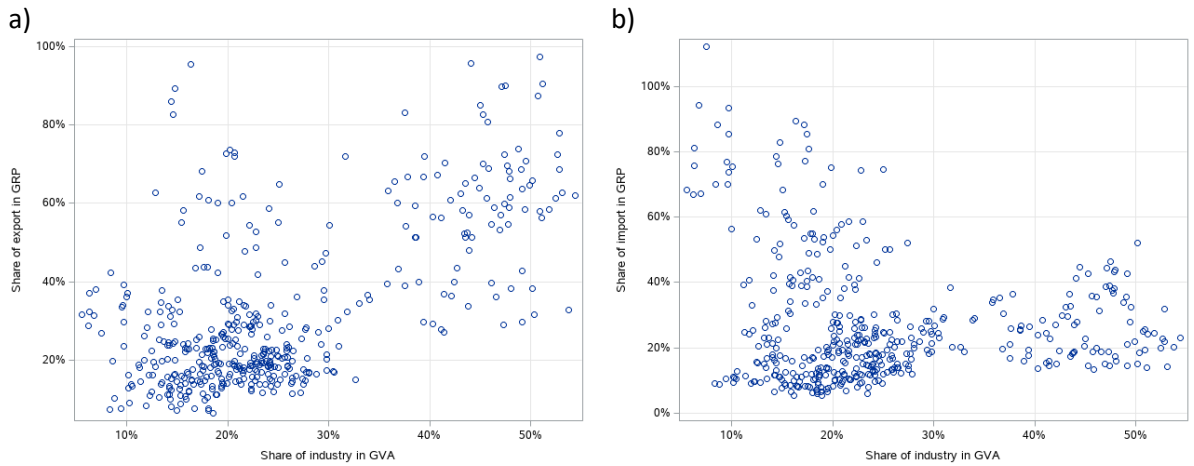

Figure 2. Relationship between the shares of export and import in GRP and industry in GVA
Note: a) share of export in GRP vs. share of industry in GVA; b) share of import in GRP vs. share of industry in GVA.
Source: own elaboration based on data from the State Statistics Service of Ukraine.

Both relationships were divided into the periods before and after 2014, when the war conflict started in Ukraine. The comparison of both periods is given in Figure 3. In the case of import, significant relationship with the share of industry in GVA was not observed in both periods. The scatter plot in the periods before and during the conflict was similar.

Regarding export, a substantial difference was identified between Figures a and b. For the pre-conflict period, the presented scatter plot suggests that some relationship existed between export and the share of industry in gross value added. In the conflict period, however, the spread of values was greater and did not follow any significant pattern. This result suggests that GVA in industry did not play an important role in export after the conflict began in Ukraine. Thus, the role of industry in export decreased in the conflict period.

The similar situation was also observed in the case of other variables. Our analysis focused on Ukraine's export and it was based on the assumption that the country's export could be significantly influenced by the export value in the previous period, gross value added, foreign direct investment, output per employee, the share of import on gross regional product and gross value added in industry. The conflict was also used as a dummy variable to improve the explanatory ability of estimated models. To uncover some specific relationships between the variables, the analysis was performed on panel data for all Ukrainian regions, as well as for coastal and non-coastal regions separately.

Table 2 presents basic descriptive statistics for variables used in the conducted analysis. It allows us to compare indicators' values of coastal and non-coastal regions and to have the overall statistics for the country. In the case of the export's share in GRP, the higher value was recorded in coastal regions, and it even exceeded the country's average value.

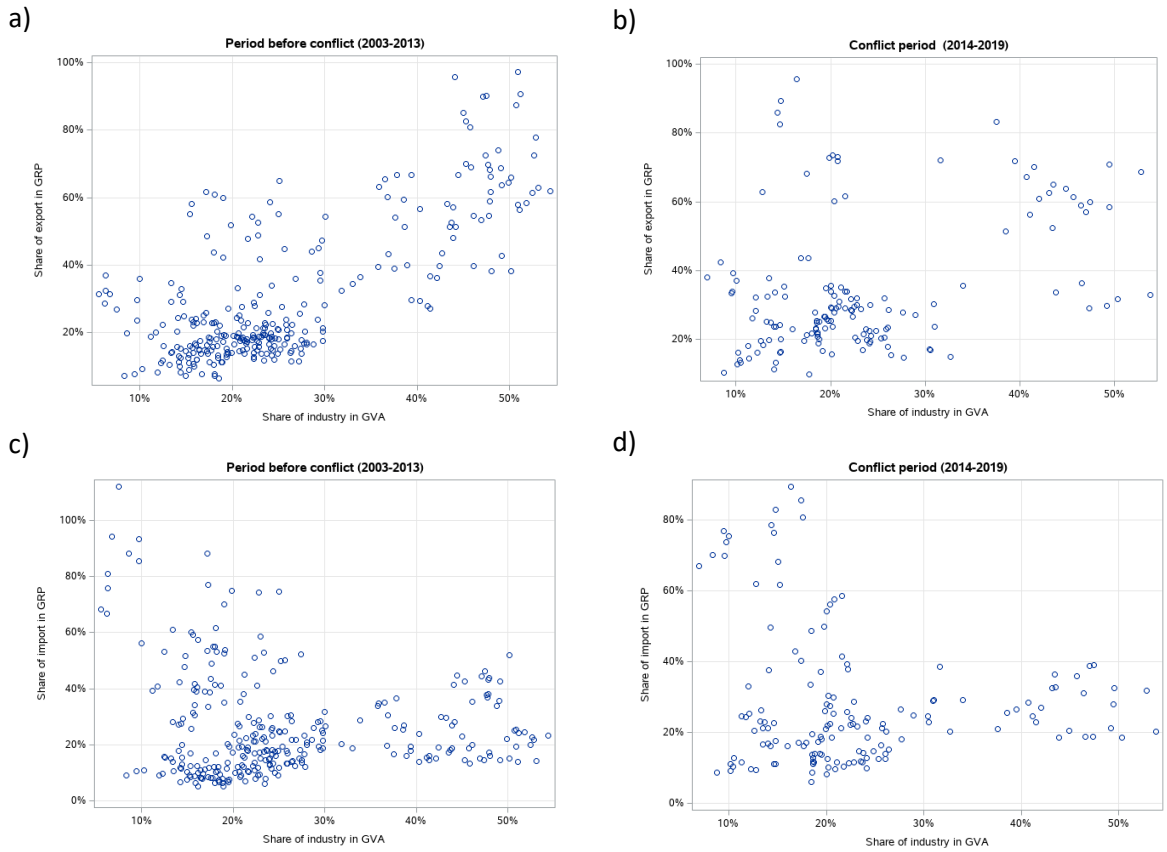

Figure 3. Relationship between the share of industry in GVA vs. the share of export and import in GRP before and after 2014

Note: a) share of export vs. share of industry in GVA in the period before the conflict; b) share of export vs. share of industry in GVA in the conflict period; c) share of import vs. share of industry in GVA in the period before the conflict; d) share of export vs. share of industry in GVA in the conflict period.

Source: own elaboration based on data from the State Statistics Service of Ukraine.

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Similar results were also seen for GVA, industry's GVA, and output per employee. The opposite situation was found in the case of FDI, for which the larger value was observed in non-coastal regions. The share of import in GRP was similar in both coastal and non-coastal regions. However, the slightly higher value in non-coastal regions was closer to the overall average in Ukraine.

Table 2. Descriptive statistics of analysed variables

Region	Variable	Mean	Standard deviation	Minimum	Maximum
	ExpShareonGRP	31.49	20.2	6.40	97.30
	GVA	4228.33	4998.10	323.30	34561.70
Ukraine	FDI	1291.27	3414.93	20.20	27278.10
	OutperEmp	38255.53	15093.03	7855.50	94748.80
	ImpShareonGRP	26.74	18.73	5.30	112.10
	GVA_industry	1090.28	1427.43	52.10	9765.50
	ExpShareonGRP	27.80	17.11	6.40	95.80
	GVA	4055.98	5169.44	323.30	34561.70
Non-coastal regions	FDI	1392.06	3770.54	20.20	27278.10
	OutperEmp	37845.82	15305.11	7855.50	94748.80
	ImpShareonGRP	26.93	20.7	5.30	112.10
	GVA_industry	947.77	1188.38	52.10	8328.00
	ExpShareonGRP	47.22	23.71	11.20	97.30
	GVA	4962.37	4137.44	712.40	19582.50
Coastal regions	FDI	864.42	807.75	64.50	3789.10
	OutperEmp	39990.78	14113.56	10702.30	70114.20
	ImpShareonGRP	25.95	11.43	7.20	53.40
	GVA_industry	1697.21	2070.99	161.80	9765.50

Source: own elaboration based on data from the State Statistics Service of Ukraine and National Bank of Ukraine.

Based on data described in Table 2, panel models with random and fixed effects were estimated for coastal and non-coastal regions separately in order to compare differences in their export dynamics as well, while the overall panel model was based on observations for all regions. The selection of the final model was based on test results shown in Table 3.

Table 3. Verification of estimated models

Test/model	Coastal regions	Non-coastal regions	All regions
F-test for no fixed effects p-value	<0.0001	<0.0001	<0.0001
Breusch Pagan test for random effects p-value	0.0099	-	-
Hausman test p-value	<0.0001	0.196	0.0549
Pooled R^2	0.8624	0.7728	0.8149
Random effects R^2	0.5348	0.4056	0.3868
Fixed effects R^2	0.9359	0.8309	0.8754

Source: own elaboration based on data from the State Statistics Service of Ukraine and National Bank of Ukraine.

The threshold significance level was 0.05. In the first phase, the performance of panel models and pooled regression with the F-test and Breusch-Pagan test for random effects was compared. The Breusch-Pagan test was estimated for coastal regions only due to the unbalanced panel dataset for non-coastal and all regions. The Breusch-Pagan p-value for coastal regions suggested the existence of significant individual effects in the variance component. A similar result was also obtained using the F-test for no fixed effects, when compared the performance of the pooled regression and fixed effect model. The F-test result was similar for coastal, non-coastal, and all regions models. This result suggests that panel models, which take into account individual effects for cross-sectional units, should be preferred over the pooled regression model. To decide whether the individual effects in data should be estimated as fixed or random effects, the Hausman test was employed. Using 0.05 level of significance, the null hypothesis was rejected for coastal regions only. For the overall model for all regions, the p-value was just slightly higher than the considered threshold. Based on the assumption that the acceptance of the null hypothesis means the non-significant difference between estimated parameters of fixed and random effect models (which means that both of them are consistent and can be used) and requirements that model results should be directly comparable, the fixed effects panel model was

selected for all three datasets. Moreover, it was evaluated better in terms of the character of the dataset (the long panel) and the explanatory ability.

The results on estimated fixed effects models are given in Table 4. This Table could be divided into three basic parts: the first part – the effect of explanatory factors, the second part (the variable before and during the conflict) – the difference in the intercept between the pre-conflict and conflict periods, and the third (bottom) part – product variables measuring the effect and significance of slope coefficient difference between the periods before and during the conflict. To compare model results for different regions, the Table also includes insignificant variables. According to expectations, the lagged variable of export share in gross regional product was significant in all estimated models, because the next value in time series was strongly dependent on its previous value. In the model for whole Ukraine, it was identified that output per employee and the share of import in gross regional product influenced the share of export in gross regional product substantially. The similar result was also found in the model for non-coastal regions. In this case, output per employee was significant at 0.1 level of significance only. The models calculated separately for coastal and non-coastal regions showed slightly different results. In the case of coastal regions, the share of import in gross regional product was the only significant explanatory factor. The influence of this factor was estimated in the bottom part of the Table for the pre-conflict and conflict periods separately.

The higher estimated value of intercept means that the portion of export in GRP was a bit larger in coastal regions in comparison with non-coastal regions. During the conflict period, the average level of export share in GRP in coastal regions even increased in contrast with its decrease in non-coastal regions (measured by parameter estimated for the dummy variable conflict). The bottom part of the Table includes parameters for variables created as products of dummy variables and original explanatory factors. Their parameters measure the change in slope between the conflict and pre-conflict periods. In other words, they show the shift on how explanatory factors influence the dependent variable.

In the case of non-coastal regions, the conflict changed substantially the relationship between the dependent variable and output per employee, the share of import in gross regional product, and the share of industry in regional gross value added. The influence of output per employee on the share of export in GRP increased in the conflict period significantly, but the impact of other two variables decreased to a substantial extent.

Estimated results for coastal regions were different. They suggest that the conflict changed the impact of all considered explanatory factors, with the exception of the share of industry on regional gross value added. The change in slope of FDI and output per employee were evaluated as substantial in the conflict period, while these variables were insignificant in the pre-conflict period. In both cases, the obtained results suggest their significant decrease. Besides, the influence of gross value added and the share of import in gross regional product on the share of export in gross regional product increased substantially during the conflict period. Overall results for the whole country in the pre-conflict period were similar to results received for non-coastal regions. On the other hand, the influence of the conflict on slope coefficients of explanatory factors was significant for all variables, with the exception of output per employee. Thus, as in the case of coastal regions, the change in the same direction was identified for non-coastal regions.

Hence, considerable differences were identified between coastal and non-coastal regions in regard to the conflict's impact. Based on the results of estimated models, it can be concluded that the dynamics of export and its relationship with determining factors were influenced in coastal regions to a greater extent. Comparing these results with findings on non-coastal regions, two major differences could be identified. First of all, during the conflict period, the share of export in GRP decreased significantly in non-coastal regions, in contrast with its substantial growth in coastal regions (according to significance of the conflict dummy variable in both models). Second, the significant change was found in both categories of regions in the relationship between export and import, as well as export and output per employee. The influence of output per employee on the share of export in GRP increased in non-coastal regions in the conflict period, but its substantial decline was identified in the case of coastal regions.

Table 4. Parameters of estimated fixed effects models

Region	Coastal regions		Non-coastal regions		All regions	
Variable	**Estimate**	**Pr > |t|**	**Estimate**	**Pr > |t|**	**Estimate**	**Pr > |t|**
Intercept	**36.46725**	**<.0001**	**11.66205**	**<.0001**	**12.09908**	**<.0001**
lagExpSH	**0.246095**	**0.0038**	**0.39244**	**<.0001**	**0.374523**	**<.0001**
GVA	-0.00289	0.1559	-0.00026	0.6238	-0.00036	0.4591
FDI	0.004495	0.2493	-0.00006	0.8872	0.000013	0.9741
OutperEmp	-0.00002	0.8245	**-0.00007**	**0.0946**	**-0.00008**	**0.0293**
ImpShareonGRP	0	.	**0.335217**	**<.0001**	**0.21725**	**0.0006**
GVA_industry	0.001897	0.5807	-0.00017	0.8877	-0.00036	0.7258
before	0	.	0	.	0	.
conflict	**23.19226**	**0.0246**	**-8.30323**	**0.0729**	-4.50557	0.2602
before*GVA	0	.	0	.	0	.
conflict*GVA	**0.007769**	**0.0002**	0.000788	0.2782	**0.001585**	**0.0172**
before*FDI	0	.	0	.	0	.
conflict*FDI	**-0.02244**	**0.0003**	-0.00068	0.4765	**-0.0017**	**0.0531**
before*OUTPEREMP	0	.	0	.	0	.
conflict*OUTPEREMP	**-0.00082**	**0.0009**	**0.000169**	**0.0789**	0.000074	0.3834
IMPSHAREONGRP*before	**0.542695**	**0.0002**	**-0.13824**	**0.0110**	0	.
IMPSHAREONGRP*conflict	**1.028887**	**0.0004**	0	.	**0.12662**	**0.0147**
GVA_INDUSTRY*before	0	.	0	.	0	.
GVA_INDUSTRY*conflict	-0.00291	0.4119	**-0.00362**	**0.0013**	**-0.00442**	**<.0001**
R squared	0.9359		0.8309		0.8754	

Source: own elaboration based on data from the State Statistics Service of Ukraine and National Bank of Ukraine.

Between the shares of export and import in GRP, the estimated slope was 0.34 in non-coastal regions in the pre-conflict period, while it declined by 0.14 in the conflict period. On the other hand, in coastal regions, this slope was estimated to be 0.54 in the pre-conflict period, and it even increased to 1.03 during the conflict period. Other minor differences were also revealed. In the case of coastal regions, the significant change was not found in the slope coefficient for the industry's gross value added. At the same time, the substantially smaller value of this slope coefficient was determined in non-coastal regions in the conflict period, despite it being insignificant in the pre-conflict period. Similarly, gross value added and foreign direct investment were both insignificant factors in the pre-conflict period for both types of regions. According to received results, the conflict changed their slopes substantially, and, in the case of gross value added, the significant growth of its influence was revealed in coastal regions.

Also, the findings confirmed that the war conflict affected Ukrainian coastal and non-coastal regions to a different extent. The results on research hypotheses formulated in our article are the following.

Hypothesis 1 supposed that output per employee had a significant positive impact on the export development in both the pre-conflict and conflict periods – the role of output was insignificant in the model for coastal regions. In the overall model for the country level and the model for non-coastal regions, this variable was significant, but its sign was negative, which was in contrast with expectations. Hypothesis 2, which assumed that output per employee had a lower positive impact on the export level in coastal regions in comparison to non-coastal regions, was not confirmed too. It can be only concluded that the spread of the conflict increased substantially the influence of output on export in non-coastal regions.

Similar results were also obtained for hypotheses 3 and 4. According to hypothesis 3, the significant positive effect of FDI on the export performance was expected to be in the pre-war and war periods. In contrast with this expectation, the substantial influence of foreign direct investment was not found. This finding is also related to hypothesis 4 about the lower positive influence of FDI on export in coastal regions. Therefore, hypothesis 4 was not supported too. It was only confirmed that the slope coefficient was significantly smaller in the case of foreign direct investment for coastal regions in the conflict period, *i.e.* its influence on export was still insignificant.

Models used in this article were based on theoretical assumptions applied by Jakšić *et al.* (2019) in their analysis of export dynamics in Croatia. They obtained results which were similar to our research findings. In their model, the only significant explanatory variable was the share of import in gross regional product, and its coefficient was 0.45 for Croatia. This corresponds to the estimated influence for the pre-conflict period in our article. In our analysis, this variable's coefficients were 0.22, 0.34, and 0.54 for the models on the country level, non-coastal regions, and coastal regions, correspondingly. The insignificance of other explanatory variables is also in accordance with the results of their study. Compared to their results, another difference was identified in the case of the variable output, which was estimated as significant at the country level in our model. Surprisingly, the negative coefficient of this variable is in accordance with insignificant coefficients in their models.

Besides, our findings were different in comparison to results by Zhylinska *et al.* (2020). These authors investigated exports in countries with more than 50% of manufacturer's export. Their research was based on the autoregressive model which included the following variables: terms of trade, GDP and manufacturing gross value added. In contrast with outcomes of this analysis, our results did not find a significant impact of industry's gross value added on the share of export in gross regional product.

Our result regarding the influence of foreign direct investment on export is in accordance with findings of Li *et al.* (2021), who analysed exports in China and did not find its significant effect. A similar result was also seen in the study by Tang and Zhang (2016). They explained this result as the indirect effect of foreign direct investments, which may not automatically appear, but depend on host country's absorptive capacity associated with the country's FDI policy, human capital, R&D, and infrastructure quality. This result is in contradiction with the research conducted by Anwar and Sun (2018), in which it was concluded that the foreign presence in China's manufacturing sector significantly positively influences its export. On the other hand, both results are in contrast with the study by Bierut and Dybka (2021), who investigated export in EU countries and found a surprisingly significant negative effect of FDI. These controversial results in regard to the influence of foreign direct investment on export can be explained by the type of FDI inflows (in EU countries, they were mainly oriented to the service sector) and the resulting transformational impact on the production and export structure of host countries.

The novelty of our article is that the influence of industry on exports of Ukrainian regions was investigated, considering coastal and non-coastal regions in the pre-conflict and conflict periods separately. The article contributes to the development of the theory and practice because it enhances the understanding of how the war conflict impacts the relationship between the selected determinants and regional export activities. The change of the export dynamics in coastal and non-coastal regions can be used as the case study for comparison of regions which are more (coastal) and less (non-coastal) affected by the war conflict.

CONCLUSIONS

Our results showed that the impact on export activities was different in Ukrainian coastal and non-coastal regions. Moreover, the findings confirm that the war conflict affected the country's coastal and non-coastal regions to various extent. Coastal regions were affected more by the spread of war conflict, which was expected due to their geographical proximity to the war zone. In the pre-conflict period, the models' results were also different for coastal and non-coastal regions, and findings on coastal regions were closer to overall results for the country-level model. During the conflict period, more significant changes were found in regard to the influence of explanatory variables on export in coastal regions. The difference in comparison to non-coastal regions was not only in terms of the number of substantial changes in slope coefficients for explanatory variables, but also in their direction. The impact of the most significant variable, the share of import in GRP (in the pre-conflict period, its values were 0.34 for non-coastal regions and 0.54 for coastal regions), decreased in non-coastal regions (by 0.14), while in coastal regions it had the large growth with the slope coefficient equal to 1.03 in the conflict period. This suggests that the war conflict changed significantly the relationship between import and export, and this effect was different in coastal regions, which were more affected by the conflict. The findings showed that export increased from these regions, while it declined from non-coastal regions.

The substantial effect of the conflict on coastal and non-coastal regions was also identified regarding the variable output per employee, but, at the same time, its influence decreased in coastal regions during the conflict period to a substantial extent. In contrast to this finding, the significant rise of the variable's influence was revealed in the case of non-coastal regions in the conflict period. This means that export from coastal regions, which were more affected by the war in the conflict period, was less depend on production in these regions.

We suggest that the reduction of the industry's impact on export trade is a consequence of changes in the Ukrainian economy due to the war conflict. Thus, it is important to support the development of Ukraine's industry. The vital step in this direction is that the country was granted candidate status for EU membership in 2022. It is necessary to continue further integration with the European Union and to deepen industrial cooperation with the EU, the USA, and other countries. It is also needed to determine priority directions of industry in order to minimize the negative influence of the war conflict on this economic branch, enhance the quality of industrial goods, and improve the sector's competitiveness in external markets. Besides, it is essential to improve the mechanism for FDI attraction, taking into account the existing situation in Ukraine.

There are some limitations of our research. Firstly, the impact of the industry on export trade was explored, using the data for Ukrainian regions only. Secondly, the effect of just one economic sector (industry) on export performance was investigated. At the same time, the above-mentioned research limitations could be considered as the basis for further studies. For instance, it would be useful to investigate the regional export performance and main factors influencing its development not just in Ukraine, but in Central European countries as well. In addition to industry, it would be possible to consider how export trade is also affected by other economic branches: agriculture, construction, etc.

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Conflict of Interest

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The EU regulation of sustainable investment: The end of sustainability trade-offs?

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ABSTRACT

Objective: The objective of the article is to explore and assess whether the SFDR legal framework creates a legitimate, effective, and efficient mechanism that supports a genuinely sustainable investment and eliminates greenwashing and other trade-offs. It targets the Regulation (EU) 2019/2088 on sustainability-related disclosures in the financial service sector aka SFDR which sets a law duty on financial market participants and advisers concerning information about sustainability (Art. 1). Corporate Social Responsibility (CSR) parasitic practices, such as greenwashing, are to be eliminated in disclosures, communications, and internet pages (Art. 9 – Art.13) by appropriate information (Art. 1(17)) and the principle of doing no significant harm (Art. 2a).

Research Design & Methods: A deep holistic five-step chronological contextual analysis of key legislative and semi-legislative instruments with LIWC assessment was performed. It was supported with a comparative and teleological interpretation and refreshed with Socratic questions.

Findings: The research led to four rather unexpected propositions: (i) the endorsement of SFDR by EU institutions varies, (ii) key instruments are expressed neutrally and technically but their authenticity varies, (iii) morality appears to be avoided, and (iv) the interpretation litigates against an artificial disassociation of concepts linked to sustainability, CSR, and shared values.

Implications & Recommendations: Since the performed analysis was instantaneous and textual and led to rather unexpected propositions, it should be juxtaposed and extended by adding the longitudinal dimension, the applied dimension, and the outside perspective along with empirical field observation.

Contribution & Value Added: This is a pioneering study regarding the wording assessment of the EU law on sustainability. Considering the critical importance of a legitimate, effective, and efficient legal framework in this area and the pre-existing academic vacuum regarding such an exploration of SFDR and related instruments, this contribution is a valuable first step.

Article type:	theoretical (conceptual) article
Keywords:	Corporate Social Responsibility (CSR); EU; Regulation 2019/2088 (SFDR); sustainable investment
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INTRODUCTION

Since a drive for competitiveness has destructive potential, the current global and highly competitive society turns more and more to the modern sustainability concept (MacGregor Pelikánová *et al.*, 2021a; 2021b; Nowak & Kasztelan, 2022; Andronie *et al*., 2021a; 2021b; Solesvik *et al.*, 2023; Stanek-Kowalczyk, 2021), which relies on the multi-stakeholder approach and cross-sector co-operation (Van Tulder *et al.*, 2016, Van Tulder & Keen, 2018; Matuszewska-Pierzynka, 2021) in both domestic and multinational dimensions (Rosińska-Bukowska, 2022). Perhaps, it has even the ambition to go above and beyond mere

social responsibility and philanthropy, *i.e.*, potentially attempt to achieve the authentic synergy labelled as shared values (Porter & Kramer, 2011; Kramer & Pfitzer, 2016; Çera *et al*., 2022).

Every member of society should carry the responsibility for the future of society and do more for society than what is strictly imposed by the law (Apostu & Gigauri, 2023). An integral element of such a modern sustainability concept is the corporate social responsibility (CSR) of businesses which needs to be communicated transparently and reliably to other stakeholders, *e.g.*, employees, investors, and consumers (Dvouletý, 2017, MacGregor Pelikánová & MacGregor, 2020a; Mura *et al*., 2021; Majerova *et al.*, 2020; Otavova *et al*., 2023), to allow them to make educated and, hopefully, pro-sustainability choices. This is complemented by the growing consideration of behavioural economics (Reed *et al.,* 2013).

The EU and EU policies have fully recognized that and joined these efforts by issuing the key EU strategy for 2010-2020 aka EU strategy for smart, sustainable, and inclusive growth (Europe 2020), and more specifically the Green Paper: Promoting a European Framework for CSR (MacGregor Pelikánová *et al.*, 2021a). This has been matched by legislative instruments, see *e.g.,* the updated Directive 2013/34/EU (Balcerzak, & MacGregor Pelikánová, 2020) imposing a CSR report duty upon certain large businesses (MacGregor Pelikánová & MacGregor, 2020b) and newly the Regulation (EU) 2019/2088 on sustainability-related disclosures in the financial service sector (SFDR). This setting has been subjected to a set of crises, see Covid-19 (Balcerzak & MacGregor Pelikánová, 2020; Vavrova, 2022; Androniceanu & Marton, 2021; Androniceanu, 2020) or the Russo-Ukrainian War. These crises have worsened the social and economic disparities which have appeared over the last three decades (Ashford *et al.,* 2020) and magnified the pre-existing differences in society (MacGregor Pelikánová *et al*., 2021c), including customers (MacGregor Pelikánová *et al.*, 2021a; Kiba-Janiak *et al.,* 2022; Waliszewski & Warchlewska, 2021; Lăzăroiu *et al.,* 2019; Lăzăroiu *et al.,* 2020). Nevertheless, the European Commission president, Ursula Von der Leyen, is determined to maintain the endorsement of the modern sustainability concept and keeps referring to 'our common priorities, like the European Green Deal, digitalization and resilience' (European Commission, 2020) and 'a climate-neutralized and resilient economy' (European Economic and Social Committee, 2019; Kowalska & Bieniek, 2022). In this context and considering the dramatic impact of these events on both public and private finances, the need for a robust EU law pro-sustainability framework inducing the engagement of all stakeholders (Hála *et al.,* 2022) appears even more important than ever before. The two most significant pillars of this framework are Directive 2013/34/EU and SFDR. Considering the legal nature (Directive v Regulation) as well as the level of specificity and potential enforceability, undoubtedly the most critical instrument in the current EU law for the financial support of sustainability from the private sector is SFDR. It sets a law duty on financial market participants and advisers regarding information about sustainability (Art. 1). The CSR parasitic practices, such as greenwashing, should be eliminated in pre-contractual disclosures, websites, reports, and marketing disclosures and communications (Art. 9 – Art. 13) by proper information (Art. 1(17)) and the principle of doing no significant harm (Art. 2a). Does SFDR mean that trade-offs regarding sustainability are to be eliminated from the financial sector? To reflect upon these complex issues, the theoretical background with a literature review and a proper research methodology need to be identified, presented, and employed. This creates the potential for a proper study of the legislative and policy evolution as well as the wording, its interpretation and assessment, refreshed by Socratic questioning. Ultimately, this could lead to a number of truly relevant and rather unexpected observations and pioneering propositions with suggestions for further studies as well as legislative and other endeavours.

LITERATURE REVIEW

Concerns regarding the sustainability and continuous existence of the society and civilization have millennial roots, *e.g.,* parables in the New Testament, the administrative, management, and building construction models employed in ancient Egypt, the sustainability of water management in Mesopotamian and Babylonian empires, or the progressive expansion of the Roman Empire and its administration.

The transformation into the modern concept of sustainability was launched by the endeavours of the Hanseatic League and the German perception of sustainability aka *Nachhaltigkeit*, see the eighteenth-century famous manuscript *Sylvicultura Oeconomica* by the German Colberist Hans Carl von Carlowitz

and the nineteenth-century milestone manuscript *Einfachste den höchsten Ertrag und die Nachhaltigkeit ganz sicher stellende Forstwirthschafts-Methode* by Emil André (MacGregor Pelikánová *et al.*, 2021a). This trend towards perpetuity of sustainability was cemented in 1948 by the Universal Declaration of Human Rights (UDHR) declared by the United Nations (UN), which incorporated in the international law that everyone has both the right to a standard of living adequate for the health and well-being of himself and of his family (Art. 25 UDHR) and the duty to the community (Art. 29 UDHR). At the same time, it must be admitted that UDHR does not deal with sustainability and CSR *per se*. The following decades brought a focus on social progressive values, see 'communitarianism' in the 1960s, compensated by a shift to a more individualist approach, see the move from the Keynesian economic theory to neoliberal theory in the 1970s (Balcerzak & MacGregor Pelikánová, 2020). This was the contextual foundation for a set of fundamental pro-sustainability instruments of the UN, starting with the pivotal report prepared in 1987 by the Gro Harlem Brundtland Commission and issued as the UN Annex to document A/42/427 called the Report of the World Commission on Environment and Development Report: Our Common Future (Brundtland Report, 1987) and leading to the current UN Resolution A/RES/71/1 from 2015 known under the name 2030 Agenda for Sustainable development (UN Agenda 2030; Dat & Hung, 2023).

This historic review reveals that until the twentieth century, sustainability was basically in the sphere of concerns shared by states, but the industrial revolution, wars with a global dimension, and the emergence of the recognition of not only negative but as well positive human rights contributed to the enlargement of the pool of sustainability proponents. Interestingly, sustainability as an outcome of public concerns and endeavours has evolved rather in the continental law tradition universe while CSR as an outcome of the projection of sustainability into the private sphere originated in the USA and has common law roots. A turning point in the CSR development was the emergence of the manuscript *Social Responsibilities of the Businessman* by Howard R. Bowen in 1953, which argued that the biggest US businesses are centres of power and decision-making and influence the lives of all (Carroll, 2016). Logically, rights come with duties and no power should be exercised at the detriment of others. This implies that the traditional, aka conventional, approach endorsed by Theodore Levitt and Milton Friedman and arguing for the exclusive profit maximization command of businesses should be put under scrutiny and a pro-CSR stakeholder approach depicted via the famous Carroll´s pyramid and founded upon shared values should be considered (Kramer & Pfitzer, 2016). Despite the expectations of traditional economics, real-life subjects do not always exhibit *a homo economicus* profile aiming at the full maximization of the conventionally perceived gain (Reed *et al*., 2013). Instead, these subjects can be either irrationally myopic with respect to what is best for them (Reed *et al.,* 2013) or prophetically visionary and altruistic with respect to what is best for the entire society in the long term (MacGregor Pelikánová & Hála, 2021). The set of behavioural factors influencing decision-making is so large and hardly measurable that the ultimate decision might be perceived as irrational (Reed *et al*., 2013), see the drive to *buy less, buy better* as embodied by, *e.g.,* the circular premium (D´Adamo & Lupi, 2021). It is more and more important especially in the modern entrepreneurial economy (Sieja & Wach, 2019), which is knowledge-based and uses artificial intelligence (Korzyński *et al.*, 2023), also in the context of sustainability.

Indeed, it cannot be overemphasized that the modern concept of sustainability rests on three pillars (Richterová *et al.,* 2021; Skvarciany *et al.,* 2021), namely economic, environmental, and social ones and hence for a business to be sustainable means to go ahead with the CSR which jeopardizes neither environmental nor social nor economic aspects. To put it differently, CSR should assist with value creation, an amelioration of the business's reputation, and the growth of the trust and respect of customers (Streimikiene & Ahmed, 2021; Rozsa *et al*., 2022) for the sake of permanent competition prosperity (Gallardo *et al*., 2019; Metzker *et al*., 2021), and the advantages of well-developed social capital (Mishchuk *et al*., 2022; Metzker & Zvarikova, 2021). Moreover, CSR needs to be in compliance or even in a synergetic interaction with demands for ethics (Sroka & Szántó, 2018) and the synergy of eco-efficiency and human capital efficiency (Polcyn, 2021). Concerning these relationships, firms implement advanced decisions aiming to take into consideration the value proposition for employees (Samoliuk *et al*., 2022), development of human resource management based on CSR principles (Stachova *et al.,* 2020), including measures within age management and CSR development (Urbancová & Vrabcová,

2020). These efforts are effective regardless of the size or age of the company (Çera *et al*., 2020). Besides, they positively affect the environmental, social, and governance performance of companies, especially in sectors with ethical implications (Cayón & Gutierrez, 2021). As a result, it is even often argued that sustainability and CSR might lead to 'a more sophisticated form of capitalism' (Porter & Kramer 2011). Nevertheless, it has been already observed that wrongly set, interpreted, applied, or communicated CSR could be a heavy contra-productive burden (MacGregor Pelikánová, & Hála, 2021). After all, the multi-stakeholder model means that sustainability and CSR can succeed only if businesses go for them effectively and efficiently and at the same time their endeavour is properly communicated to other stakeholders (Hála *et al.,* 2022), such as investors and consumers (Ting *et al.,* 2019), and they act accordingly (MacGregor *et al.*, 2020a; 2020b). The EU got this message and one decade ago, it came up with the idea of the compulsory CSR reporting of certain large businesses and materialized it with the Directive 2013/34/EU as well as with a radical modernization of traditional EU policies, such as the readjustment of six priorities of the Common Agricultural Policy, including the 2020 key objective 'to rebalance power in the food chain' by improving the cooperation between farmers and market transparency, supporting the development of market-driven production models (geographical indications, organic production and local food systems), and fostering research, development, and innovation (Borychowski *et al.,* 2020). An even more radical step happened in 2019 when the EU adopted the SFDR, *i.e.,* a Regulation applicable across the entire EU and bringing rules regarding sustainability-related disclosures in the financial services sector. Namely, financial market participants and financial advisers in the EU must transparently inform the public about sustainability risks and adverse sustainability impacts, so investors and consumers could learn about the entire and genuine impact and make their educated decisions (Androniceanu, 2021). Greenwashing and other CSR parasitic practices, including manipulative and misleading practices, should be ended and genuine and transparent sustainability reporting should build mutual trust and induce other stakeholders, including investors and consumers, to veto bad investments and to pay a CSR premium aka sustainability bonus or circular premium (D´Adamo & Lupi, 2021). The EU, EU key institutions, and EU law are conceptually very clear about it, *e.g.,* the current taxonomy drive (MacGregor Pelikánová & Rubáček, 2022). However, what is the reality? The SFDR and other sources need to be methodologically processed and analysed to find out whether the EU has brought forth a legitimate, effective, and efficient framework, in particular, whether SFDR means that trade-offs regarding sustainability are to be eliminated from the financial sector.

RESEARCH METHODOLOGY

The study and assessment of whether the EU creates a legitimate, effective, and efficient framework regarding sustainability-related disclosures, in particular, whether SFDR means that trade-offs regarding sustainability are to be eliminated from the financial sector, demanded the use of multidisciplinary and multi-jurisdictional data, its processing by appropriate methods and a critical comparative juxtaposition of the yielded propositions. A strong aspect was the call for a dynamic and chronological study of the evolving legislation.

The primary source of data was the key EU law database called EurLex, the e-platforms of the European Commission and European Parliament, which offer SFDR, related legislative, semi-legislative, and policy instruments. Naturally, at the very centre, there was the SFDR and information about the legislative process leading to its enactment. However, to obtain sufficiently robust data, novelization, and amendment instruments and their preparatory process had to be included in the analysis. Therefore, a deeper dynamic understanding of EU regulation about the sustainable investment required a holistic approach and five-step chronologic analysis addressing (i) the legislative history of the Regulation of sustainable investment, (ii) in particular SFDR and (iii) its Art. 2a, which was added by Regulation (EU) 2020/852 on the establishment of a framework to facilitate sustainable investment (Regulation 2020/852) and which creates the demand for (iv) the exploration of the new taxonomy Regulation, and (v) the newest contribution of the European Commission to this framework.

The selected methods were chosen based on the nature of the sources and data (Yin, 2008). Considering the law's nature, it was relevant to consider legal modelling, systemic interpretation, and sim-

ilar methods. Specifically, considering the EU law nature, the teleological approach focusing on the 'spirit of the law' had to be prioritized. As a support, the literate approach and trend monitoring had to be added. Naturally, a thematic analysis and content analysis was central for all employed methods, regarding all processed data (Silverman, 2013). The resulting thematic analysis entailed both induction and deduction addressing the conceptual background points to categories and keywords for the legislative data assessment (Vourvachis & Woodward, 2015). The involved content analysis extended to legislative, semi-legislative, and policy documents (Krippendorff, 2013) and entailed both quantitative aspects presented by automatic word counts (frequency and concentration of pre-set keywords) and qualitative aspects (Kuckartz, 2014) revealed by the combination of manual scoring and glossing and of automatic processing by artificial intelligence such as Linguistic Inquiry and Word Count (LIWC) (Boyd, 2017; Tausczik & Pennebaker, 2010), in particular LIWC-22 exploring of 1000 words, see https://www.liwc.app/. Namely, LIWC is suggested as the gold standard in software for analysing word use, it is suitable for the assessment of legislative, semi-legislative and policy documents, and it allows different assessment based on the type of document (such as personal writing or formal writing). It offers two sets of results, that is, traditional LIWC dimensions deal with the tenor, social and cognitive aspects, while the summary variables are composites derived from scientific research and include one category about analytical or formal thinking and another category about authenticity as a property of language that reflects when someone is speaking in an unfiltered, off-the-cuff fashion.

Naturally, the collected information could be accepted *per se*, without a strong forensic juxtaposition leading to the critical comparison, refreshed by Socratic questioning (Areeda, 1996) and glossing. Although dominated by qualitative features, still the comparison and Meta-Analysis have their merits (Glass, 1976; Schmidt & Hunter, 2014) while demonstrating that we ultimately had known (or should have recognized that we knew) more than we initially believed. The LIWC results are not conclusive, instead, this artificial intelligence tool is a good instrument to be used along with the other above-described instruments and strategies, as presented in the five-step analysis.

RESULTS AND DISCUSSION

A deeper understanding of EU regulation about sustainable investment requires a holistic approach and five-step chronologic analysis addressing (i) the legislative history of the Regulation of sustainable investment, (ii) in particular SFDR, and (iii) its Art. 2a, which was added by Regulation 2020/852 and which creates the demand for (iv) the exploration of the new taxonomy Regulation, and (v) the ultimate 'self-presentation' of this framework by the European Commission.

The first step addresses the legislative history towards SFDR. In March 2018, the European Commission released the action plan on financing sustainable growth with 10 actions (Action Plan), while Action 9 included the strengthening of sustainability disclosure and the material (EC, 2022). Namely, the Action plan outlines 10 reforms in three areas: a) reorienting capital flows towards sustainable investment, to achieve sustainable and inclusive growth, b) mainstreaming sustainability into risk management, and c) fostering transparency and long-termism in financial and economic activity. On 24 May 2018, the European Commission presented, while referring to Action 9, the proposal for SFDR including a developed memorandum, see 2018/0179(COD) (EurLex, 2022). The legal basis was Art. 114 TFEU, and the process was the ordinary legislative procedure (ex-codecision procedure) (European Parliament, 2022). European Committee of Regions, European Central Bank, and Economic and Social Committee presented their opinions between July and December 2018. Interestingly, the Council of EU has engaged in a long discussion about this proposal, which extended from May 2018 to November 2019. The European Parliament appeared to be more satisfied with the proposal and after hearing the opinion of its Committee on Economic and Monetary Affairs and its Committee on the Environment, Public Health and Food Safety went in April 2019 ahead with the first reading. One of the key reasons for that was the fact that the Committee on Economic and Monetary Affairs adopted the report by Paul Tang, with the recommendation that the European Parliament's position adopted at first reading under the ordinary legislative procedure should merely amend the proposal (European Parliament, 2022). On 27 November 2019, the SFDR was signed, to be soon amended by Regulation 2020/852, see

the issue of taxonomy (MacGregor Pelikánová & Rubáček, 2022). In the summer of 2022, the Parliament launched a preparatory phase about 2022/2634(DEA – Delegated Acts Procedure), *i.e.,* Delegated Regulation supplementing Regulation (EU) 2019/2088 aka Supplementing 2018/0179(COD) (European Parliament, 2022). The new proposal addresses the principle of 'do no significant harm,' while addressing the content, methodologies, and presentation of information about sustainability indicators and adverse sustainability impacts, including the information regarding the promotion of environmental or social characteristics and sustainable investment objectives in pre-contractual documents, on websites and in periodic reports (Parliament, 2022). The legislative evolution appears rather smooth and organic, while the procedure 2018/0179/COD might be replaced by 2022/2634(DEA) in rather a more evolutionary than revolutionary manner, while correctly observing various factors, such as behavioural influences (Reed *et al*., 2013).

The second step was to explore the valid wording of the SFDR, *i.e.,* to identify the SFDR, to realize that the original version was amended in 2020 by Regulation (EU) 2020/852 and to localize and further use the consolidated version of SFDR. Therefore, all consecutive references to the SFDR mean the text after the 2020 amendment, unless otherwise specified. The SFDR includes a preamble with 35 paragraphs and a body with only 20 Articles. Table 1, below, recapitulates the most relevant provisions of the SFDR for the consideration of the statement that SFDR eliminates, or at least contributes to the elimination of trade-offs regarding sustainability in the financial services sector.

Table 1. SFDR: selected provisions about sustainable investment

Art. 1 Subject matter	Harmonized rules for financial market participants and financial advisers on transparency about sustainability risks.
Art. 2 (17) Definitions	'Sustainable investment' is an investment in an economic activity that contributes to an environmental objective, without causing significantly harm.
Art. 2a Principle of doing no significant harm	Technical standards to be developed by the European Supervisory Authorities (the 'ESAs').
Art. 3 Transparency of sustainable risk policies	Financial market participants and advisers must publish information about sustainability on their websites – integration of sustainability risks.
Art. 4 Transparency of adverse sustainability impacts at the entity level	Financial market participants and advisers must publish information about their sustainability on their websites – adverse impact, etc.
Art. 5 Transparency of remuneration policies	Remuneration policies mentioning the integration of sustainability risks to be published on their websites.
Art. 6 Transparency of the integration of sustainability risks	Descriptions about the integration of sustainability risks in investment decisions. Descriptions of pre-contractual disclosures.
Art. 10 Transparency of the promotion … on websites	Description of the environmental or social characteristics …. Description of the methodology used.
Art. 11 Transparency of the promotion …. in periodic reports	Description of environmental or social characteristics …. the sustainability indicators … the designated index.
Art. 12 Review of disclosures	Duty to update.

Source: own elaboration based on SFDR and EurLex.

This rather developed and sophisticated wording has to be interpreted and applied following the prevailing EU law approach, namely the teleological approach. Although it demands a deeper and contextual understanding, its foundation entails the advanced linguistic exploration of its wording. This can be formed by artificial intelligence digital instruments, such as LIWC. Due to the technical setting of LIWC and the segment feature of SFDR, the selected provisions of SFDR are split into two groups for LIWC assessment.

The first group included Art. 1, Art. 2(17), Art. 2a, Art. 3, and Art. 4 and LIWC revealed unsurprisingly a neutral tenor and a surprising lack of moralization. Of course, SFDR is, after all, a legislative instrument (neutrality), but considering its scope and aim, at least some moralization might be expected, see Table 2.

The second group included Art. 5, Art. 6, Art. 10, and Art. 11 and LIWC revealed an even more neutral tenor along with the average analytic and authentic features and a surprising lack of allure and

moralization, *i.e.,* these more specific SFDR provisions are even more technically dry and remote from soft law and an ethical correlation, see Table 3.

Table 2. SFDR: first group of provisions assessed by LIWC (formal writing category used)

Category	Art. 1, Art. 2(17), Art. 2a, Art. 3 and Art. 4	Average for Formal Language
Traditional LIWC Dimension		
I-words (I, me, my)	0.00	0.67
Positive Tone	1.10	2.33
Negative Tone	0.37	1.38
Social Words	5.31	6.54
Cognitive Processes	13.37	7.95
Allure	1.10	3.58
Moralization	0.00	0.30
Summary Variables		
Analytic	97.52	87.63
Authentic	29.82	28.90

Source: own elaboration based on LIWC.

Table 3. SFDR: second group of provisions assessed by LIWC (formal writing category used)

Category	Art. 1, Art. 2(17), Art. 2a, Art. 3 and Art. 4	Average for Formal Language
Traditional LIWC Dimension		
I-words (I, me, my)	0.20	0.67
Positive Tone	0.20	2.33
Negative Tone	0.59	1.38
Social Words	3.35	6.54
Cognitive Processes	15.35	7.95
Allure	0.39	3.58
Moralization	0.00	0.30
Summary Variables		
Analytic	99.16	87.63
Authentic	41.44	28.90

Source: own elaboration based on LIWC.

The third step was to consider perhaps the most important SFDR provision regarding sustainable investment and the (alleged) end of sustainability trade-offs, *i.e.,* Art.2a *Principle of do no significant harm* which was incorporated into SFDR by the legislative change done through Regulation 2020/852. The LIWC exploration of this very specific provision revealed a significantly less neutral tenor and noticeable drive to allure. However, moralization is still omitted here. The most surprising feature is the extremely low value for authenticity, see Table 4.

The fourth step is to holistically consider Regulation 2020/852, and in particular to quickly review the events leading to Regulation 2020/852 and to consider the suggested issue of authenticity. On 22 April 2016, the Paris Agreement was approved by the EU. On 22 November 2016, the European Commission issued a Communication on the next steps for a sustainable European future in order to bring the SDGs into the EU framework. On 20 June 2017, the Council re-affirmed the endorsement (by both the EU and EU member states) of the 2030 Agenda in a full, coherent, comprehensive, integrated, and effective manner, in close cooperation with partners and other stakeholders. On 11 December 2019, the European Commission published its communication on 'The European Green Deal.' However, prior to that, on 24 May 2018, the European Commission adopted its proposal for Regulation 2020/852, which was prepared by Valdis Dombrovskis from the Directorate General for Financial Stability. The legislative pathway to the signature of Regulation 2020/852 was definitely not as smooth and fast as

in the case of SFDR and *e.g.,* a second reading in the European Parliament was needed. Ultimately, on 18 June 2020, Regulation 2020/852 was adopted and since 12 July 2020, it has been applicable.

Table 4. Art. 2a added to SFDR and assessed by LIWC (formal writing category used)

Category	Art.2a	Average for Formal Language
Traditional LIWC Dimension		
I-words (I, me, my)	0.00	0.67
Positive Tone	0.96	2.33
Negative Tone	0.96	1.38
Social Words	0.96	6.54
Cognitive Processes	8.65	7.95
Allure	3.85	3.58
Moralization	0.00	0.30
Summary Variables		
Analytic	99.73	87.63
Authentic	2.92	28.90

Source: own elaboration based on LIWC.

Regulation 2020/852 has a manifest potential to be much more than merely a technical legislative instrument to amend the SFDR by making replacements and additions regarding Art. 2a, Art. 8, Art. 9, and Art. 11. It must be emphasized that Regulation 2020/852 ambitiously attempts to set unified criteria to define across the EU whether an economic activity can be considered environmentally sustainable. Consequently, Regulation 2020/852 is labelled as a 'taxonomy' regulation. It is one of myriads of actions set up to help to reach the following three objectives of the action plan: (i) to push capital flows towards sustainable investments; (ii) to manage financial risks implied by climate change, natural disasters, environmental degradation, and social issues; and (iii) to foster transparency (EurLex, 2020b). It is absolutely crucial to demonstrate that the particular economic activity is environmentally sustainable because it significantly contributes to at least one of the six environmental objectives set out in Regulation 2020/852 and at the same time does not significantly harm ANY of these six environmental objectives (Art.3 Regulation 2020/852). These six key environmental objectives are a) climate change mitigation; b) climate change adaptation; c) the sustainable use and protection of water and marine resources; d) the transition to a circular economy; e) pollution prevention and control; f) the protection and restoration of biodiversity and ecosystems (Art.9 Regulation 2020/852). The LIWC exploration of pertinent provisions of Art. 3-6 of Regulation 2020/852 reveals significantly a very neutral tenor and drive to allure, but moralization is still omitted. The most positive feature is a high value for analytic features and a very high value for authenticity, see Table 5.

Table 5. Art. 3-6 of Regulation 2020/852 assessed by LIWC (formal writing category used)

Category	Art.3-6	Average for Formal Language
Traditional LIWC Dimension		
I-words (I, me, my)	0.00	0.67
Positive Tone	0.14	2.33
Negative Tone	0.27	1.38
Social Words	0.68	6.54
Cognitive Processes	8.17	7.95
Allure	1.50	3.58
Moralization	0.00	0.30
Summary Variables		
Analytic	98.56	87.63
Authentic	40.23	28.90

Source: own elaboration based on LIWC.

The fifth step represents a potential future legislative instrument, *i.e.,* Commission Delegated Regulation supplementing SFDR concerning regulatory technical standards (RTS) while focusing on the content and presentation of the information in relation to the principle of 'do no significant harm' (Delegated Regulation on SFDR). In February 2021, the EBA, EIOPA and ESMA aka European Supervisory Authorities (ESAs) submitted the draft RTS to the Commission. On 6 April 2022, the European Commission brought its proposal which defines the content, methodology, and publication of data to be disclosed, and thus ameliorated its quality and comparability (EC, 2022). This proposal, COM(2022) 1931 final is undergoing legislative scrutiny with a scheduled application in 2023/2024. It includes a directly applicable regulation which brings further disclosure demands and so expands demands imposed upon pre-existing sectoral legislations (AIFMD, UCITS, Solvency II, IDD and MiFID II), through a self-standing text (lex specialist) establishing full harmonization, multi-sectorial consistency and regulatory neutrality (EC, 2022). Similarly to Regulation 2020/852, the LIWC exploration of pertinent provisions of Art. 2-4 of the proposal for Delegated Regulation RTS reveals significantly a very neutral tenor and a drive to allure, but moralization is still omitted. The most positive feature is a high value for analytic features and a very high value for authenticity, see Table 6.

Table 6. Art. 2-4 of Proposal for Delegated Regulation RTS assessed by LIWC (formal writing category used)

Category	Art.2 – Art.4 of Proposal for Delegated Regulation RTS	Average for Formal Language
Traditional LIWC Dimension		
I-words (I, me, my)	0.52	0.67
Positive Tone	0.52	2.33
Negative Tone	0.00	1.38
Social Words	4.77	6.54
Cognitive Processes	8.76	7.95
Allure	1.80	3.58
Moralization	0.00	0.30
Summary Variables		
Analytic	98.78	87.63
Authentic	39.30	28.90

Source: own elaboration based on LIWC.

CONCLUSIONS

Does the EU law framework regarding sustainable investment create a legitimate, effective, and efficient mechanism supporting a genuinely sustainable investment and eliminating greenwashing and other trade-offs? The performed five-step chronological contextual analysis of key legislative and semi-legislative instruments with LIWC assessment led to highly relevant and rather unexpected observations and offers at least four pioneering propositions with suggestions for further studies as well as legislative and other endeavours.

Firstly, this framework having at its centre SFDR is in process of a very dynamic evolution prompted by the European Commission and partially, but not fully, endorsed by the European Council and European Parliament. Secondly, key legislative and semi-legislative instruments are expressed in a rather neutral and technical manner, but their authenticity varies dramatically. The trend observation suggests a progressive increase in authenticity and this should be applauded. Thirdly, highly surprisingly, morality appears to be totally avoided, which is plainly in contrast with the entire sustainability and CSR evolution, especially its last milestones. Fourthly, already the plain literate interpretation of the wording of the explored documents, Action Plan, SFDR, Regulation 2020/852 on taxonomy and Proposal for Delegated Regulation on RTS, strongly litigates against an artificial disassociation of concepts linked to sustainability, CSR, and shared values. The contextual and teleological interpretation even points to the drive for the synergetic and holistic approach by the European Commission and this is in line with behavioural economics. In sum, between 2018 and 2022, the European Commission engaged in a myriad of endeavours

to stimulate sustainable investment and progressively has been working on more and more detail-oriented and truly enforceable legislative measures, see the way from recommendations to RTS. Stakeholders, especially managers, should keep a close eye on this development and adjust their attitude to general issues, such as long-term strategies, as well as very particular issues, such as shaping their reports.

Since the performed analysis was instantaneous, textual and, had no empirical field observation, it has inherent limitations which should be reflected by future studies. Its longitudinal dimension is underdeveloped, especially the observation of the destiny of the Proposal for Delegated Regulation on RTS should be done in the future. Further, the applied dimension is missing and needs to be added, especially the observation regarding compliance and enforcement, including giving sanctions. Further, the multi-stakeholder model test is missing and should be brought, *e.g.,* via surveys, in order to learn the points of view of various groups of stakeholders and update the framework accordingly. Finally, the LIWC exploration should be complemented by parallel software and other content exploration instruments. Thus far, the European Commission has demonstrated commitment and closely worked with ESAs towards the establishment of a legitimate, effective, and efficient framework for sustainable investment. At the same time, the European Commission does not seem to enthusiastically engage and include others, except ESAs, in this process. However, the sustainable growth and meeting of SDGs truly need support across the entire society and the EU, via European Commission, should proclaim it in a very clear manner. The historical examples, regardless of whether they concern the Hanseatic League or the Brundtland Report 1987 are self-explanatory. Those who do not learn history are doomed to repeat it, as stated by George Santayana, a famous follower of Spinoza.

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