



Ekonomická
fakulta
Faculty
of Economics

Jihočeská univerzita
v Českých Budějovicích
University of South Bohemia
in České Budějovice

SBORNÍK VYBRANÝCH PŘÍSPĚVKŮ 5. ROČNÍKU
MEZINÁRODNÍ VĚDECKÉ KONFERENCE

ETIKA V 21. STOLETÍ





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Etika v 21. století

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Ekonomická fakulta

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Úvod

Mezinárodní vědecká konference Etika v 21. století, pořádaná Ekonomickou fakultou Jihočeské univerzity v Českých Budějovicích, se 14. května 2026 uskutečnila již popáté. Konference dlouhodobě vytváří prostor pro mezioborovou diskusi o aktuálních etických otázkách a propojuje akademickou sféru, odborníky z praxe i zástupce veřejného sektoru.

Letošní ročník reflektoval etické výzvy spojené se současnými společenskými, ekonomickými, technologickými a environmentálními proměnami. Pozornost byla věnována zejména etice v podnikání a společenské odpovědnosti, environmentální etice a udržitelnosti, digitalizaci a umělé inteligenci, ale také otázkám mediální odpovědnosti, vzdělávání, marketingu či vědeckého publikování.

Předkládaný recenzovaný sborník navazuje na odbornou diskusi, která během konference zazněla, a představuje výběr původních odborných příspěvků. Zahrnuje teoretické a konceptuální studie, empirické výzkumy i analýzy konkrétních etických problémů. Tematická rozmanitost jednotlivých textů ukazuje, že etika dnes prostupuje širokým spektrem oblastí lidské činnosti a stále více vyžaduje mezioborový přístup a schopnost propojovat teoretické poznání s praktickou zkušeností.

Společným jmenovatelem publikovaných příspěvků je snaha porozumět současným etickým výzvám, kriticky reflektovat jejich dopady a přispět k hledání odpovědných řešení. Sborník tak zachycuje nejen aktuální směry odborné diskuse, ale zároveň nabízí prostor pro sdílení poznatků, zkušeností a různých perspektiv.

Věříme, že publikace bude pro čtenáře zdrojem odborných poznatků i inspirací pro další výzkum, mezioborovou spolupráci a praktické uplatňování etických principů v prostředí organizací, institucí i společnosti.

Jménem organizačního výboru

Nikola Soukupová

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Vývoj předmětu „Organizace“ ve vysokoškolském studiu ekonomických oborů v Českých Budějovicích

Drahoš Vaněček¹

Abstrakt: Cílem článku je ukázat na postupné změny, které se týkaly výuky předmětu „Organizace“, především z hlediska jeho obsahu a uplatnění v různých studijních programech, nejprve na Provozně ekonomické fakultě VŠZ Praha, od roku 1960 na Provozně ekonomické fakultě VŠZ Praha v Č. Budějovicích, následně od roku 1983 na Agronomické fakultě, od roku 1992 na Zemědělské fakultě a od roku 2007 na Ekonomické fakultě JU v Č. Budějovicích. Zahrnuje období let 1952-2025, které autor rozděluje do čtyř částí, z nichž každou postupně charakterizuje.

1 Úvod

Předmět „Organizace“ se začal vytvářet od samotného vzniku Provozně ekonomické fakulty v Praze a měl reagovat na radikální změny v československém zemědělství, které v té době probíhaly (zakládání JZD). Kulakům - bohatším rolníkům - byl majetek zabaven a spojován s drobným majetkem ostatních zemědělců, kteří si s ním ale nevěděli rady. Muselo docházet ke specializaci pracovníků a nedostatek strojů měly formou služeb zajišťovat strojné traktorové stanice (STS).

Na PEF v Praze se začal vyučovat předmět „Organizace socialistických zemědělských závodů“ a na jeho tvorbě se podílel především prof. Neumann, který též vydal první učebnici (Neumann, 1960), dále doc. Pilíšek, prof. Vrba a další. Brzy se do tohoto projektu zapojily i další vysoké zemědělské školy v republice (Brno, Nitra) a s příchodem prof. Neumanna jako děkana do Č. Budějovic též českobudějovická PEF. Pořádaly se každoroční schůzky a připravovaly se další společné učebnice.

Celé toto období 1952-2025 lze rozdělit na dvě části, přičemž přelomem je rok 1989, kdy u nás skončilo období socialistického plánování a ČR se zapojila do evropské ekonomiky. Přitom v každé této části lze vytipovat dvě odlišné oblasti. V první části je to oblast od roku 1952 přibližně do roku 1970 a druhá část se týká období 1970-1989. Druhé období pak rozděluje nástup umělé inteligence, přibližně rok 2020, také na dvě části. Toto členění bude v následujícím textu akceptováno, především pro větší přehlednost.

2.1 Období 1952-1970

Nově vznikající JZD neměla žádné zkušené pracovníky, kteří by dokázali řídit podniky o výměrách kolem 500 ha, což byla zhruba průměrná výměra jednotlivých obcí. Tam potom bylo třeba přidělovat a kontrolovat práci zhruba pro 30 - 50 lidí, starat se o dobytek, dodržovat agrotechnické lhůty polních prací a podobně. Komunistické vedení to řešilo po svém: dělejte to tak jako v Sovětském svazu. Tam ale bylo zemědělství po různých „stalinských čistkách“ ještě v horším stavu a tak se doporučované příklady u našich zemědělců nesetkávaly s příznivým ohlasem. V živočišné výrobě se doporučovala například masáž vemene krav před dojením podle dojičky Malininové, vzdušný odchov telat, pečení chleba pro prasnice, a podobně. V polní výrobě se zase muselo sledovat, kolik hektarů brambor se zasadilo křížově hnízdovým způsobem, kolik hektarů kukuřice se oselo (tehdy ještě nebyly vhodné odrůdy kukuřice pro naše podmínky a ta dávala menší výnosy než tradiční jetel či vojtěška). To vše a další podobné ukazatele se sledovaly a kontrolovaly, i když většinou přinášely negativní důsledky. Nehledělo se na výrobní podmínky, ukazatelé se rozplánovaly tak, aby kontrolní orgány měly co kontrolovat.

Mimo zemědělství se propagovalo například „Stachanovské hnutí“, kdy horník Stachanov výrazně překračoval normy při ražení chodeb v dolech, bylo to ale za cenu zvýšení intenzity fyzické práce a neřešilo to budoucnost. V dané situaci byla důležitým počinem publikace prof. J. Neumanna (Neumann, 1960), která vytvořila podklad pro výuku stejnojmenného předmětu na vysokých zemědělských školách v ČR, včetně PEF Č. Budějovice. Publikace byla zaměřena na rozbor používaných technologií v rostlinné a živočišné výrobě, výpočtu potřebných pracovníků, dopravních prostředků a podobně.

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Z hlediska potřeb výuky byl problém, že nebyla k dispozici téměř žádná zahraniční literatura. Ta ruská byla pro nás téměř nepoužitelná - kromě publikace Svirščevského (Svirščevský, 1961), zabývající se využitím strojů a jejich pohybem po polích. Jak jsme později zjistili, neexistovala ani žádná vhodná zahraniční literatura, protože v zahraničí převažovala jen malá soukromá hospodářství a jejich zkušenosti se pro naši zemědělskou velkovýrobu nedaly použít. Zbývalo jediné: podívat se do některých našich úspěšných zemědělských podniků, jak to tam dělají, zobecnit tyto zkušenosti a použít je ve výuce. Tato metoda je platná trvale a umožňuje udržovat neustálý kontakt teorie s praxí. Mezi zemědělskými fakultami došlo také k určité specializaci, nač by se měla každá zaměřit. PEF Č. Budějovice se měla více specializovat na oblast horskou a podhorskou, protože ostatní fakulty byly spíše v rovinné krajině. To znamenalo více se zajímat o pěstování brambor a chov dobytka na pastvinách.

Problémem ale zůstával cíl „organizace“. Měla to být úspora nákladů celkem, úspora pracovníků, snížení námahy při práci či něco dalšího? Protože v dané politické době nesměla být u nás nezaměstnanost a každý musel být někde zaměstnán, nemělo smysl dělat nějaké projekty, kde by se ušetřili pracovníci. Ti by tam stejně dál zůstali na svých místech. „Organizace“ se proto spíše zaměřovala na snižování námahy při práci (tak zvané silové studie) a drobné úpravy pracovišť.

2.2 Období 1970-1989

Toto období lze charakterizovat jako opatrné uvolňování ve všech oblastech. Vláda i ÚV KSČ si začaly uvědomovat, že dosavadní systém striktního řízení „shora dolů“ a detailní plánování na mnoho let dopředu nevedou k očekávanému rozvoji, a proto začaly nechávat větší prostor pro iniciativu podniků. Jakoby náhodou byl v archívech objeven článek Lenina o taylorismu a zveřejněn v Rudém právu. Lenin tam ukazoval, že Taylorovy metody organizace práce nebyly zcela špatné, že vedly ke zvyšování výroby, ale že byly zneužity ke zvýšenému vykořisťování pracujících (Taylor, 1946; Gilbreth F. B., Gilbreth L. M., 1923). U nás to pak vedlo k tomu, že některým odborným pracovníkům bylo dovoleno vycestovat do zahraničí a své zkušenosti, které tam získali, publikovat (Dřevjaný, 1962). Rovněž bylo již možné nakupovat zahraniční vědeckou literaturu.

Na fakultě v Českých Budějovicích se začala rozvíjet ergonomie, tj. nauka o tom, jak uspořádat pracoviště tak, aby co nejlépe odpovídalo fyzickým a psychickým schopnostem člověka. Taková pracoviště umožňují nejen snižovat námahu, ale i zvyšovat produktivitu práce. V této oblasti fakultě hodně pomohla Vojenská nemocnice v Č. Budějovicích, kde k tomu účelu měli již některé přístroje a naši studenti na nich mohli provádět jednoduché pokusy. Tato spolupráce, především s doktorem Bürgrem, trvala řadu let (Gabriel, Vaněček, Přibyl, 1966).

V této době začaly do výuky a výzkumu na fakultě pronikat aplikace některých matematických metod, například metody PERT (Marunová, 1966) nebo lineární programování. Dochází ke spolupráci s experty (např. doc. Habr), kteří vysvětlují tyto metody učitelům na fakultě s tím, aby je po zvážení aplikovali do své výuky. Tyto snahy bohužel v praxi nenacházely odezvu, zůstalo jen u pokusů – například optimalizace rozvozu hnoje od několika stájí na několik různě vzdálených pozemků. V praxi s tím bylo hodně starostí a malý efekt.

Další problematika, která rozšířila oblast organizace, přicházela z Japonska ve formě hnutí Kaizen. Japonsko po druhé světové válce mělo průmysl ve velmi špatném stavu a navíc dle mírových dohod některá odvětví nemohlo rozvíjet vůbec. Uvádělo se, že například celoroční produkce automobilů v Japonsku byla v USA vyrobena za půl dne. Přesto se Japoncům podařilo postupně zvyšovat výrobu a hlavně kvalitu na takovou úroveň, že předčili tu americkou. Začali používat Kaizen, což je skupina drobných metod, z nichž každá ušetří třeba jen jednu korunu za den, ale ve svém součtu to mohou být stokrát a tisíce korun. Každý Japonec byl podporován, aby hledal na svém pracovišti nějaká zlepšení a za to pak dostávali pochvaly nebo drobné dárky. Často se jednalo jen o lepší uspořádání pracoviště, odstranění nepořádku, úsporu materiálu a podobně. Žádný nápad nebyl odmítnut, vždy následovala pochvala a tak postupně z těchto drobných zlepšení vzešel japonský zázrak, kdy i Američané začali kupovat japonská auta pro jejich vynikající kvalitu a nízkou cenu. Do té doby se automobily v USA vyráběly formou pásové výroby, ale ta se neměnila a dělníci nebyli nabádáni k tomu, aby hledali sami nějaká zlepšení. Japonský zázrak tak obohatil náplň předmětu „Organizace“, u nás se pro tyto drobné metody používal spíše termín „racionalizace“.

Uvedený příklad charakterizuje oblast průmyslu. Také v zemědělství docházelo k podstatným změnám. Příkladem bylo JZD Slušovice na Zlínsku (Vácha, 1988). Tam stále přetrvával „batismus“, Baťovy metody ve výrobě, kdy za nadprůměrné výsledky dostávali dělníci nadprůměrnou mzdu a samozřejmě za podprůměrné výsledky jim byla mzda snižována. Tyto zásady začalo několik jedinců uplatňovat v zemědělství. Každý pracovník měl svůj úkol a ten byl pravidelně hodnocen. Bylo to jako dnes v populárním sportu, například ve fotbale. Kdo byl ve čtvrtletním hodnocení na posledním místě, sestoupil z vedoucího manažerského místa do „nižší

ligy“ a měl na starosti menší úsek a samozřejmě i menší plat. Pokud se ale v té nižší lize dostal za čtvrt roku na první místo, vrátil se zpět mezi nejvyšší skupinu manažerů. Je to jen stručná ukázka, jak každý mohl uplatnit své schopnosti a pracovat tam, kde mu to šlo nejlépe. Vedoucí pracovníci měli za úkol zvyšovat tržby každý rok o 30%, i když v okolních podnicích to bylo jen o 2-3%. Záhy se ukázalo, že zemědělství již neumožňuje tento rychlý rozvoj a tak se úkoly rozšířily i na služby, jako zakládání loupáren brambor vlastní dům ve Zlíně s prodejnou vlastních produktů, a později i výroba průmyslového zboží (počítače). Velké zisky umožnily též rozsáhlý sociální program pro všechny zaměstnance. To samozřejmě nebylo možné bez souhlasu nejvyšších politických orgánů, které si tak vytvářely možnost ukázkového podniku pro zahraniční delegace, ale další podobné projekty nebyly povoleny. Rovněž vybraní studenti z PEF Č. Budějovice měli možnost JZD Slušovice několikrát navštívit.

Jiný zdroj informací o organizaci zemědělské výroby poskytovaly Státní statky Šumava. Byl to komplex 10 statků, které sdružily své finanční prostředky, aby mohly nakoupit v zahraničí moderní technologie výroby. Bylo to nutné i z toho důvodu, že v oblasti Šumavy byl nedostatek pracovních sil a původní JZD tam zanikla. Šumava byla blíže k Č. Budějovicím než Slušovice a tak bylo možné organizovat tam více exkurzí a ukazovat velkokapacitní stavby pro dobytek, sklady pro tekutá hnojiva a podobně.

Kromě zmíněného komplexu Státní statky Šumava byly zdrojem informací pro předmět „Organizace“ též státní statky Tachov. Protože řada tamních pracovníků neměla odpovídající vzdělání pro svoje funkce, uzavřel tento komplex statků smlouvu s PEF Č. Budějovice o tříletém dálkovém studiu pro tyto pracovníky. Naši učitelé tam jezdili na konzultace vždy v sobotu a neděli a tento čas nevěnovali pouze výuce, ale často i exkurzím na zajímavé objekty. Projekt to byl oboustranně přínosný.

Významnou úlohu v rozvoji zemědělské organizace mělo i tehdejší Ministerstvo zemědělství a lesního hospodářství. To zřídilo Ústav práce, který se měl zabývat racionalizací práce, tedy metodami, které by vhodně propojily nástup nové techniky a její vhodné využívání. Ministerstvo též organizovalo různé kurzy, do kterých byli zapojeni i učitelé z česobudějovické fakulty (Gabriel, Vaněček, Příbýl, 1966).

Ústav práce se tehdy zaměřoval na lepší využívání strojů. K tomu ale bylo třeba sestavovat normy, jaké výkony bude mít stroj v různých podmínkách (svažitost, druh půdy, výměra půdy a podobně) (Kunc a kol., 1983). Tyto údaje potom měly umožnit nejen spravedlivější odměňování pracovníků pracujících v různých podmínkách, ale i lepší plánování potřeby strojů pro dané rozpětí agrotechnických lhůt (Sborník normativů potřeby pracovníků v zemědělství, 1985).

S Ústavem práce katedra řízení PEF Č. Budějovice úzce spolupracovala a získávala tak řadu údajů a dokumentů, které nebyly určeny širší veřejnosti. S rozvojem nových technologií ale význam norem postupně upadal, odměňování pracovníků podle norem přestalo být atraktivní, zaváděla se spíše pevná mzda a různé prémie a po roce 1989 Ústav ukončil svoji činnost.

3.1 Období od roku 1989 do nástupu umělé inteligence 2020

Toto období přineslo podstatné změny do politiky i ekonomiky státu, na které musela vysokoškolská výuka reagovat. Nové technologie a výkonné stroje již delší dobu snižovaly potřebu pracovníků v zemědělství, kde pracovalo stále méně lidí a ubylo i studentů na zemědělských fakultách. V držbě pozemků došlo k privatizaci, půda se vrátila původním majitelům, kteří na ní mohli nyní sami hospodařit nebo ji dobrovolně sdružovat do větších celků. JZD a státní statky přestaly existovat.

Jednotlivé vysoké školy si začaly vytvářet vlastní studijní programy, jejich vzájemná spolupráce spočívala již jen na dílčích společných zájmech. Význam předmětu „Organizace“ zaměřeného na zemědělskou výrobu postupně klesal. Nabídlo se zde ale mnohem větší působistiště, kterým je oblast průmyslu, kde se organizace původně začala vyvíjet jako operační management. Navíc bylo třeba reagovat na zvýšenou potřebu dopravy a skladování, což v sobě soustředila logistika. Rozdělení studia na bakalářský a magisterský stupeň pak vyžadovalo, aby na každém z nich byla nabízena výuka na odlišné úrovni. Na PEF Č. Budějovice byl proto postupně vytvořen pro bakalářské studium předmět „Operační management“ (Vaněček a kol., 2010) a „Logistika“ (Vaněček, 1998). Pro předmět „Logistika“ byly velkou pomocí konzultace s katedrou logistiky na VŠE v Praze a jejich publikace (Pernica, 1994). Pro magisterské studium pak byl vytvořen předmět „Štíhlá výroba“ (Vaněček a kol., 2013) a „Řízení dodavatelského řetězce“ (Vaněček, 2008). Vyžadovalo to ovšem delší období, ani zde nebylo možné převzít hotový koncept jiných zahraničních univerzit. Kromě toho jsme postupně připravovali i výuku pro zahraniční studenty v angličtině, a to pouze ve dvou předmětech: „Operations management“ (Vaněček, 2008) a „Logistics“ (Vaněček, 2010). Tato výuka probíhá úspěšně již řadu let.

EF Č. Budějovice se snaží o to, aby výuka magisterských předmětů (Štíhlá výroba, Řízení dodavatelského řetězce) nebyla pouhou kopií toho, co se učí v bakalářském programu, ale aby tvořila skutečnou nadstavbu s novými poznatky.

Také na ostatních vysokých školách je obdobná problematika vyučována v samostatných předmětech. Například Logistika je na ČVUT- dopravní fakultě, na UTB Zlín, VŠE Praha a dalších. Supply Chain Management je nabízen na VŠE Praha, Škoda Auto M. Boleslav, VŠE Praha a dalších. Operační management nebo Řízení výroby nabízí VUT Brno, Univerzita Jana Evangelisty Purkyně v Ústí nad Labem, UTB Zlín a další.

3.2 Období po roce 2020

Toto období nemá přesný počátek, mělo by vyjadřovat především radikální změnu, ke které zde dochází. V evropském, ale i celosvětovém měřítku je to především snaha zabránit oteplování atmosféry omezením škodlivých emisí, hlavně CO₂. Jinou snahou je uplatňování cirkulární ekonomiky, protože zdroje surovin jsou omezené a jejich nedostatek je hrozbou pro další rozvoj ekonomiky. Tyto snahy vyústily například do tzv. Green Dealu, který byl ale nastaven nerealisticky, pouze ekologicky, a začal snižovat konkurenceschopnost evropských firem. V Evropské unii se také prosazuje snaha o komplexní řešení, tzv. ESG (Environment - životní prostředí, S - sociální prostředí jako jsou pracovní podmínky, bezpečnost práce, vztahy se zaměstnanci i komunitou, G - governance - řízení a správa, etika, složení vedení, odměňování, prevence korupce). ESG ukazuje, zda je podnikání dlouhodobé a udržitelné, nejen ziskové. Na to všechno musí výuka reagovat tak, aby studenti byli s uvedenými problémy seznamováni a dokázali si vytvořit vlastní názor.

Tyto rychlé a globální změny neumožňují, aby se kvůli nim každé 2 - 3 roky psaly nové učebnice. Místo toho učebnice slouží jako základ výuky, ale každoročně jsou některé kapitoly upravovány, doplňovány a prezentovány v informačním systému studijní agendy na JU (STAG) pro aktuální výuku. Uvedený způsob výuky se jeví jako optimální. Je však třeba, aby též studenti byli schopni na nové situace rychle reagovat a nehledali jen nějaké „trvalé pravdy“ v učebnicích, ale aby se aktivně zapojovali do diskusí na přednáškách a cvičeních.

4 Závěr

Článek charakterizuje období uplynulých 73 let a vývoj výuky předmětu „Organizace“, zprvu na VŠZ Praha, od roku 1960 na Provozně ekonomické fakultě Č. Budějovice. S ohledem na organizační změny pak výuka pokračovala na Agronomické fakultě, Zemědělské fakultě a od roku 2007 až do současné doby na Ekonomické fakultě JU Č. Budějovice.

Předmět „Organizace“ dokázal reagovat na změny v českém hospodářství a postupně změnil své zaměření ze zemědělství na mnohem širší oblast průmyslu a služeb. To si ale vyžádalo užší specializaci na nové předměty jako operační management, logistika, řízení dodavatelského řetězce, štíhlá výroba. Studenti tak mají možnost vybírat si předměty dle svého zájmu a zaměření. Ve výuce je kladen důraz především na metody zkoumání, které mají dlouhodobý význam a širší použití než rychle se měnící fakta. Do budoucna se členové katedry řízení na EF chtějí zaměřit na změny, které do těchto oblastí přináší umělá inteligence a další nové technologie tak, aby se v nich studenti dokázali sami dobře orientovat a rozpoznávat jejich klady a zápory.

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Etické dilemy manažmentu cien: transparentnosť, férovosť a dôvera spotrebiteľov

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Abstrakt: Cieľom príspevku je identifikovať a analyzovať hlavné etické dilemy, ktorým čelia manažéri pri tvorbe a implementácii cenových stratégií v prostredí rastúcej digitalizácie a algoritmického oceňovania. Práca sa zameriava na tri kľúčové dimenzie – transparentnosť cenového mechanizmu, vnímanú férovosť cien a budovanie dôvery spotrebiteľov – a nadväzuje na dizertačný výskum autora v oblasti moderných koncepcií riadenia cien a tržieb. Metodologicky ide o systematickú rešerš literatúry databáz Web of Science a Scopus, pričom sú syntetizované klasické behaviorálne štúdie (napr. Kahneman et al., 1986) s novšími empirickými a modelovými prácami o férovosti cien a dynamickom oceňovaní (napr. Malc et al., 2016; Alderighi et al., 2022; Diao et al., 2023; Radic, 2024). Výsledky poukazujú na štyri skupiny etických dilem spojených s napätím medzi maximalizáciou zisku a spravodlivým zaobchádzaním so zákazníkmi a opisujú mechanizmus, prostredníctvom ktorého transparentnosť zvyšuje vnímanú férovosť a dôveru spotrebiteľov. Diskutované zistenia sú pretransformované do praktických odporúčaní pre manažerov, ktorí chcú navrhovať cenové stratégie tak, aby boli ekonomicky udržateľné a zároveň vnímané ako etické a férové.

Kľúčové slová: etika cenotvorby, manažment cien, transparentnosť cien, férovosť cien, dôvera spotrebiteľov, dynamické oceňovanie.

1 Úvod

Manažment cien predstavuje jednu z najdôležitejších, no zároveň eticky najnáročnejších oblastí podnikového rozhodovania. V súčasnom trhovom orientovanom prostredí čelia manažéri permanentnému napätiu medzi tlakom na maximalizáciu zisku na jednej strane a zodpovednosťou voči spotrebiteľom na strane druhej. Zavádzanie sofistikovaných algoritmických a dynamických cenových systémov tento konflikt ešte prehĺbuje, keďže umožňuje využívať individuálne dátové profily spotrebiteľov spôsobmi, ktoré nie sú pre nich viditeľné ani pochopiteľné.

Etické rozmery cenotvorby pritom nie sú akademickou abstrakciou – majú priamy dopad na správanie spotrebiteľov, ich lojalitu a celkovú reputáciu firmy. Výskum opakovane potvrdzuje, že vnímaná nespravodlivosť ceny vedie k nižším zámerom opätovného nákupu, negatívnemu ústnemu šíreniu a poklesu dôvery v predajcu (Xia et al., 2004; Haws & Bearden, 2006; Malc et al., 2016). Napriek tomu zostáva systematická reflexia etických dilem v manažmente cien v odbornej literatúre pomerne okrajovou témou – väčšina prác sa koncentruje na optimalizáciu výnosov alebo behaviorálne aspekty cenových rozhodnutí, pričom normatívna etická perspektíva zostáva na pozadí.

Tento príspevok sa zameriava na tri vzájomne prepojené dimenzie etiky manažmentu cien: 1. transparentnosť cenového mechanizmu, 2. vnímanú férovosť cien a 3. budovanie dôvery spotrebiteľov. Prepojenie týchto dimenzií s praktickými otázkami konkurencieschopnosti a dlhodobej lojality zákazníkov vytvára základ pre relevantný akademický príspevok, ktorý má praktickú pridanú hodnotu pre podnikovú prax.

1.1 Výskumná medzera

Hoci existujú rozsiahle štúdie venované vnímanej férovosti cien (Xia et al., 2004; Bolton et al., 2003; Tarrahi et al., 2016; Malc et al., 2016) a efektom dynamického oceňovania (Haws & Bearden, 2006; Ayadi et al., 2017; Alderighi et al., 2022; Diao et al., 2023), komplexný pohľad integrujúci transparentnosť, férovosť a dôveru v rámci jednotného etického rámca manažmentu cien je v literatúre nedostatočne rozvinutý. Väčšina existujúcich prác skúma tieto konštrukty izolovane, bez ohľadu na ich vzájomné interakcie a implikácie pre podnikovú stratégiu.

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1.2 Prínosy výskumu

Príspevok prispieva k odbornej diskusii trojako: 1. integruje existujúce teoretické poznatky o etike cenotvorby do uceleného analytického rámca; 2. identifikuje mechanizmy, prostredníctvom ktorých transparentnosť a férovosť ovplyvňujú dôveru spotrebiteľov; 3. formuluje praktické odporúčania pre manažerov zodpovedných za cenové rozhodnutia, ktoré chcú zosúladiť ekonomické ciele s etickými normami.

2 Metodika

2.1 Cieľ výskumu

Cieľom príspevku je na základe systematickej analýzy sekundárnych zdrojov identifikovať a charakterizovať hlavné etické dilemy v manažmente cien so zameraním na tri kľúčové dimenzie: 1. transparentnosť cenového mechanizmu, 2. vnímanú férovosť cien a 3. dôveru spotrebiteľov. Príspevok ďalej sleduje, ako sú tieto dimenzie vzájomne prepojené a akým spôsobom ovplyvňujú podnikové výsledky a konkurencieschopnosť.

2.2 Výskumné otázky

Na základe preskúmanej literatúry a identifikovanej výskumnej medzery boli sformulované nasledujúce výskumné otázky:

- VO1: Aké sú hlavné etické dilemy, ktorým čelia manažéri pri tvorbe a implementácii cenových stratégií?
- VO2: Akým spôsobom ovplyvňujú transparentnosť cenového mechanizmu a vnímaná férovosť cien dôveru spotrebiteľov?
- VO3: Ako môže etický manažment cien prispieť k dlhodobej lojalite zákazníkov a konkurencieschopnosti podniku?

2.3 Metodológia výskumu

Príspevok využíva metódu systematickej rešerše literatúry ako primárny metodologický nástroj. Systematická rešerš literatúry predstavuje vedecky uznanú metódu syntézy poznatkov z existujúcich štúdií, ktorá umožňuje identifikovať trendy, medzery a zhody v odbornom poznaní. Práca sa metodologicky opiera o odporúčania pre naratívne rešerše, čo zodpovedá cieľu integrovať poznatky z viacerých podoblastí (etika cenotvorby, behaviorálna ekonómia, manažment cien).

2.4 Zdroje dát a limitácie

Literatúra bola vyhľadávaná primárne v databázach Web of Science a Scopus s využitím kľúčových slov: price fairness, price ethics, pricing transparency, consumer trust, dynamic pricing ethics, ethical pricing management. Vyhľadávanie bolo obmedzené na recenzované vedecké články publikované v renomovaných časopisoch. Do rešerše boli zahrnuté aj klasické behaviorálne štúdie staršieho dát (napr. Kahneman et al., 1986), ktorých závery sú v novších výskumoch opakovane potvrdzované.

Limitáciou štúdie je skutočnosť, že ide o kvalitatívnu rešerš literatúry, nie o primárny empirický výskum. Zistenia nie sú priamo overené v kontexte slovenských podnikov, čo ponúka príležitosť pre budúci výskum.

3 Výsledky

3.1 Etické dilemy v manažmente cien – analytický rámec

Na základe rešerše literatúry možno identifikovať štyri hlavné kategórie etických dilem v manažmente cien, ktoré systematicky prepájajú dimenzie transparentnosti, férovosti a dôvery.

Dilema 1: Maximalizácia zisku verus férovosť ceny. Ústrednou etickou dilemou manažmentu cien je napätie medzi tlakom na maximalizáciu zisku a povinnosťou správať sa k zákazníkom férovým spôsobom. Kahneman a kol. (1986) empiricky preukázali, že spotrebiteľia odmietajú cenové rozhodnutia, ktoré vnímajú ako využívanie ich zraniteľnosti, napríklad zdražovanie pri kríze alebo živeľnej pohrome. Firmy, ktoré konajú v súlade s komunitnými normami férovosti, si udržiavajú dlhodobú reputáciu a zákaznícku lojalitu, zatiaľ čo krátkodobé maximalizovanie zisku na úkor zákazníkov môže mať devastujúce dlhodobé dôsledky.

Dilema 2: Transparentnosť verus strategická ochrana informácií. Manažéri stoja pred voľbou medzi odhaľovaním informácií o cenových mechanizmoch a ochranou citlivých obchodných informácií. Miao a Mattila (2007) ukázali, že vyššia transparentnosť zvyšuje vnímanie férovosti a ochotu zákazníkov platiť, čo je argument

v prospech transparentnosti. Na druhej strane, úplné odhalenie cenových algoritmov môže firmu znevýhodniť voči konkurencii. Riešením tejto dilemy môže byť selektívna transparentnosť – napríklad vysvetlenie princípov cenového mechanizmu bez odhalenia konkrétnych algoritmov.

Dilema 3: Personalizované oceňovanie verzus rovnaké zaobchádzanie. Personalizované oceňovanie umožňuje firmám maximalizovať zisky tým, že každému zákazníkovi ponúknu cenu zodpovedajúcu jeho maximálnej ochote platiť. Richards (2016) však zdôrazňuje, že percepcia cenovej nerovnosti môže vyvolávať silnú averziu k neférovosti (inequity aversion), ktorá je potenciálne seba poškodzujúca pre firmy. Grewal a kol. (2004) potvrdili, že identifikovanie zákazníkov a následné individuálne prispôbovanie cien výrazne znižuje dôveru a zámer opätovného nákupu.

Dilema 4: Dynamické oceňovanie a vnímaná manipulácia. Dynamické cenové systémy sú ekonomicky efektívne, no vyvolávajú etické otázky o férovosti a transparentnosti voči zákazníkom (Ayadi et al., 2017). Alderighi a kol. (2022) preukázali, že dynamické oceňovanie v hotelierstve má signifikantný negatívny vplyv na vnímanie férovosti zákazníkmi. Bez dostatočného vysvetlenia, prečo sa ceny menia, môžu zákazníci vnímať tieto praktiky ako manipulatívne.

Tieto dilemy sa v rôznych podobách objavujú naprieč odvetviami a potvrdzujú, že etika cien je systémovou otázkou, nie izolovaným rozhodnutím jednotlivých manažérov..

3.2 Mechanizmus vplyvu transparentnosti na dôveru spotrebiteľov

Syntézou dostupnej literatúry možno skonštruovať mechanizmus, prostredníctvom ktorého transparentnosť ovplyvňuje dôveru spotrebiteľov. Transparentnosť cenového mechanizmu funguje ako signál benevolentnosti predajcu, ktorý spotrebiteľom naznačuje, že firma nemá zámer skrývať informácie alebo ich zneužiť (Yang & Battocchio, 2021). Tento signál znižuje informačnú asymetriu medzi predajcom a kupujúcim, čo vedie k vyššej vnímanej férovosti a v konečnom dôsledku k posilneniu dôvery.

Tabuľka 1 Vzťahy medzi transparentnosťou, férovosťou a dôverou spotrebiteľov

Dimenzia	Kľúčové faktory	Dopad na dôveru	Reprezentatívna štúdia
Transparentnosť ceny	Dostupnosť a zrozumiteľnosť informácií	Pozitívny	Miao & Mattila (2007)
Nákladová transparentnosť	Odhalenie štruktúry nákladov	Výrazne pozitívny	Yang & Battocchio (2021)
Férovosť ceny	Princíp dvojitého nároku, referenčné ceny, sociálne porovnanie	Pozitívny	Xia et al. (2004); Malc et al. (2016); Tarrahi et al. (2016); Radic (2024)
Dynamické oceňovanie	Bezdôvodné cenové rozdiely, časovo závislé ceny	Negatívny bez vysvetlenia, potenciálne neutrálny pri transparentnej komunikácii	Haws & Bearden (2006); Alderighi et al. (2022); Diao et al. (2023)
Personalizované oceňovanie	Identifikácia zákazníka, cenová diskriminácia	Výrazne negatívny pri skrytej diskriminácii	Grewal et al. (2004); Richards (2016)

Zdroj: Vlastné spracovanie na základe literatúry

Dôvera má preukázaný pozitívny vplyv na lojalitu zákazníkov: dôverujúci zákazníci sú ochotní opakovane nakupovať, platia vyššie ceny a generujú pozitívne odporúčania (Grewal et al., 2004; Malc et al., 2016). Etický manažment cien, ktorý kladie dôraz na transparentnosť a férovosť, tak prispieva nielen k etickej zodpovednosti podniku, ale aj k jeho dlhodobej ekonomickej výkonnosti.

3.3 Etický manažment cien ako zdroj konkurencieschopnosti

Etický manažment cien nie je len otázkou morálnej zodpovednosti – má priame implikácie pre konkurencieschopnosť podniku. Meta-analýza Tarrahiho a kol. (2016) potvrdila, že neopodstatnené zdražovanie má signifikantne väčší negatívny dopad na vnímanie férovosti ako opatrenia znižujúce ceny, čo naznačuje asymetriu v zákaznických reakciách. Novšie teoretické a empirické práce naznačujú, že integrácia férovostných obáv spotrebiteľov do cenových modelov môže viesť k rovnováham, v ktorých sú férovejšie cenové trajektórie dlhodobo výhodné aj pre firmy (Diao et al., 2023; Radic, 2024).

4 Záver

Výsledky rešerše poukazujú na niekoľko zásadných poznatkov, ktoré majú implikácie pre teóriu aj prax manažmentu cien. Po prvé, etické dilemy manažmentu cien nie sú izolované rozhodnutia – sú systémovým fenoménom odrážajúcim základné napätie medzi ekonomickými a etickými cieľmi podniku. Tento záver rezonuje s dizertačným výskumom autora venovaným moderným koncepciám rozhodovania v oblasti riadenia cien a tržieb, kde sa zdôrazňuje, že cenové rozhodnutia sú multidimenzionálne a zasahujú všetky úrovne riadenia.

Po druhé, zavádzanie algoritmického a dynamického oceňovania výrazne prehľbuje etické riziká v oblasti transparentnosti a férovosti. Zatiaľ čo tieto systémy preukazujú optimalizačný potenciál z pohľadu výnosov, ich použitie bez dostatočnej komunikácie a etickej reflexie môže mať vážne dôsledky pre dôveru a lojalitu zákazníkov. Ayadi a kol. (2017), Alderighi et al. (2022) aj novšie modelové práce Diao et al. (2023) upozorňujú, že zanedbanie obáv spotrebiteľov z neférovosti môže viesť k nestabilným alebo neoptimálnym rovnováham.

Po tretie, existujú praktické manažérske riešenia etických dilem, ktoré nevyžadujú vzdanie sa ziskovosti. Participatívne oceňovanie (Richards, 2016), selektívna transparentnosť (Miao & Mattila, 2007) a komunikácia o dôvodoch cenových zmien (Kahneman et al., 1986; Tarrahi et al., 2016) sú príkladmi prístupov, ktoré umožňujú zachovať etický rámec pri zachovaní ekonomickej efektívnosti. Tieto poznatky sú osobitne relevantné pre slovenské podniky, kde systematické etické reflexie cenových rozhodnutí stále absentujú.

Obmedzením príspevku je jeho charakter rešerše sekundárnych zdrojov, čo neumožňuje priamu empirickú verifikáciu navrhnutého analytického rámca v konkrétnom podnikovom kontexte. Budúci výskum by mal empiricky testovať mediačný model vzťahu transparentnosť – férovosť – dôvera na vzorkách slovenských spotrebiteľov a podnikov. Príspevok identifikoval a analyzoval hlavné etické dilemy v manažmente cien prostredníctvom systematickej rešerše vedeckej literatúry. Na základe vykonanej analýzy možno sformulovať nasledujúce záverečné tvrdenia a odporúčania.

Etika manažmentu cien sa odvíja od troch vzájomne prepojených dimenzií – transparentnosti cenového mechanizmu, vnímanej férovosti cien a dôvery spotrebiteľov. Tieto dimenzie nie sú autonómne, ale tvoria systémový celok: transparentnosť zvyšuje férovosť, férovosť posilňuje dôveru a dôvera podmieňuje dlhodobú lojalitu zákazníkov.

Rešerš literatúry preukázala, že eticky zodpovedný manažment cien nie je v protiklade s ekonomickými cieľmi podniku – naopak, predstavuje zdroj dlhodobej konkurenčnej výhody. Podniky, ktoré investujú do transparentnej cenovej komunikácie a zabráňujú praktikám vnímaným ako neférovosť, dosahujú vyššiu zákaznickú lojalitu a odolnosť voči negatívnemu ústnemu šíreniu.

Pre manažérsku prax z výsledkov vyplývajú nasledujúce odporúčania:

1. Komunikovať dôvody cenových zmien – vysvetlenie, prečo sa cena mení (náklady, inflačný tlak, sezónnosť), výrazne zmierňuje negatívne vnímanie férovosti (Kahneman et al., 1986; Tarrahi et al., 2016).
2. Selektívne zavádzať nákladovú transparentnosť – dobrovoľné odhalenie časti nákladovej štruktúry posilňuje autenticitu značky a dôveru zákazníkov (Yang & Battocchio, 2021).
3. Vyhnuť sa bezdôvodnej personalizovanej cenovej diskriminácii – prispôbovanie cien na základe individuálneho profilu zákazníka bez jeho vedomia výrazne narúša dôveru (Grewal et al., 2004; Richards, 2016).
4. Vytvoriť etický rámec pre zavádzanie dynamického oceňovania – podniky využívajúce algoritmické cenové systémy by mali implementovať interné etické smernice, ktoré zabezpečia súlad s komunitnými normami férovosti (Ayadi et al., 2017; Diao et al., 2023).

Budúci výskum by mal empiricky testovať navrhnutý rámec na vzorke slovenských podnikov a spotrebiteľov, pričom osobitná pozornosť by mala byť venovaná sektorovým rozdielom a vplyvu kultúrneho kontextu na vnímanie cenovej férovosti.

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Fiškálna udržateľnosť v Slovenskej republike a Českej republike: komparatívna analýza vybraných ukazovateľov za rok 2024

Jozef Kovács¹

Abstrakt: Príspevok sa zameriava na komparatívnu analýzu fiškálnej udržateľnosti verejných financií v Slovenskej republike a Českej republike za analyzovaný rok 2024. Hlavným cieľom je komparovať vybrané ukazovatele fiškálnej pozície oboch krajín, konkrétne saldo verejnej správy, hrubý verejný dlh, štrukturálne saldo a indikátor dlhodobej fiškálnej udržateľnosti. Analýza vychádza zo sekundárnych dát publikovaných v správach o dlhodobej udržateľnosti verejných financií, ktoré spracovali inštitúcie Rada pre rozpočtovú zodpovednosť a Národní rozpočtová rada. Skúmané obdobie zahŕňa rok 2024. Na spracovanie údajov bola použitá komparatívna analýza doplnená o vyčíslenie rozdielov medzi krajinami v percentuálnych bodoch. Výsledky preukázali, že Slovenská republika dosiahla menej priaznivé hodnoty vo všetkých sledovaných ukazovateľoch, pričom najvýraznejší rozdiel bol zaznamenaný pri hrubom verejnom dlhu (16,0 p. b.) a pri štrukturálnom salde (2,3 p. b.). Zistenia prispievajú k lepšiemu pochopeniu rozdielov vo fiškálnej pozícii dvoch ekonomicky a historicky blízkych krajín.

Kľúčové slová: fiškálna udržateľnosť, verejné financie, deficit verejnej správy, verejný dlh,

1 Úvod

Fiškálna udržateľnosť predstavuje jeden zo základných predpokladov makroekonomickej stability štátu a dlhodobej solventnosti verejných financií. V odbornej literatúre sa spája najmä so schopnosťou vlády dlhodobo plniť svoje záväzky bez potreby nadmerného zadlžovania alebo náhlych zmien vo fiškálnej politike. Hodnotenie fiškálnej udržateľnosti sa preto opiera predovšetkým o vývoj deficitu verejnej správy, verejného dlhu a ukazovateľov zachytávajúcich potrebnú mieru fiškálneho prispôsobenia v dlhodobom horizonte. V postkrízovom prostredí nadobudla táto problematika ešte väčší význam, nakoľko ekonomiky štátov čelili zhoršeniu rozpočtových sald, rastu verejného dlhu a súčasne aj rastúcim výdavkovým tlakom. Krajewski, Mackiewicz a Szymańska (2016) upozorňujú, že aj v krajinách strednej a východnej Európy, kde bezprostredne nehrozila dlhová kríza, môže pokračovanie expanzívnej fiškálnej politiky zvyšovať budúce riziká. Podobne Wysocki, Czyżewski a Matuszczak (2021) poukazujú na to, že po globálnej kríze ostala fiškálna udržateľnosť v európskom priestore významnou výzvou a jej hodnotenie si vyžaduje dôsledné sledovanie dynamiky verejného dlhu a rozpočtových sald. V rámci krajín Vyšehradskej skupiny sa otázka fiškálnej udržateľnosti spája aj s kvalitou fiškálnych pravidiel, inštitucionálnym rámcom a schopnosťou vlád reagovať na hospodárske krízy. Postuła, Klepacki a Sobolewska (2018) zdôrazňujú, že dlhové pravidlá predstavujú dôležitý nástroj podpory dlhodobej stability verejných financií, pričom ich účinnosť závisí nielen od ich formálneho nastavenia, ale aj od ich kompatibility s ekonomickým prostredím krajiny. Na túto líniu nadväzuje aj Provazníková (2023), ktorá pri analýze krajín V4 a pobaltského priestoru ukazuje, že štáty nevstupovali do krízy COVID-19 s rovnakou mierou fiškálnej pripravenosti. Rozdiely vo fiškálnej disciplíne a vo východiskovej pozícii verejných financií následne ovplyvnili rozsah a charakter prijímaných opatrení. Tieto zistenia sú dôležité aj pre komparáciu Slovenskej republiky a Českej republiky, pretože naznačujú, že aktuálna fiškálna pozícia štátu je výsledkom dlhodobého vývoja a kvality verejnofinančného riadenia. Pre česko-slovenský kontext sú obzvlášť relevantné štúdie, ktoré sa venujú priamo obom ekonomikám. Farkašovský, Lawson a Zimková (2015) analyzovali dlhovú udržateľnosť Českej republiky a Slovenskej republiky neparametrickým prístupom a ukázali, že hodnotenie dlhovej trajektórie úzko súvisí s tempom hospodárskeho rastu, úrokovými nákladmi a schopnosťou vlády vytvárať primerané primárne saldo. Zeman et al. (2020) zároveň poukazujú na to, že Česká republika a Slovenská republika sa líšia v pripravenosti na externé šoky, pričom priaznivejšia východisková fiškálna pozícia zvyšuje odolnosť ekonomiky v krízových situáciách. V prípade Českej

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republiky upozorňujú Regnerová, Šišková a Šáľková (2023) na rastúce riziká verejného dlhu v dôsledku po sebe nasledujúcich kríz a na potrebu koncepčného riadenia dlhu.

Na slovenskej strane Matoušková (2020) konštatuje, že rizikom nie je len samotná výška verejného dlhu, ale aj nedostatočné vytváranie fiškálneho priestoru v obdobiach priaznivého hospodárskeho vývoja. Dôležitým prvkom súčasnej literatúry je aj širší regionálny a komparatívny pohľad. Uryszek (2018) vo svojom výskume krajín V4 zdôrazňuje, že fiškálna udržateľnosť je podmienená zodpovedným riadením verejných financií na rôznych úrovniach verejnej správy. Komissarova a Sergeev (2019) zároveň ukazujú, že európske fiškálne riadenie a tlak na rozpočtovú konsolidáciu vo vyšehradskom priestore prispeli k posilneniu rozpočtovej disciplíny, avšak odhalili aj limity fiškálnych reakcií založených prevažne na krátkodobých opatreniach. Tieto závery podporujú potrebu sledovať nielen aktuálnu úroveň deficitu a dlhu, ale aj ich dlhodobejšie implikácie pre fiškálnu stabilitu krajiny.

Na základe uvedených teoretických východísk možno konštatovať, že deficit verejnej správy a verejný dlh patria medzi hlavné faktory ovplyvňujúce dlhodobú fiškálnu udržateľnosť. Ich význam je však potrebné posudzovať v širšom kontexte kvality fiškálnych inštitúcií, pripravenosti ekonomiky na externé šoky a schopnosti verejnej správy reagovať na rastúce výdavkové tlaky. Práve preto je komparácia Slovenskej republiky a Českej republiky za rok 2024 opodstatnená, pretože umožňuje zachytiť rozdiely vo fiškálnej pozícii dvoch ekonomicky a historicky blízkych krajín, ktoré však vykazujú odlišný vývoj verejných financií.

2 Metodika

Cieľom príspevku je komparovať vybrané indikátory fiškálnej udržateľnosti verejných financií v Slovenskej republike a Českej republike za analyzovaný rok 2024. Výskum je založený na kvantitatívnom prístupe a využíva komparatívnu analýzu vybraných fiškálnych indikátorov oboch krajín. Analýza vychádza zo sekundárnych dát publikovaných v správach o dlhodobej udržateľnosti verejných financií, ktoré spracovali Rada pre rozpočtovú zodpovednosť v Slovenskej republike a Národní rozpočtová rada v Českej republike. Konkrétne ide o Správu o dlhodobej udržateľnosti verejných financií za rok 2024 (RRZ, 2025) a Zprávu o dlouhodobé udržitelosti veřejných financí (NRR, 2025). Analyzované údaje sa vzťahujú na obdobie roka 2024. V rámci analýzy boli použité štyri premenné, konkrétne saldo verejnej správy (% HDP), hrubý verejný dlh (% HDP), štrukturálne saldo (% HDP) a indikátor dlhodobej fiškálnej udržateľnosti (% HDP). Keďže za každú z porovnávaných krajín je za analyzovaný rok k dispozícii jediná hodnota každého ukazovateľa, výsledky sú prezentované formou priamej komparácie doplnenej o vyčíslenie rozdielu medzi krajinami v percentuálnych bodoch. Pri interpretácii výsledkov je potrebné zohľadniť, že indikátory dlhodobej udržateľnosti oboch krajín nie sú metodicky úplne porovnateľné. Zatiaľ čo český ukazovateľ hrubého dlhu (% HDP) 55,81% podľa zákona č. 293/2001 Sb., ostatné tri sledované premenné sú metodicky plne porovnateľné.

Výskumný predpoklad

Predpokladá sa, že Slovenská republika vykazovala v roku 2024 menej priaznivé hodnoty vybraných ukazovateľov fiškálnej udržateľnosti ako Česká republika.

Výskumná otázka

VO: Aké sú hlavné rozdiely vo vybraných ukazovateľoch fiškálnej udržateľnosti medzi Slovenskou republikou a Českou republikou v roku 2024?

3 Výsledky

V súlade so stanoveným cieľom, výskumným predpokladom a výskumnou otázkou bola realizovaná komparatívna analýza vybraných ukazovateľov fiškálnej udržateľnosti Slovenskej republiky a Českej republiky za analyzovaný rok 2024. Analýza vychádza z hodnôt publikovaných Radou pre rozpočtovú zodpovednosť v Správe o dlhodobej udržateľnosti verejných financií za rok 2024 (RRZ, 2025) a Národní rozpočtovou radou v Zprávě o dlouhodobé udržitelosti veřejných financí (NRR, 2025). Sledovanými premennými sú saldo verejnej správy, hrubý verejný dlh, štrukturálne saldo a indikátor dlhodobej fiškálnej udržateľnosti, všetky vyjadrené ako podiel na hrubom domácom produkte. Keďže za každú z porovnávaných krajín je za analyzovaný rok k dispozícii jediná hodnota každého ukazovateľa, výsledky sú prezentované formou priamej komparácie doplnenej o vyčíslenie rozdielu medzi krajinami v percentuálnych bodoch. Tento postup umožňuje zachytiť nielen smer, ale aj rozsah divergencie vo fiškálnej pozícii oboch ekonomík. Vzhľadom na zaradenie štrukturálneho salda medzi sledované premenné je zároveň možné posúdiť, do akej miery majú zistené rozdiely trvalý charakter, keďže tento ukazovateľ je očistený

o vplyv hospodárskeho cyklu a jednorazových vplyvov. V tabuľke 1 sú zobrazené výsledky jednotlivých skúmaných premenných za analyzované obdobie oboch krajín.

Tabuľka 1 Komparácia vybraných ukazovateľov fiškálnej udržateľnosti Slovenskej republiky a Českej republiky za rok 2024 (% HDP)

Ukazovateľ	Slovenská republika	Česká republika	Rozdiel (p. b.)
Saldo verejnej správy	- 5,3	-2,2	-3,1
Hrubý verejný dlh	59,3	43,3	16
Štrukturálne saldo	- 4,2	-1,9	-2,3
Indikátor dlhodobej udržateľnosti	4,1	2,88	1,22

Zdroj: Vlastné spracovanie na základe RZZ (2025) a NRR (2025)

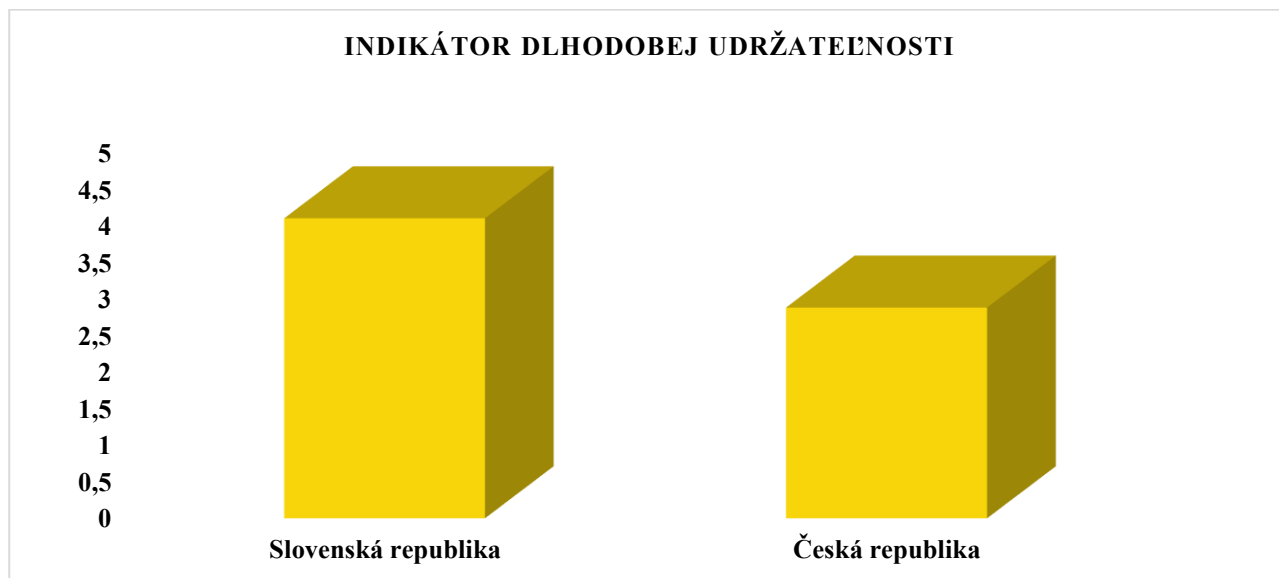
Z výsledkov uvedených v tabuľke 1 vyplýva, že Slovenská republika dosiahla v roku 2024 menej priaznivé hodnoty vo všetkých štyroch sledovaných ukazovateľoch. Saldo verejnej správy dosiahlo v Slovenskej republike deficit na úrovni 5,3 % HDP, zatiaľ čo v Českej republike 2,2 % HDP, čo predstavuje rozdiel 3,1 percentuálneho bodu. Slovenský deficit tak bol viac než dvojnásobný oproti českému. Ešte výraznejší rozdiel bol identifikovaný pri hrubom verejnom dlhu. Slovenská republika vykázala ku koncu roka 2024 dlh na úrovni 59,3 % HDP, čím prekročila horný limit stanovený ústavným zákonom o rozpočtovej zodpovednosti a zotrvala v najvyššom sankčnom pásme dlhovej brzdy. Česká republika dosiahla 43,3 % HDP, teda hodnotu bezpečne pod národnou hranicou dlhovej brzdy stanovenou na úrovni 55 % HDP.

Rozdiel 16,0 percentuálneho bodu predstavuje najvýraznejšiu divergenciu spomedzi všetkých sledovaných premenných. Štrukturálne saldo, ktoré poskytuje pohľad na fiškálnu pozíciu krajiny po očistení o vplyv hospodárskeho cyklu a jednorazových vplyvov, dosiahlo v Slovenskej republike deficit 4,2 % HDP a v Českej republike 1,9 % HDP. Rozdiel 2,3 percentuálneho bodu má osobitnú výpovednú hodnotu, pretože na rozdiel od celkového salda nie je ovplyvnený momentálnou fázou hospodárskeho cyklu, a preto indikuje trvalý nesúlad medzi príjmami a výdavkami verejnej správy.

Indikátor dlhodobej udržateľnosti dosiahol v Slovenskej republike hodnotu 4,10 % HDP a v Českej republike 2,88 % HDP. Vyššia hodnota tohto ukazovateľa signalizuje väčší rozsah opatrení potrebných na stabilizáciu verejného dlhu v dlhodobom horizonte, a teda vyššiu mieru fiškálneho rizika. Podľa hodnotiacej škály Rady pre rozpočtovú zodpovednosť sa slovenská hodnota nachádza v pásme stredného rizika.

Na základe prezentovaných výsledkov možno konštatovať, že vo všetkých sledovaných ukazovateľoch dosiahla priaznivejšie hodnoty Česká republika. Výsledky komparatívnej analýzy tak potvrdili stanovený výskumný predpoklad, podľa ktorého Slovenská republika vykazovala v roku 2024 menej priaznivé hodnoty vybraných ukazovateľov fiškálnej udržateľnosti než Česká republika.

Graf č. 1 Porovnanie indikátora dlhodobej udržateľnosti v Slovenskej republike a Českej republike za rok 2024



Zdroj: Vlastné spracovanie

Graf 1 nadväzuje na výsledky uvedené v tabuľke 1 a vizuálne znázorňuje porovnanie indikátora dlhodobej udržateľnosti v Slovenskej republike a Českej republike za rok 2024. Z grafu 1 je zrejmé, že Slovenská republika dosiahla vyššiu hodnotu tohto ukazovateľa, konkrétne 4,10 % HDP, zatiaľ čo v Českej republike bola zaznamenaná hodnota 2,88 % HDP.

4 Diskusia

Tieto výsledky sú v súlade s teoretickými východiskami príspevku, podľa ktorých saldo verejnej správy a verejný dlh patria medzi hlavné determinanty dlhodobej fiškálnej stability krajiny a ich nepriaznivý vývoj sa premieta do rastu fiškálneho rizika. Z pohľadu teórie je dôležité, že výsledky neukazujú len momentálny rozdiel medzi dvoma ekonomikami, ale naznačujú aj odlišnú kvalitu fiškálneho riadenia a rozdielnu schopnosť vytvárať fiškálny priestor. Na tento aspekt upozorňujú aj Postuła, Klepacki a Sobolewska (2018), ktorí zdôrazňujú význam fiškálnych pravidiel a ich praktickej aplikácie pre stabilitu verejných financií, ako aj Provnáková (2023), podľa ktorej štáty V4 nevstupovali do krízových období s rovnakou mierou fiškálnej pripravenosti. V tomto kontexte možno interpretovať priaznivejšie výsledky Českej republiky ako prejav stabilnejšej fiškálnej pozície, zatiaľ čo výsledky Slovenskej republiky naznačujú vyššiu mieru zraniteľnosti verejných financií.

Osobitnú pozornosť si zasluhuje indikátor dlhodobej udržateľnosti, ktorý v analyzovanom roku dosiahol vyššiu hodnotu v Slovenskej republike než v Českej republike. Keďže tento ukazovateľ zachytáva mieru dlhodobého fiškálneho rizika, jeho vyššia hodnota signalizuje menej priaznivú perspektívu dlhodobej stability verejných financií. Výsledok korešponduje s teoretickými závermi Farkašovského, Lawsons a Zimkovej (2015), podľa ktorých je dlhová udržateľnosť úzko previazaná nielen s aktuálnou úrovňou dlhu, ale aj s celkovou trajektóriou fiškálnej politiky, tempom rastu ekonomiky a schopnosťou vlády vytvárať primerané primárne či štrukturálne saldá. Práve kombinácia vyššieho deficitu a vyššieho dlhu v prípade Slovenska pravdepodobne prispela k menej priaznivému hodnoteniu dlhodobej udržateľnosti. Vzhľadom na odlišné referenčné hranice, voči ktorým sú indikátory oboch krajín konštruované, je pritom potrebné interpretovať tento rozdiel skôr ako orientačný, pričom smer zisteného rozdielu potvrdzujú aj metodicky plne porovnateľné premenné. Diskutované zistenia sú zároveň v súlade s regionálnou literatúrou zameranou na krajiny strednej a východnej Európy. Krajewski, Mackiewicz a Szymańska (2016) upozorňujú, že pokračovanie expanzívnej fiškálnej politiky aj po krízových obdobiach môže zvyšovať budúce riziká fiškálnej udržateľnosti. Podobne Wysocki, Czyżewski a Matuszczak (2021) poukazujú na to, že aj po odznení globálnej finančnej krízy zostávala otázka udržateľnosti verejných financií v Európe vysoko aktuálna. Výsledky tohto príspevku naznačujú, že uvedené závery sú relevantné aj pre porovnanie Slovenskej republiky a Českej republiky, keďže rozdiely vo fiškálnej pozícii oboch krajín sa premietli aj do rozdielnej úrovne dlhodobého fiškálneho rizika.

Na českú a slovenskú ekonomiku sa tieto zistenia viažu aj v širšom kontexte pripravenosti na externé šoky. Zeman et al. (2020) uvádzajú, že priaznivejšia východisková fiškálna pozícia zvyšuje odolnosť ekonomiky voči neočakávaným otrasom. Z tohto pohľadu možno priaznivejšie hodnoty Českej republiky interpretovať ako signál vyššej fiškálnej odolnosti, zatiaľ čo Slovenská republika sa vzhľadom na horšie ukazovatele môže nachádzať v menej komfortnej pozícii pri zvládaní budúcich ekonomických a sociálnych výziev. Na slovenskej strane tento záver podporuje aj Matoušková (2020), ktorá upozorňuje, že rizikom nie je len samotná výška verejného dlhu, ale aj nedostatočné vytváranie fiškálneho priestoru v priaznivých fázach hospodárskeho cyklu. Práve v tomto bode nadobúda osobitnú výpovednú hodnotu štrukturálne saldo, ktoré v Slovenskej republike dosiahlo deficit 4,2 % HDP oproti 1,9 % HDP v Českej republike. Keďže tento ukazovateľ je očistený o vplyv hospodárskeho cyklu a jednorazových vplyvov, zistený rozdiel nemožno pripísať odlišnej fáze hospodárskeho vývoja ani rozdielnemu rozsahu dočasných opatrení. Ide teda o prejav trvalého nesúladu medzi príjmami a výdavkami verejnej správy, ktorý potvrdzuje vyššie uvedené závery Matouškovej (2020) a zároveň naznačuje, že zistená divergencia nemá prechodný charakter. Z analytického hľadiska je dôležité dodať, že výsledky majú prierezový charakter a zachytávajú fiškálnu pozíciu oboch krajín k jednému referenčnému obdobiu. Ich význam však spočíva v tom, že aj pri porovnaní dvoch krajín za jeden rok sa ukázali zreteľné rozdiely vo fiškálnej pozícii oboch ekonomík.

Diskusia tak podporuje záver, že saldo verejnej správy, verejný dlh a najmä štrukturálne saldo predstavujú nielen samostatné ukazovatele stavu verejných financií, ale aj významné faktory, ktoré sa premietajú do hodnotenia dlhodobej fiškálnej udržateľnosti. V tomto zmysle výsledky príspevku nadväzujú na teoretické východiská a potvrdzujú opodstatnenosť komparácie Slovenskej republiky a Českej republiky v analyzovanom roku 2024.

5 Záver

Na základe výsledkov odpovedáme na výskumnú otázku:

Aké sú hlavné rozdiely vo vybraných ukazovateľoch fiškálnej udržateľnosti medzi Slovenskou republikou a Českou republikou v roku 2024?

Odpoveďou na stanovenú výskumnú otázku je zistenie, že hlavné rozdiely vo vybraných ukazovateľoch fiškálnej udržateľnosti medzi Slovenskou republikou a Českou republikou spočívajú predovšetkým v úrovni akumulovaného verejného dlhu a v hĺbke štrukturálneho deficitu. Najvýraznejší rozdiel bol identifikovaný pri hrubom verejnom dlhu, kde slovenská hodnota 59,3 % HDP prevyšovala českú hodnotu 43,3 % HDP o 16,0 percentuálneho bodu. Druhým podstatným rozdielom je štrukturálne saldo, ktoré v Slovenskej republike dosiahlo deficit 4,2 % HDP oproti 1,9 % HDP v Českej republike. Tieto faktory sa následne premietajú do odlišných hodnôt indikátora dlhodobej udržateľnosti, ktorý v Slovenskej republike dosiahol 4,10 % HDP a v Českej republike 2,88 % HDP.

Hlavným cieľom tohto príspevku bolo komparatívne zhodnotiť stav verejných financií a úroveň dlhodobej fiškálnej udržateľnosti v Slovenskej a Českej republike na základe sekundárnych dát za analyzovaný rok 2024. Vykonaná analýza preukázala, že slovenská ekonomika čelí v porovnaní so svojim susedom vyšším fiškálnym rizikám vo všetkých štyroch sledovaných ukazovateľoch. Podľa hodnotiacej škály Rady pre rozpočtovú zodpovednosť sa slovenská hodnota indikátora dlhodobej udržateľnosti nachádza v pásme stredného rizika, do ktorého sa krajina vrátila po predchádzajúcom období v pásme vysokého rizika. Zistenia zároveň naznačujú, že hlavnou príčinou tejto divergencie nie je iba samotná výška naakumulovaného verejného dlhu, ale predovšetkým viac než dvojnásobný rozdiel v štrukturálnych deficitoch oboch krajín. Keďže štrukturálne saldo je očistené o vplyv hospodárskeho cyklu a jednorazových vplyvov, zistený rozdiel indikuje trvalý nesúlad medzi príjmami a výdavkami verejnej správy v Slovenskej republike, ktorý pôsobí ako hlavná brzda fiškálnej konsolidácie.

Tieto výsledky poukazujú na potrebu pokračovania v konsolidácii verejných financií v Slovenskej republike. Pre zabezpečenie udržateľného ekonomického rastu a medzigeneračnej spravodlivosti sa javí ako nevyhnutné pristúpiť k štrukturálnym reformám a implementovať dôveryhodný viacročný konsolidačný plán. Bez týchto krokov možno očakávať postupné znižovanie konkurencieschopnosti slovenskej ekonomiky a neúmerné prenášanie finančného bremena na budúce generácie.

Limity výskumu

1. Obmedzený rozsah analyzovaných údajov

Limitom výskumu je obmedzený rozsah analyzovaných údajov, keďže komparácia vychádza len z dvoch krajín a jedného analyzovaného roka. Z tohto dôvodu majú výsledky prierezový a komparatívny charakter a zachytávajú fiškálnu pozíciu oboch krajín k jednému referenčnému obdobiu bez posúdenia jej dlhodobějšího vývoja.

2. Využitie sekundárnych dát

Ďalším limitom výskumu je použitie sekundárnych dát, ktoré boli prevzaté z oficiálnych správ o dlhodobej udržateľnosti verejných financií. Výsledky sú preto závislé od metodologických prístupov a spôsobu spracovania údajov použitých príslušnými národnými inštitúciami. Zároveň platí, že údaje o hospodárení verejnej správy za rok 2024 mali v čase publikovania správ predbežný charakter a môžu byť predmetom následnej revízie.

3. Obmedzený počet ukazovateľov

Výskum sa zameriava len na vybrané ukazovatele fiškálnej udržateľnosti, konkrétne saldo verejnej správy, verejný dlh, štrukturálne saldo a indikátor dlhodobej udržateľnosti. Do analýzy tak neboli zahrnuté ďalšie faktory, ktoré môžu ovplyvňovať dlhodobú stabilitu verejných financií, napríklad demografický vývoj, výdavky na zdravotníctvo alebo dôchodkový systém.

4. Metodická porovnateľnosť indikátorov

Posledným limitom je skutočnosť, že indikátory dlhodobej udržateľnosti oboch krajín nie sú metodicky úplne totožné. Slovenský ukazovateľ je vzťahovaný k hornej hranici dlhu na úrovni 50 % HDP, zatiaľ čo český ukazovateľ k hranici dlhovej brzdy na úrovni 55 % HDP. Slovenský indikátor je teda konštruovaný voči prísnejšej referenčnej hranici, čo pri inak rovnakých podmienkach vedie k jeho vyššej hodnote. Zistený rozdiel pri tomto ukazovateli má preto skôr orientačný charakter, pričom jeho smer potvrdzujú aj metodicky plne porovnateľné premenné.

Financovanie príspevku

Tento príspevok bol podporený Vedeckou grantovou agentúrou Ministerstva školstva SR a Slovenskej akadémie vied (VEGA) v rámci grantu „Vznik, rozvoj a udržateľnosť inovatívnych podnikov“, číslo 1/0198/25 v rozsahu 50 % a je čiastkovým výstupom projektu mladých vedeckých pracovníkov s číslom A-25-104/3020-05 s názvom projektu „Kľúčové faktory strategickej udržateľnosti podnikov a miesto hybridných pracovných modelov a work-life balance medzi týmito faktormi“ v rozsahu 50%.

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Titel: Fiscal Sustainability in the Slovak Republic and the Czech Republic: A Comparative analysis of selected indicators for year 2024

Abstract: This paper presents a comparative analysis of the fiscal sustainability between public finances in Slovak Republic and the Czech Republic for the year 2024. The study focuses on comparing selected indicators of fiscal position, such as the public sector balance, gross public debt, structural balance, and long-term fiscal sustainability indicators. The analysis is based on secondary data obtained from reports published by the Council for Budget Responsibility and the National Statistical Office. The results show that Slovakia achieved less favourable outcomes in all monitored indicators compared to the Czech Republic, with the largest differences observed in gross public debt (16.0 percentage points) and structural balance (2.3 percentage points). The findings contribute to a better understanding of fiscal position differences between two economically and historically close countries.

Keywords: fiscal sustainability, public finances, general government deficit, public debt.

Profesijná etika účtovného odborníka a jej význam pri poskytovaní a overovaní informácií o udržateľnosti

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Abstrakt: Základný cieľ účtovníctva – poskytovať verný a pravdivý obraz skutočnosti – má silný etický rozmer. Udržateľnosť vo svojich environmentálnych, sociálnych a riadiacich aspektoch reflektuje zodpovednosť podnikov voči planéte, zamestnancom, obchodným partnerom i ostatným záujmovým skupinám. Nestačí pritom len dosahovať zisk, nevyhnutné je zohľadňovať dlhodobé dopady podnikateľskej činnosti a jej dôsledky pre budúcnosť. Účtovníctvo v súčasnosti predstavuje nástroj transformácie ekonomických, environmentálnych, sociálnych a riadiacich javov do informácií využiteľných pri rozhodovaní. Ich kvalita však závisí nielen od dodržiavania pravidiel, ale aj od morálky a integrity osôb, ktoré ich pripravujú, zverejňujú i overujú. V podmienkach regulácie, napr. prostredníctvom CSRD a ESRS sa etika stáva kľúčovým predpokladom dôveryhodnosti informácií. Cieľom príspevku je preskúmať význam profesijnej etiky účtovného odborníka pri poskytovaní a overovaní informácií o udržateľnosti a identifikovať a následne analyzovať základné predpoklady etického výkonu profesie účtovného odborníka v kontexte rastúcich nárokov na transparentnosť a dôveryhodnosť informácií o udržateľnosti.

Kľúčové slová: účtovníctvo, udržateľnosť, účtovník, audítor, etické princípy, vzdelávanie

1 Úvod

Pre zdravý rozvoj a fungovanie ekonomiky je správne vedené účtovníctvo a najmä jeho výstupy mimoriadne dôležité. V súčasnosti v oblasti účtovníctva i samotnej etiky dominuje veľmi významná téma udržateľného rozvoja. Komisia OSN pre životné prostredie a rozvoj udržateľný rozvoj definuje ako taký rozvoj, ktorý zabezpečí potreby súčasných generácií a neohrozí pritom plnenie potrieb budúcich generácií. V súvislosti s udržateľným rozvojom sa sleduje jeho ekonomický, environmentálny, sociálny a riadiaci rozmer. Keďže v účtovníctve sa ekonomické procesy a javy zobrazujú vždy za určitý presne vymedzený ekonomický celok bez ohľadu na jeho vnútorné členenie a štruktúru, v tomto príspevku sa budeme zaoberať aspektami udržateľnosti práve jedného ekonomického celku. Udržateľným správaním podniku rozumieme také podnikateľské správanie, ktoré bude prospešné nielen pre vlastníkov (angl. shareholders), ale aj pre širší okruh záujmových skupín (angl. stakeholders). V súvislosti so správaním zabezpečujúcim udržateľný rozvoj podniku často hovoríme i o spoločensky zodpovednom správaní podniku (angl. corporate social responsibility). Rozumieme ním také správanie podniku, keď podnik prispieva k tvorbe lepšej spoločnosti a čistejšieho životného prostredia tým, že sa do svojej bežnej podnikateľskej činnosti snaží zakomponovať sociálne, environmentálne i riadiace aspekty. Spoločensky zodpovedné správanie podniku je zároveň významne podporené tým, že podnik všetkým záujmovým skupinám (napr. investorom, zamestnancom, zákazníkom, dodávateľom, veriteľom, štátnym orgánom, miestnym komunitám i analytikom, atď.) poskytuje kvalitné informácie nielen o výsledkoch svojej ekonomickej činnosti, ale aj o jej environmentálnych, sociálnych a riadiacich aspektoch. Ohľadne spoločensky zodpovedného správania sa často stretávame s protichodnými názormi. Na jednej strane existujú názory, že spoločensky zodpovedné správanie podniku zvyšuje jeho ekonomickú výkonnosť (napr. prostredníctvom zníženia environmentálnych nákladov či zvýšenia výnosov vďaka lepšej reputácii podniku) a na druhej strane, že ju znižuje. (Dytrt et al., 2006) Jedno je však isté, aby sa podnik mohol správať spoločensky zodpovedne, potrebuje jeho vedenie včasné, relevantné a spoľahlivé informácie, ktoré mu umožnia robiť informované ekonomické rozhodnutia s ohľadom na environmentálne, sociálne a riadiace aspekty svojej činnosti. A takéto informácie poskytuje práve účtovníctvo. Základným cieľom účtovníctva je, prostriedkami jemu vlastnými, poskytovať verný a pravdivý obraz o finančnej a výnosovej situácii účtovnej jednotky. Silný etický rozmer účtovníctva je tak zakomponovaný už v samotnom ciele účtovníctva. Účtovníctvo sa neustále vyvíja, prispôsobuje sa ekonomickej realite, ktorú dokumentuje. Odrazom tejto skutočnosti je i modifikovaná a rozšírená podoba definície účtovníctva rešpektujúca požiadavky na účtovníctvo 21. storočia, podľa ktorej je účtovníctvo technická, spoločenská a morálna prax, ktorá sa zaoberá

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udržateľným využívaním zdrojov a riadnou zodpovednosťou voči zainteresovaným stranám, aby sa umožnil rozkvet organizácií, ľudí a prírody. (Carnegie et al., 2021)

V odbornej literatúre sa v tejto súvislosti stretávame s pojmom „účtovníctvo udržateľného rozvoja“. Tento pojem je relatívne nový, v odbornej literatúre sa začal objavovať na začiatku 21. storočia a doposiaľ nie jednoznačne vymedzený. Účtovníctvo udržateľného rozvoja je možné chápať ako systém nástrojov a metód, ktoré si každý podnik vyberá podľa svojej konkrétnej situácie, vlastných cieľov a aktuálnych potrieb v oblasti udržateľnosti s prihliadnutím na kľúčové záujmové skupiny. Účtovníctvo udržateľného rozvoja by malo poskytovať informácie o dopadoch environmentálnych, sociálnych a riadiacich javov na ekonomickú výkonnosť podniku, o environmentálnych, sociálnych a riadiacich dopadoch činnosti podniku na jeho okolie i o vzájomných vzťahoch medzi ekonomickými, environmentálnymi a sociálnymi javmi. (Král et al., 2018) Účtovníctvo ako informačný systém podniku totiž dokáže poskytovať a následne sprostredkovať nielen finančné informácie, ale aj informácie o tom, ako podnik prispieva k udržateľnému rozvoju. Problematika udržateľného rozvoja je v súčasnosti predmetom tak finančného, ako aj manažérskeho účtovníctva, pričom zdrojom informácií pre rozhodovanie a kontrolu procesov v environmentálnej, sociálnej a riadiacej oblasti je najmä manažérske účtovníctvo, ktoré disponuje nástrojmi na systematické zobrazovanie parametrov procesov smerujúcich k udržateľnosti. Neustále sa zvyšujúce požiadavky na kvalitu a rozsah vykazovaných informácií o udržateľnosti vedú k zdokonaľovaniu podnikových procesov zameraných na riadenie, zaznamenávanie a kontrolu environmentálnych, sociálnych a riadiacich aspektov ekonomickej činnosti účtovných jednotiek. S narastajúcimi požiadavkami na vykazované ESG informácie rastú nároky nielen na odbornosť účtovných odborníkov, ale rozširuje sa i etická zodpovednosť profesie, pretože ide o informácie s vysokým spoločenským dosahom, pri ktorých akékoľvek skreslenie alebo manipulácia môžu výrazne ovplyvniť rozhodovanie investorov, veriteľov i ostatnej verejnosti.

2 Metodika

Na základe rozsiahlej literárnej rešerše boli skúmané vývojové trendy i súčasné tendencie uplatňovania profesijnej etiky účtovného odborníka. Východiskom pre spracovanie príspevku bola analýza odborných domácich a zahraničných zdrojov z oblasti účtovníctva, audítorstva, podnikateľskej etiky i relevantných európskych dokumentov upravujúcich poskytovanie informácií o udržateľnosti, ktoré sa premietajú do národnej legislatívy. Prostredníctvom komparácie teoretických poznatkov a požiadaviek regulačného prostredia boli identifikované hlavné úlohy účtovných odborníkov pri poskytovaní a overovaní informácií o udržateľnosti i základné predpoklady etického výkonu profesie účtovného odborníka v podmienkach rastúcich nárokov na transparentnosť a dôveryhodnosť nefinančného reportingu.

Na základe získaných poznatkov boli formulované závery poukazujúce na skutočnosť, že základ profesijnej etiky tvorí rešpektovanie etických princípov, najmä bezúhonnosti, objektívnosti, odbornej spôsobilosti a náležitej starostlivosti, dôvernosti a profesionálneho správania sa. Súčasne sa ukázalo, že významnú úlohu pri etickom rozhodovaní zohrávajú aj osobnostné a charakterové predpoklady jednotlivca. Z týchto zistení bola odvodená potreba systematického rozvoja etických kompetencií prostredníctvom vzdelávania nielen v rámci profesijnej podpory účtovných odborníkov, ale naprieč celým vzdelávacím systémom.

3 Výsledky

Rastúce nároky na rozsah i obsah vykazovaných informácií týkajúcich sa environmentálnych, sociálnych a riadiacich aspektov činností účtovných jednotiek sú výsledkom neustáleho tlaku na spoločensky zodpovedné správanie podnikov. Spoločensky zodpovedné správanie podnikov sa prakticky nepretržite vyvíja od začiatku 20. storočia. Témy spoločensky zodpovedného správania podnikov sa neustále menili a odrážali potreby svojej doby. V priebehu dejín sa týkali najmä ochrany práv a zdravia zamestnancov a obmedzenia detskej práce, ochrany ľudských práv a boja proti diskrimináciám, neskôr sa do popredia dostávajú témy environmentálnej zodpovednosti, týkajúce sa napr. dopadov výroby výrobkov na životné prostredie, bezpečnosti spotrebiteľov, ale i etických otázok, keď podniky začali zavádzať etické kódexy správania. Uvedené trendy formovali súčasný prístup k spoločenskej zodpovednosti podnikov, ktorý spočíva v tom, že podniky sa snažia do svojich aktivít integrovať spoločenský záujem. Vo svete vzniklo množstvo iniciatív, organizácií a dokumentov, ktoré výrazne ovplyvnili vznik inštitucionálneho zázemia pre podporu spoločensky zodpovedného správania. Postupne sa vytvorili rámce, normy a princípy, podľa ktorých dnes podniky, verejné inštitúcie aj investori posudzujú zodpovedné správanie.

3.1 Vykazovanie udržateľnosti vychádzajúce z európskej legislatívy

Tým, že sa jednotlivé aspekty problematiky trvalo udržateľného rozvoja postupne dostali do pozornosti nadnárodných organizácií a vlád, dostali sa i do dokumentov (napr. štandardov, nariadení, smerníc či odporúčaní) týchto organizácií. Orgány EÚ v posledných rokoch postupne vydali a časom i priebežne aktualizovali právne dokumenty, ktoré tému vykazovania udržateľného rozvoja pokrývajú. Najvýznamnejšími z nich sú smernice (Pakšiová, 2024):

- NFRD (Non-Financial Reporting Directive; Smernica o nefinančnom vykazovaní; Smernica Európskeho parlamentu a Rady 2014/95/EÚ, ktorou sa mení smernica 2013/34/EÚ, pokiaľ ide o zverejňovanie nefinančných informácií a informácií týkajúcich sa rozmanitosti niektorými veľkými podnikmi a skupinami);
- CSRD (Corporate Sustainability Reporting Directive; Smernica Európskeho parlamentu a Rady (EÚ) 2022/2464, ktorou sa mení nariadenie (EÚ) č. 537/2014, smernica 2004/109/ES, smernica 2006/43/ES a smernica 2013/34/EÚ, pokiaľ ide o vykazovanie informácií o udržateľnosti podnikov) a
- CSDDD (Corporate Sustainability Due Diligence Directive; Smernica Európskeho parlamentu a Rady (EÚ) 2024/1760 o náležitej starostlivosti podnikov v oblasti udržateľnosti a o zmene smernice (EÚ) 2019/1937 a nariadenia (EÚ) 2023/2859).

V oblasti vykazovania udržateľnosti v EÚ sú okrem uvedených smerníc relevantné i ďalšie právne normy, napr. (Pakšiová, 2024):

- Nariadenie SFDR (Sustainable Finance Disclosures Regulation; Nariadenie (EÚ) 2019/2088 o zverejňovaní informácií súvisiacich s udržateľnosťou v sektore finančných služieb);
- Nariadenie (EÚ) o Taxonómii (Taxonomy; Nariadenie (EÚ) 2020/852, ktorým sa stanovuje rámec na uľahčenie udržateľných investícií);
- Delegované nariadenie Komisie (EÚ) 2021/2178, ktorým sa dopĺňa nariadenie Európskeho parlamentu a Rady (EÚ) 2020/852 upresnením obsahu a prezentácie informácií, ktoré majú zverejňovať podniky, na ktoré sa vzťahuje článok 19a alebo 29a smernice 2013/34/EÚ, pokiaľ ide o environmentálne udržateľné hospodárske činnosti, a upresnením metodiky na splnenie uvedenej povinnosti zverejňovania;
- Delegované nariadenie Komisie (EÚ) 2023/2772, ktorým sa dopĺňa smernica Európskeho parlamentu a Rady 2013/34/EÚ, pokiaľ ide o štandardy vykazovania informácií o udržateľnosti (The European Sustainability Reporting Standards, ESRS štandardy).

Tieto právne predpisy majú za cieľ podporiť naplnenie Európskej zelenej dohody a súboru opatrení na úrovni EÚ proti klimatickej kríze. Tieto nadnárodné legislatívne úpravy sa následne premietajú do národnej účtovnej legislatívy, čím aktívne ovplyvňujú súčasnú podobu finančného účtovníctva v SR.

Na vysvetlenie právnej záväznosti týchto právnych predpisov si uvedme, že v rámci právnej úpravy vykazovania informácií o udržateľnosti v EÚ existujú dve hlavné kategórie uplatňovaných európskych právnych noriem s odlišnou právnou silou – nariadenia a smernice. Nariadenie je všeobecný akt záväzný v plnom rozsahu. Nariadenie je určené všetkým, predstavuje právny predpis, ktorý je okamžite platný vo všetkých členských štátoch rovnako ako vnútroštátne právo a bez toho, aby museli zasiahnuť vnútroštátne orgány. Smernice EÚ stanovujú ciele, ktoré majú dosiahnuť členské štáty a na ktorých dosiahnutie si môžu jednotlivé štáty zvoliť vlastné prostriedky podľa vlastných preferencií a vnútroštátnych špecifik. Smernice EÚ sa teda transponujú do vnútroštátneho práva s možnosťou voľby v prípade existencie viacerých možností. Ustanovenia smerníc sa stanú právne záväznými pre subjekty v konkrétnom členskom štáte EÚ až po ich transpozícii do právnych noriem daného štátu. (Šlosárová et al., 2011)

NFRD bola transponovaná do slovenskej účtovnej legislatívy prostredníctvom zákona č. 431/2002 Z. z. o účtovníctve v znení neskorších predpisov (ďalej len „zákon o účtovníctve“) s úplnou účinnosťou od roku 2017. V súlade s touto smernicou musel subjekt verejného záujmu, ktorého priemerný prepočítaný počet zamestnancov za účtovné obdobie prekročil 500 zamestnancov uvádzať vo výročnej správe aj nefinančné informácie o vývoji, konaní, pozícii a o vplyve činnosti účtovnej jednotky na environmentálnu, sociálnu a zamestnaneckú oblasť, informáciu o dodržiavaní ľudských práv a informáciu o boji proti korupcii a úplatkárstvu. Smernica NFRD bola nahradená smernicou CSRD. Smernica CSRD bola transponovaná do slovenskej účtovnej legislatívy

prostredníctvom zákona o účtovníctve. Smernica rozšírila povinnosti mnohých podnikov v oblasti vykazovania informácií o udržateľnosti. Mnohé podniky preto musia prispôbiť svoje informačné systémy na zber, triedenie, spracovanie i archiváciu údajov potrebných na vypracovanie správ o udržateľnosti. Nové rozšírené požiadavky v CSRD sú prispôbené rôznym veľkostným skupinám podnikateľov a poskytujú prechodné obdobie na ich prípravu na nové požiadavky. Od podnikov sa vyžaduje, aby zverejňovali podrobné informácie o udržateľnosti v súlade so štandardami ESRS. Záväznosť ESRS vychádza zo smernice CSRD, ktorej cieľom je, aby vykazovanie informácií o udržateľnosti bolo rovnako spoľahlivé a porovnateľné ako vykazovanie finančných informácií.

Podniky pri vykazovaní nefinančných informácií v SR postupujú podľa zákona o účtovníctve. Zatiaľ čo vykazovanie finančných informácií je v SR dlhodobo podrobne upravené právnymi predpismi na úrovni opatrení MF SR, oblasť vykazovania nefinančných informácií v SR nemala vytvorené presné právne rámce vykazovania, ktoré by zabezpečili potrebnú porovnateľnosť zverejňovaných informácií. Na vykazovanie nefinančných informácií si účtovné jednotky mohli zvoliť akékoľvek celosvetovo uznávané štandardy pre rôzne oblasti. Povinnosti účtovných jednotiek v oblasti nefinančných informácií boli definované iba rámcovo, pričom konkrétna obsahová náplň i forma zverejnenia bola v kompetencii samotnej účtovnej jednotky. Je zrejmé, že tento spôsob vykazovania nefinančných informácií nedosahoval najmä na úrovni porovnávania (napr. pri rozhodovaní o investíciách) požadovanú úroveň. Preto sa z dôvodu zabezpečenia porovnateľnosti pristúpilo na úrovni EÚ ako aj v SR k štandardizácii vykazovania týchto informácií. Cieľom štandardizácie prostredníctvom CSRD a nadväzujúcich ESRS štandardov je, aby údaje o environmentálnom a spoločenskom vplyve podnikania boli verejne dostupné každému, kto sa o tieto informácie zaujíma.

Nakoľko implementácia pravidiel týkajúcich sa vykazovania informácií o udržateľnosti je mimoriadne komplexná, náročná a nákladná, Európska komisia postupne pripravuje a zavádza opatrenia s názvom Omnibus, ktorých cieľom je zjednodušiť regulácie v oblasti udržateľnosti s dôrazom na zníženie byrokratickej záťaže pre menšie podniky. Opatrenia sa týkajú zmien CSRD, CSDDD, nariadenia EÚ o taxonómii a mechanizmu kompenzácie uhlíka na hraniciach. K najzásadnejším opatreniam patria napr.: výrazne sa zužuje rozsah pôsobnosti smernice CSRD (pokles o takmer 85 %, povinnosť sa bude vzťahovať len na veľké spoločnosti s viac ako 1 000 zamestnancami a obrátom nad 450 mil. eur); posúvajú sa termíny vykazovania o dva roky; radikálne sa znižuje objem dát, ktoré budú musieť podniky vykazovať (pokles o 70 %); zavádza sa úľava pre spoločnosti s menej než 1 000 zamestnancami – budú mať právo odmietnuť poskytovanie informácií nad rámec dobrovoľných štandardov vykazovania; povinnosť podávať správy o zosúladení s taxonómiou EÚ sa bude vzťahovať iba na spoločnosti, ktoré spadajú do pôsobnosti legislatívy CSRD (t. j. spoločnosti s viac ako 1 000 zamestnancami a obrátom 450 mil. eur); CSDDD sa bude vzťahovať iba na tie najväčšie spoločnosti s aspoň 5 000 zamestnancami a čistým obrátom 1,5 miliardy eur. (Havlíková, 2025)

V tejto súvislosti je pre podniky a finančné inštitúcie potrebný stabilný legislatívny rámec, ktorý im umožní efektívne implementovať požiadavky bez častých zásadných zmien. Aby sa totiž zabezpečila úspešná implementácia nových požiadaviek na vykazovanie podnikateľov, je dôležité, aby podniky presne vedeli, aké informácie potrebujú zhromažďovať a od ktorého účtovného obdobia, aby mohli poskytovať presné informácie podľa smernice CSRD a súvisiacej legislatívy.

3. 2 Úloha účtovných odborníkov v procese poskytovania a overovania informácií o udržateľnosti

Aby účtovníctvo mohlo byť garanciou bezproblémovej dostupnosti relevantných informácií o integrovanom obraze podniku, musí pokryť prísun informácií tak z ekonomickej činnosti ako i informácií o ESG aspektoch svojej činnosti. Neoddeliteľnou súčasťou toho je odborná a morálna výbava tých, ktorí tieto informácie pripravujú a poskytujú.

Účtovníctvo ako informačný servis zabezpečujú účtovní odborníci. Účtovnými odborníkmi možno rozumieť špecialistov zaoberajúcich sa vedením účtovníctva, zostavením účtovnej závierky, externých audítorov i interných audítorov. Každý z uvedených typov odborníkov má svoj podiel na zverejňovaní a teda i ovplyvňovaní informácií o udržateľnosti. Každý z týchto odborníkov sa musí pripraviť na nové výzvy, ktoré sú s vykazovaním informácií o udržateľnosti spojené. Predsa len účtovníctvo je tradične spájané s finančnými informáciami. Kým finančné informácie majú účtovní odborníci priamo pod metodickou kontrolou, informácie o udržateľnosti pochádzajú z rôznych oblastí.

Samotnú realizáciu činností spojených so zberom, triedením a zverejňovaním informácií o udržateľnosti môžu vykonávať interní zamestnanci alebo môže účtovná jednotka poveriť týmito činnosťami inú právnickú alebo fyzickú osobu, čím sa však nezbavuje zodpovednosti za tieto informácie. Informácie o udržateľnosti sú súčasťou

výročnej správy, ktorá musí poskytovať verný a pravdivý obraz a musí byť overená audítorom. Vzhľadom na komplexnosť činností spojených s dosiahnutím a preskúmaním verného a pravdivého obrazu, zodpovednosť za verný a pravdivý obraz nemôžeme morálne zúžiť len na právne vymedzenú zodpovednosť za vedenie účtovníctva. Dosiahnutie a preskúmanie verného a pravdivého obrazu o environmentálnych, sociálnych a riadiacich aspektoch činnosti účtovnej jednotky je výsledkom funkčnej a dlhodobej spolupráce manažérov, vlastníkov, členov dozorných orgánov, kontrolórov, interných audítorov, externých audítorov, environmentálnych špecialistov, odborníkov na sociálnu oblasť a ľudské zdroje, expertov v oblasti riadenia, no najmä samotných účtovníkov, ktorí obraz o účtovnej jednotke počas celého účtovného obdobia vytvárajú.

Účtovník pôsobí ako garant kvality, spoľahlivosti, transparentnosti, preukázateľnosti a kvantitatívnej integrity dát, kým ostatní odborníci dodávajú vecný a analytický základ informácií o udržateľnosti. Účtovník musí zabezpečiť, aby boli použité ESG ukazovatele jasne definované a spoľahlivo merateľné. Účtovníci transformujú a následne integrujú rozmanité údaje o udržateľnosti do účtovného systému tak, aby boli porovnateľné, auditovateľné a interpretovateľné. Účtovníci overujú správnosť a úplnosť podkladov, ktoré sa zverejňujú a zabezpečujú súlad so štandardami vykazovania a napokon zodpovedajú za sprostredkovanie týchto informácií externým používateľom. Verný a pravdivý obraz je možné dosiahnuť a preskúmať len pomocou kvalifikovaných a nezávislých odborníkov.

V tejto súvislosti sa ako kľúčová pre dosiahnutie verného a pravdivého obrazu, vrátane informácií o udržateľnosti, javí úloha etiky, postoja účtovníka, jeho úmysel i úroveň jeho morálneho vedomia. Podľa Hvoždarovej (2007) postoj účtovníka ako kľúčového subjektu, ktorý je závislý od vlastníka a od manažmentu, môže byť v zásade trojakého typu:

- účtovník je plne stotožnený s uplatňovaním všeobecne uznávaných účtovných zásad a každý svoj krok hodnotí, či je v súlade najmä so zásadou verného a pravdivého obrazu o skutočnosti a tento jeho postoj je v súlade s postojom vlastníka a manažmentu;
- účtovník je ochotný využiť legálne možnosti, čím v rámci platnej legislatívy dôjde k čiastočnému porušeniu zásady verného a pravdivého obrazu, napr. voľbou spôsobu oceňovania, odpisovej metódy, pri odhadoch najrôznejšieho typu – znehodnotenie a doba používania dlhodobého majetku, emisné povolenky, environmentálne záväzky a rezervy na uvedenie do pôvodného stavu, zverejnenia ohľadom budúcnosti;
- účtovník je ochotný na príkaz manažmentu vytvoriť účtovnú závierku, ktorá bude minimalizovať daňovú povinnosť alebo vylepšiť, alebo naopak zhoršiť obraz o účtovnej jednotke, čím úmyselne a vedome poruší zásadu verného a pravdivého obrazu. Bez pevného etického postoja sa tak zber i zverejňovanie informácií o udržateľnosti ľahko môže stať nástrojom marketingovej manipulácie, tzv. greenwashingu alebo interného prispôbovania výsledkov očakávaniam vedenia účtovnej jednotky.

Podľa nášho názoru uvedenú typológiu účtovníka môžeme rozšíriť i na fyzické či právnické osoby, ktoré účtovníctvo zabezpečujú dodávateľským spôsobom. Hvoždarová (2007) ďalej uvádza, že najväčšiu skupinu tvoria účtovníci druhého typu, ktorí vďaka dôkladnej znalosti právnych predpisov dokážu optimalizovať niektoré ukazovatele v súlade so záujmami vlastníka i manažmentu, a preto sú aj vlastníkmi a manažermi cenení najviac.

Súčasný trend účtovníctva vyžaduje vysoké nároky na schopnosti účtovných profesionálov. Profesionálny účtovník sa v krajinách s vyspelou trhovou ekonomikou chápe ako podnikový ekonóm, ktorý má dostatočné vedomosti nielen v účtovníctve, ale aj v ďalších súvisiacich disciplínach. Najdôležitejšou požiadavkou na profesiu účtovníka je popri vysokej ekonomickej odbornosti, tiež dôsledne dodržiavaná etika, pretože porušenie etických noriem môže mať vážny vplyv na transparentnosť, ako aj na celkovú dôveryhodnosť ekonomického prostredia. To platí pri ochrane záujmov a majetku jednotlivých ekonomických subjektov, ako aj investorov na finančnom trhu.

Vysoké nároky na kvalitu profesie účtovníka sú v priamom rozpore s legislatívnymi požiadavkami na osoby, ktoré majú záujem poskytovať účtovnícke služby, keď činnosť účtovných poradcov a vedenie účtovníctva patrí aj v súčasnosti do voľných živností, pri ktorých sa preukazovanie odbornej ani inej spôsobilosti nevyžaduje. Riziko odbornej nespôsobilosti a nenáležitej starostlivosti hrozí najmä vtedy, keď účtovná jednotka realizuje povinnosť viesť účtovníctvo dodávateľským spôsobom. Absencia legislatívnej regulácie má za následok, že profesia účtovníka má na rozdiel od profesie audítorov či daňových poradcov nízky status, často spojený s odbornou nespôsobilosťou, či neplnením etických štandardov profesie. Jedná sa pritom o paradox, pretože

profesie účtovníka i audítora sú si veľmi blízke. Obe profesie majú veľmi podobné požiadavky na výkon povolania, rovnaký pohľad na etiku, rovnaký predmet záujmu i rovnakú prípravu na výkon povolania.

Čiastočne kompenzačne voči nedostatočným legislatívnym požiadavkám na profesiu účtovníka bol v roku 2000 v Slovenskej republike mimo legislatívneho rámca z iniciatívy vtedajšieho Slovenského zväzu účtovníkov a v spolupráci s britskou Asociáciou certifikovaných účtovníkov (Association of Chartered Certified Accountants, ďalej len „ACCA“) implementovaný systém certifikácie účtovníkov, ktorý spĺňa dôležité parametre kvalifikačných požiadaviek na výkon profesie účtovník (Škultéty & Laučík, 2005). Systém ACCA je zavedený v 180 krajinách sveta, má viac ako 240 000 členov a 500 000 študentov a považuje sa za prestížnu kvalifikáciu. Absolventi vzdelávacieho programu majú oprávnenie viesť účtovníctvo pre spoločnosti dodávateľským spôsobom alebo v pracovnoprávnom vzťahu. V súčasnosti sa v Slovenskej komore certifikovaných účtovníkov na princípe dobrovoľnosti združujú certifikovaní účtovníci. Ich praktické pôsobenie regulujú etické pravidlá formulované v Etickom kódexe Slovenskej komory certifikovaných účtovníkov (ďalej len „Etický kódex SKČÚ“) podľa odporúčaní Medzinárodnej federácie účtovníkov (International Federation of Accountants, ďalej tiež „IFAC“) a podľa zvyklostí iných obdobných organizácií v zahraničí. Systém certifikácie a vzdelávania účtovníkov je jednoznačne jedným z dôležitých krokov, ktoré približujú účtovníkov v SR obvyklému štandardu v krajinách EÚ a vytvárajú podmienky na ich uplatnenie na trhu práce v rámci EÚ.

Z objektívnych dôvodov informácie o udržateľnosti zverejnené vo výročnej správe podliehajú auditu. Rozhodujúcu úlohu pri interpretácii a preskúmaní verného a pravdivého obrazu o skutočnostiach, ktoré sú predmetom účtovníctva, vrátane informácií vo výročnej správe, majú teda audítori. Logicky majú teda i zodpovednosť za finálnu podobu obrazu, ktorý o sebe účtovná jednotka prostredníctvom zostavenej a zverejnenej účtovnej závierky a výročnej správy šíri. Vonkajšia kontrola účtovníctva uskutočňovaná audítormi v podstatnej miere prispieva ku skvalitneniu celého systému účtovníctva vrátane vnútorného kontrolného systému účtovníctva, nakoľko sa vyžaduje, aby externý audítor preveril systém vnútorných kontrol auditovaného podniku a odhadol riziko významných nesprávností v účtovnej závierke, spôsobených či už chybami alebo podvodmi. V procese posudzovania týchto rizík sa audítor musí zamýšľať nad vnútornými kontrolami, relevantnými pre prípravu a vernú prezentáciu účtovnej závierky podniku, s cieľom naplánovať audítorské postupy zodpovedajúce danému prostrediu. Externý audítor, podobne ako interný audítor je vnímaný aj ako preventívny faktor. Externý audit je zameraný najmä na overovanie účtovnej závierky ako výsledného produktu spracovania účtovných informácií a overovanie súladu účtovnej závierky s výročnou správou. Interný audit hodnotí vnútorné kontrolné systémy a príslušným orgánom účtovnej jednotky a vrcholovému vedeniu poskytuje informácie, analýzy a odporúčania k lepšiemu plneniu ich úloh. Povinnosť overovania účtovnej závierky audítorom je pre vybraný okruh účtovných jednotiek explicitne ustanovená v zákone o účtovníctve, resp. v inom osobitnom predpise. Audítor oznamuje výboru pre audit hlavné závery vyplývajúce z výkonu auditu, najmä o významných nedostatkoch vo vnútornej kontrole účtovnej jednotky vo vzťahu k procesu zostavovania účtovnej závierky. Úloha audítora pri audite informácií o udržateľnosti spočíva v tom, aby nezávisle overil, či sú zverejnené environmentálne, sociálne a riadiace údaje správne, úplne, spoľahlivé a vypracované v súlade s požadovanými štandardami a legislatívou. V podmienkach EÚ ide najmä o požiadavky vyplývajúce zo smernice CSRD, štandardov ESRS, prípadne iných rámcov (napr. GRI, WEF IBC metriky, TCFD), a taxonómie EÚ. Audítor kontroluje nastavenie a správnosť zverejňovaných ESG ukazovateľov, spôsob výpočtu metrík, konzistentnosť údajov, ako aj podklady, z ktorých podnik vychádzal pri zverejňovaní ESG údajov. Audítor preveruje napr. emisie CO₂, spotrebu energií, údaje o zamestnancoch, diverzite, pracovnej bezpečnosti, etike riadenia. Audítor tiež skúma, či má podnik nastavené spoľahlivé systémy zberu ESG údajov, interné kontroly, metodiky merania, procesy riadenia rizík v oblasti udržateľnosti. Audítor rovnako posudzuje koncept dvojitej významnosti, t. j. ako externé faktory udržateľnosti (napr. zmena klímy, nové zákony, nedostatok zdrojov) ovplyvňujú samotný podnik, jeho finančnú výkonnosť, peňažné toky a trhovú hodnotu podniku a ako samotná činnosť podniku, jeho produkty a dodávateľský reťazec vplyvajú na životné prostredie, zamestnancov, lokálne komunity a spoločnosť ako celok (napr. uhlíková stopa, pracovné podmienky). Audítor preveruje, či podnik správne identifikoval významné témy, t. j. také oblasti ESG, ktoré majú najväčší vplyv na podnik alebo naopak na aké oblasti má podnik najväčší vplyv. Výsledkom práce audítora je správa s uisťovacím záverom, pričom v súčasnosti sa pri väčšine ESG auditov vyžaduje obmedzené uistenie, ale v budúcnosti sa predpokladá prechod na primerané uistenie. Audit udržateľnosti zvyšuje dôveru investorov, veriteľov i ostatných záujemcov o informácie, pomáha bankám a poisťovniam pri hodnotení rizík, znižuje riziko greenwashingu a podporuje transparentnosť informácií poskytovaných podnikom. Audítor nehodnotí len číselné údaje, ale aj kvalitu riadenia v ESG oblasti, kvalitu procesov a spôsob, akým podnik

pristupuje k udržateľnosti. Informácie potvrdené externým audítorm majú výrazne vyššiu informačnú hodnotu a kredibilitu.

Výsledkom auditu je názor nezávislého audítora, že účtovná závierka a výročná správa účtovnej jednotky neobsahujú významné nesprávosti a chyby. Je to zásadná odlišnosť od účtovníka, ktorý je spravidla v zamestnaneckom pomere v účtovnej jednotke, a teda je závislý jej vlastníkov. Účtovník je obmedzovaný svojou závislosťou od vlastníka i od manažmentu, kým audítor je vo svojom rozhodovaní sa pri výbere etických postojov nezávislý. Názor audítora je preto pre verejnosť zárukou, že sa možno na informácie z účtovnej závierky a výročnej spravy spoľahnúť. Audítor vyjadruje svoj názor vo verejnom záujme a kvalita auditu je zárukou bezpečnosti v obchodných vzťahoch i finančných transakciách. Aj preto sú na audítorov v porovnaní s účtovníkmi už pri vstupe do profesie kladené vysoké kvalifikačné predpoklady a nadväzné celoživotné vzdelávanie, samozrejme v spojitosti s uplatňovaním základných etických princípov zakotvených v Etickom kódexe audítora Slovenskej komory audítorov (ďalej len „SKAU“), ktorý je v súlade s Etickým kódexom IFAC.

3. 3 Etické princípy ako základný predpoklad etického výkonu profesie účtovného odborníka

Etické kódexy vo všeobecnosti slúžia na podporu etického myslenia a konania. Etické kódexy sú formou inštitucionalizácie profesijnej etiky. V oblasti účtovníctva a auditu v SR sú to predovšetkým dva etické kódexy – Etický kódex SKČÚ a Etický kódex SKAU. Základom oboch kódexov je Medzinárodný etický kódex pre profesionálnych účtovníkov, ktorý vydáva Rada pre medzinárodné etické štandardy účtovníkov (International Ethics Standards Board for Accountant, ďalej len „IESBA“). IESBA je nezávislý orgán, ktorý pôsobí pod záštitou IFAC. Kódex IESBA slúži ako celosvetový základ pre etické správanie a nezávislosť. Na jeho základe potom jednotlivé národné profesijné organizácie ako napr. SKČÚ alebo SKAU vytvárajú a schvaľujú etické kódexy pre účtovníkov a audítorov pôsobiacich na Slovensku. Kódex je univerzálne postavený na piatich základných etických princípoch – *bezúhonnosti, objektívnosti, odbornej spôsobilosti a náležitej starostlivosti, dôvernosti informácií a profesionálnom správaní*. (IESBA, 2025) Tieto princípy vychádzajú z predpokladu, že účtovníci i audítori neslúžia len ako odborníci na vedenie účtovníctva a jeho overovanie, ale aj ako strážcovia dôvery – osoby, ktorých konanie má priamy vplyv na stabilitu hospodárskeho prostredia.

Bezúhonnosť (čestnosť, integrita)

Čestnosť predstavuje základný pilier nielen účtovníckej profesie, ale aj trvalo udržateľného podnikania. V praxi znamená ochotu prezentovať pravdivé a úplné informácie bez snahy prikrášľovať realitu. V oblasti environmentálnych informácií sa čestnosť uplatňuje predovšetkým pri odolávaní tlaku zamlčať negatívne dopady činnosti podniku (napr. prekročenie emisných limitov, plytvanie energiou). Etická povinnosť účtovníka spočíva v presnej prezentácii údajov, aj keď sú pre podnik nepriaznivé. V sociálnej oblasti sa čestnosť prejavuje pri zachytávaní údajov o mzdovej spravodlivosti, pracovnej bezpečnosti či diverzite. V oblasti informácií o riadení sa čestnosť týka pravdivého vykazovania štruktúry riadenia, konfliktov záujmov či mechanizmov interného dohľadu. Bez zásady čestnosti vzniká napr. riziko tzv. greenwashingu – situácie, keď podnik vedome prezentuje svoju činnosť ako udržateľnú, hoci reálne údaje svedčia o opaku. Účtovník by mal preto pôsobiť ako garant pravdivého obsahu, ktorý upozorní na nezrovnalosti medzi deklarovanými cieľmi a reálnymi ukazovateľmi.

Pri overovaní informácií o udržateľnosti má bezúhonnosť/čestnosť osobitný význam preto, ESG informácie často obsahujú nefinančné ukazovatele, odhady a predpoklady, kvalitatívne informácie alebo údaje o klimatických rizikách či sociálnych dopadoch. Tieto informácie môžu byť náchylnejšie na subjektívne interpretácie alebo greenwashing. Preto audítor musí byť schopný odolávať tlaku spoločnosti a objektívne posúdiť, či sú zverejnené informácie pravdivé, úplné a v súlade s požiadavkami na vykazovanie udržateľnosti.

Objektívnosť

Objektivita znamená nezávislosť myslenia a názoru. Účtovník musí byť schopný odolávať tlaku vedenia či investorov pri interpretácii hodnôt, ktoré môžu ovplyvniť reputáciu podniku. V oblasti vykazovania informácií o udržateľnosti by mal účtovník objektívnosť uplatniť najmä pri vyhodnocovaní materiálnych tém – účtovník by mal posudzovať relevantnosť informácií podľa ich skutočného významu a nie podľa reputačnej výhodnosti. Účtovník by mal byť objektívny aj pri výbere prezentovaných ukazovateľov, čím sa zaručí, že zverejňované informácie nebudú jednostranne zamerané len na pozitívne aspekty činnosti podniku. Objektívnosť zároveň súvisí s potrebou nezávislej kontroly ESG údajov. Účtovník ako garant spoľahlivosti informácií vystupuje ako spojovací článok medzi poskytovateľmi údajov (manažmentom podniku) a ich overovateľmi (audítormi).

Objektívnosť audítora pri overovaní informácií o udržateľnosti znamená, že postupuje nezaťažato, bez konfliktov záujmov a nedovolí, aby akýkoľvek vonkajší tlak alebo osobná predpojatosť ovplyvnili jeho profesionálny úsudok. Audítor predchádza konfliktu záujmov tým, že nesmie poskytovať poradenstvo pri tvorbe informácií o udržateľnosti a zároveň ich overovať, keďže by tak vlastne kontroloval svoju vlastnú prácu. Vzťah audítora k overovanej spoločnosti musí byť striktnie profesionálny, bez finančných, osobných alebo majetkových väzieb, ktoré by mohli vzbudzovať zdanie nespoľahlivosti. Audítor rovnako musí voči klientovi uplatniť kritický prístup, to znamená, že vyžaduje objektívne dôkazy (napr. certifikáty o spotrebe energie, dodávateľské zmluvy) a nespolieha sa na vyhlásenia spoločnosti. Pri prezentovaní informácií o udržateľnosti sa často vychádza z odhadov, interných metodík a nefinančných metrík, ktoré sa ťažšie merajú. Objektívnosť zabezpečuje, že vykazované ciele a výsledky nie sú formou greenwashingu, čím zainteresované strany chráni pred zavádzaním.

Odborná spôsobilosť a náležitosť starostlivosti

Princíp odbornej spôsobilosti a náležitej starostlivosti znamená kontinuitu odborného vzdelávania a porozumenie novým európskym štandardom ESRS. V kontexte ESG vykazovania je tento princíp kľúčový, pretože účtovník musí porozumieť metodikám merania environmentálnych dopadov, musí poznať ukazovatele sociálnej dimenzie (napr. fluktuáciu, rovnosť príležitostí, možnosti vzdelávania, bezpečnosť a ochranu zdravia pri práci) a vedieť ich posúdiť a overiť, potrebuje mať znalosti o mechanizmoch riadenia, štruktúre orgánov ako aj o vnútorných pravidlách a postupoch spoločnosti, ktoré zabezpečujú jej fungovanie v úplnom súlade s platnými zákonmi a etickými normami, aby mohol garantovať logickú konzistentnosť údajov. Odborná spôsobilosť neznamená, že účtovník musí byť expertom v každej oblasti ESG vykazovania, ale musí disponovať takou úrovňou znalostí, ktorá mu umožní rozpoznať nekvalitné alebo nespoľahlivé údaje. Zároveň v prípade pochybností má povinnosť konzultovať odborné otázky so špecialistami príslušných oddelení, čím prispieva k interdisciplinárnej validácii dát.

Pri overovaní informácií o udržateľnosti sa princíp odbornej spôsobilosti a náležitej starostlivosti prejavuje tým, že audítor musí disponovať potrebnými znalosťami, zručnosťami a skúsenosťami na vykonanie zákazky a zároveň postupovať dôsledne, objektívne a s primeranou mierou profesionálnej obozretnosti. Audítor musí rozumieť problematike udržateľnosti, environmentálnym, sociálnym a riadiacim aspektom činnosti účtovnej jednotky, požiadavkám na vykazovanie podľa ESRS a príslušným právnym predpisom. V prípade, že v špecifickej oblasti (napr. emisie skleníkových plynov, klimatické riziká, sociálne ukazovatele) nemá dostatočné znalosti, môže využiť prácu experta v príslušnej oblasti. Audítor musí dôkladne naplánovať zákazku, identifikovať oblasti s vyšším rizikom významných nesprávností v informáciách o udržateľnosti, posúdiť procesy zberu ESG údajov a vnútorných kontrol. Audítor sa pri svojej práci nemôže spoliehať iba na vyhlásenia spoločnosti, musí aktívne získavať a vyhodnocovať dôkazy podporujúce vykazované údaje. Predložené informácie musí posudzovať kriticky a preveriť ich vierohodnosť. Preto, že sa oblasť udržateľnosti rýchlo vyvíja, audítor je povinný priebežne aktualizovať svoje odborné znalosti o nových štandardoch, metodikách merania a regulačných požiadavkách. Súčasne musí zdokumentovať vykonané postupy, získané dôkazy a odborné úsudky tak, aby bolo možné preukázať, že zákazka bola vykonaná s náležitou starostlivosťou.

Dôvernosť informácií

Dôvernosť predstavuje záväzok zachovávať mlčanlivosť o informáciách, s ktorými účtovník prichádza do kontaktu. V rámci ESG vykazovania je tento princíp mimoriadne dôležitý, pretože mnohé údaje napr. o environmentálnych nedostatkoch, o sťažnostiach zamestnancov, mzdovej politike či interných kontrolných procesoch majú citlivý charakter a ich predčasné zverejnenie by mohlo spôsobiť ekonomickú alebo reputačnú ujmu. Povinnosť účtovníka zachovávať mlčanlivosť teda slúži dvojakému účelu – jednak chráni integritu spoločnosti a jednak buduje a zachováva dôveru všetkých zainteresovaných strán voči účtovníckej profesii. V praxi sa dôvernosť uplatňuje napr. pri komunikácii s externými audítormi, pri interných kontrolách ESG dát alebo pri tvorbe konsolidovaných správ skupiny, kde účtovník musí strážiť presuny interných citlivých údajov v súlade s GDPR a inými regulačnými požiadavkami.

Princíp dôvernosti pri audite informácií o udržateľnosti znamená, že audítor je povinný chrániť všetky informácie získané počas výkonu zákazky a nesmie ich bez oprávnenia zverejniť ani využiť vo svoj prospech alebo v prospech tretích strán. Audítor má prístup k množstvu neverejných informácií z oblasti udržateľnosti, ktoré nesmie sprístupniť neoprávneným osobám. Pri overovaní ESG informácií môže audítor pracovať s údajmi, ktoré sú predmetom obchodného tajomstva, napr. s údajmi o výrobných procesoch, technológiách, investičných zámeroch alebo stratégií dekarbonizácie. Tieto informácie podliehajú ochrane aj v prípade, že sa ich časť následne

premieta do zverejňovanej správy. Prejavom dôvernosti je zabezpečenie primeranej ochrany pracovnej dokumentácie, elektronických súborov a získaných dôkazov pred neoprávneným prístupom, stratou alebo zneužitím. Povinnosť dôvernosti informácií získaných pri zákazke nekončí audítorovi vydaním správy ani ukončením zmluvného vzťahu s klientom, audítor je viazaný mlčanlivosťou aj po skončení auditu. Dôvernosť však nie je absolútna. Ak to audítorovi ukladá právny predpis, súdne rozhodnutie alebo orgán dohľadu musí získané informácie zverejniť. Rovnako je audítor povinný oznámiť i porušenia právnych predpisov.

Profesionálne správanie

Princíp profesionálneho správania účtovníka zahŕňa dodržiavanie zákonov, predpisov a štandardov, ale aj vystupovanie, ktoré posilňuje renomé profesie účtovníka. V kontexte ESG to znamená dodržiavanie požiadaviek smernice CSRD, štandardov ESRS, aktívne pôsobenie proti praktikám, ktoré môžu viesť k manipulácii s údajmi o udržateľnosti a podporu etickej komunikácie v podniku – účtovník má byť vzorom zodpovedného prístupu k informáciám. Profesionalita účtovníka v oblasti ESG sa prejavuje aj v tom, ako pristupuje k spolupráci s ostatnými odborníkmi. Musí dbať o jasné vymedzenie kompetencií, správnu dokumentáciu procesov a zabezpečenie auditovateľnej stopy všetkých údajov. Takto sa stáva hlavným koordinátorom transparentnosti medzi rôznymi funkčnými úrovňami spoločnosti.

Princíp profesionálneho správania pri audite informácií o udržateľnosti znamená, že audítor je povinný dodržiavať právne predpisy, odborné štandardy, etické požiadavky a vyhýbať sa akémukoľvek konaniu, ktoré by mohlo poškodiť dobré meno audítorskej profesie alebo znížiť dôveru verejnosti vo výsledky overovania. Audítor rešpektuje požiadavky týkajúce sa nezávislosti, dokumentácie a kvality vykonanej práce. Svoje zistenia komunikuje objektívne, pravdivo a zrozumiteľne. Neposkytuje zavádzajúce alebo prehnane priaznivé informácie o udržateľnosti, nepodporuje ani netoleruje, keď podnik prezentuje svoje environmentálne a sociálne výsledky v lepšom svetle než sú v skutočnosti. V prípade, že zistí významné nezrovnalosti alebo zavádzajúce tvrdenia, musí na ne primerane reagovať vo svojom závere. Informácie o udržateľnosti majú slúžiť všetkým zainteresovaným stranám, preto audítor musí konať tak, aby posilnil dôveru v spoľahlivosť vykazovaných informácií o udržateľnosti. Audítor sa musí vyhýbať konaniu, ktoré by mohlo poškodiť meno profesie, napr. neprijímať zákazky, na ktoré nemá dostatočnú odbornú spôsobilosť, nevykonávať činnosti, ktoré by mohli spochybniť jeho nezávislosť alebo objektívnosť, nevyužívať svoje postavenie na získanie neoprávnenej výhody. Keďže audit informácií o udržateľnosti je relatívne novou a dynamicky sa rozvíjajúcou oblasťou, audítor musí k svojej práci pristupovať s primeranou odbornou zodpovednosťou a priebežne si dopĺňať svoje vedomosti.

Žiaden etický kódex však na samotné zabezpečenie etického správania nestačí. Etické princípy dokáže aplikovať iba osoba, ktorá disponuje určitými vlastnosťami. Tieto vlastnosti môžeme rozdeliť na eticko-profesionálne a charakterové vlastnosti. Medzi najdôležitejšie eticko-profesionálne vlastnosti účtovných odborníkov zaradíme pravdivosť a férovosť, zodpovednosť, precíznosť, dôslednosť, dochvilnosť a česťnosť. Medzi najdôležitejšie charakterové vlastnosti účtovných odborníkov zaradíme vyrovnanosť, rozvážnosť, spoľahlivosť, trpezlivosť, emocionálnu vyrovnanosť, vychovanosť, taktosť či nezišnosť. (Remišová, 2011)

Dôležitosť charakterových vlastností pre výkon profesie účtovníka bola zdôraznená už v prvej tlačou vydanej publikácii o podvojnej sústave, ktorá pochádza z roku 1494 od talianskeho autora Lucu Pacioliho a nesie názov *Summa de Arithmetica, Geometria, Proportioni et Proportionalita*. Dielo sa okrajovo dotýka problematiky osobnosti účtovníka, jeho charakterových vlastností, pričom tieto spája aj s etikou. (Pacioli, 2004) V našich podmienkach sa prvé knihy venované problematike účtovníctva objavujú až koncom 18. storočia a začiatkom 19. storočia, najskôr nemecké a potom české. Prvú vysokoškolskú učebnicu účtovníctva napísal v roku 1920 profesor Pazourek považovaný za zakladateľa účtovníctva u nás s názvom *Theorie a praxe účetních soustav*. Aj v nej autor okrajovo spomína problematiku osobnosti účtovníka a tiež jeho etickej vyspelosti, jeho mravnosti, morálneho profilu a spoločenského postavenia. (Pazourek, 1920)

Zmysel pre etické konanie sa prejaví zväčša v situáciách, keď legislatíva umožňuje uplatniť alternatívne riešenia. Aby účtovný odborník naplnil význam účtovníctva z pohľadu etiky a dosiahol stav, že účtovná závierka a výročná správa budú poskytovať verný a pravdivý obraz o činnosti účtovnej jednotky a jej dopadoch na spoločnosť, musí byť s etickými princípmi stotožnený.

3. 4 Vzdelávanie ako faktor prevencie etických pochybení účtovných odborníkov

Napriek snahe a úsiliu účtovných odborníkov konať v súlade s uvedenými základnými etickými princípmi, môžu sa v praxi vyskytnúť okolnosti, ktoré spôsobia, že účtovní odborníci nebudú konať v súlade s týmito

etickými princípmi. Medzi najzásadnejšie riziká, ktoré môžu ohroziť dodržiavanie uvedených princípov možno zaradiť napr.: uprednostňovanie osobných záujmov účtovných odborníkov nad záujmom verejným, chybný úsudok, ovplyvňovanie klienta, resp. zamestnávateľa, vplyv spriaznenej osoby či zastrašovanie. (Meluchová & Mateášová, 2022)

Súčasnosť nás stále viac presviedča, že popri odborných znalostiach má v účtovníctve a pri výkone auditu mimoriadne silné postavenie i aplikácia základných etických princípov. Práve z dôvodu úzkeho prepojenia účtovníctva a etiky je dôležité, aby etika bola neoddeliteľnou súčasťou výchovy a vzdelávania budúcich i existujúcich účtovných odborníkov. Etické vzdelávanie je súčasťou vzdelávacieho systému profesijných komôr ako napr. SKCÚ, SKAU, ale i ACCA, ktoré majú profesionálnu etiku zakomponovanú vo svojich vzdelávacích osnovách. Odborné vzdelávanie v oblasti účtovníctva i audítorstva je rovnako doplnené o etický rozmer i na stredných a vysokých školách ekonomického zamerania. V tomto zmysle je dôležité, že už študenti na stredných a vysokých školách sú konfrontovaní s aplikáciou etických prístupov v konkrétnych podmienkach práce účtovných odborníkov, a to v nadväznosti na vývoj účtovníctva smerom k uplatňovaniu legislatívnych ustanovení zákona o účtovníctve, IFRS i ESRS v prípade zverejňovania porovnateľných, transparentných a štandardizovaných údajov o environmentálnych, sociálnych a riadiacich otázkach a tiež smerom k neustále sa zdokonaľujúcim technickým podmienkam spracovania účtovných informácií. Štandardizácia poskytovania finančných informácií i informácií o udržateľnosti prostredníctvom priebežne sa zdokonaľujúcich nadnárodných úprav vyžaduje čoraz precíznejší obraz o skutočnosti, používané nástroje sú čoraz zložitejšie, vrátane nástrojov umelej inteligencie, ich aplikácia vyžaduje nové prístupy a nové vedomosti, znalosti a zručnosti, čo súčasne znamená rozšírenie možností na zneužitie týchto nástrojov. Zásadu verného a pravdivého zobrazenia skutočnosti možno obchádzať s použitím čoraz rafinovanejších spôsobov, pričom dopad skresľovania obrazu môže mať na vývoj svetovej ekonomiky a aj ekonomiky SR nežiaduce následky. (Hvožďarová, 2009) V študentoch je dôležité upevňovať povedomie, že v praxi oni ako konkrétne fyzické odborne zdatné osoby, budú tým činiteľom, ktorého názor alebo rozhodnutie, môže významne ovplyvniť vernosť a pravdivosť obrazu o skutočnostiach prebiehajúcich v podniku. Pri výučbe etiky je kľúčové, aby si študenti osvojili schopnosť zaujať etické postoje pri riešení etických konfliktov a uvedomili si potrebu predchádzať etickým konfliktom. Osvojenie si a prijatie etických princípov, ich aplikácia pri rozhodovaní účtovných odborníkov, ktorí účtovníctvo vedú, zostavujú účtovnú závierku a výročnú správu a overujú účtovnú závierku a výročnú správu, je jedným z predpokladov zabezpečenia nepretržitosti pokračovania v činnosti podniku a následne i trvalo udržateľného rozvoja podniku a trvalo udržateľného rozvoja celej spoločnosti. Študenti odchádzajúci do praxe bezpochyby majú poznať základy etického myslenia, bez ohľadu na fakt či ich nadväzne v praxi uplatnia alebo aj neuplatnia.

4 Záver

Vykazovanie informácií o udržateľnosti sa stáva neoddeliteľnou súčasťou výročných správ, pomáha používateľom informácií, resp. zainteresovaným stranám lepšie porozumieť celkovým vplyvom podniku na spoločnosť a životné prostredie. Tieto informácie neslúžia iba na splnenie legislatívnej povinnosti účtovných jednotiek, ale predstavujú nástroj na dosiahnutie väčšej transparentnosti a spoločenskej zodpovednosti podnikov voči všetkým zainteresovaným stranám. Splnenie si tejto povinnosti môže rovnako pomôcť zlepšiť prístup k financovaniu udržateľných aktivít vďaka vyššej atraktívnosti pre investorov. V tomto kontexte je účtovníctvo, ktorého súčasťou sú i výročné správy, stále viac vnímané ako nástroj na vykreslenie integrovaného obrazu podniku, ktorý nie je obmedzený iba na finančné ukazovatele. Vykazovanie nefinančných informácií umožňuje podnikom posunúť sa za rámec tradičného merania výkonnosti a zohľadniť ich prínos pre spoločnosť ako celok.

Dôveryhodnosť zverejňovaných informácií o udržateľnosti nezávisí len od zvolenej metodiky, ale najmä od etickej integrity tých, ktorí tieto informácie spracúvajú a sprostredkujú, ako aj od tých, ktorí ich overujú. V kontexte informácií o udržateľnosti nadobúda profesijná etika osobitný význam, pretože pri absencii etiky hrozí zneužitie vo forme greenwashingu, manipulácia s metódami výpočtu alebo zámerné zamlčovanie nepriaznivých skutočností. Informácie o udržateľnosti majú totiž špecifickú povahu – sú menej presne merateľné, často závislé od odhadov, externých ukazovateľov či kvalitatívnych opisov, ich interpretácia je do veľkej miery ovplyvnená hodnotovým nastavením podniku. Účtovník nie je primárne tvorcom ESG údajov, tie vznikajú v prostredí environmentálneho, personálneho či riadiaceho manažmentu. Jeho prínos spočíva v kompletizácii, sprístupnení a prepojení týchto údajov s finančnými výkazmi tak, aby bolo možné posúdiť komplexnú výkonnosť podniku. Etická zodpovednosť účtovníka sa teda netýka obsahu jednotlivých ukazovateľov, ale spôsobu, akým sú spracované, overené a komunikované. Rozširujúce sa regulačné požiadavky (CSRD, ESRS) vytvárajú potrebu novej profesijnej identity účtovníka, ktorý sa postupne stáva „správcom dát o udržateľnosti“. Tento posun si

vyžaduje aj rozvoj etických kompetencií, nie iba vedomostí o normách, ale aj morálneho úsudku pri interpretácii výsledkov. Účtovný odborník je povinný zachovávať základné etické princípy – bezúhonnosť, objektívnosť, odbornú spôsobilosť a náležitú starostlivosť, dôvernosť a profesionálne správanie. Medzi jednotlivými zásadami existujú vzájomné väzby a v praxi sa uplatňujú vo všetkých oblastiach ESG. Čestnosť ochraňuje pravdivosť údajov, objektivita nezávislosť ich spracovania, odborná spôsobilosť ich metodickú kvalitu, dôvernosť zachováva reputáciu a profesionálne správanie spája všetky dimenzie do jedného rámca transparentnej komunikácie. Dodržiavanie etických princípov je predpokladom pre správnosť a dôveryhodnosť všetkých informácií, ktoré účtovný odborník spracúva alebo overuje a tiež je zárukou, že informácie o udržateľnosti budú nielen numericky správne, ale aj obsahovo úprimné a spoločensky využiteľné. Významnú úlohu pri dodržiavaní etických princípov zohrávajú i osobnostné predpoklady a charakterové vlastnosti každého jedinca, preto je ich nevyhnutné kultivovať štúdiom etiky naprieč celým vzdelávacím systémom.

Ak by účtovníctvo stratilo etický rozmer, hrozila by devalvácia samotného zmyslu vykazovania informácií o udržateľnosti – údaje by sa stali formálnou povinnosťou, nie zdrojom relevantných informácií pre investičné a spoločenské rozhodovanie. Preto je posilňovanie etickej dimenzie účtovníckej i auditorskej profesie kľúčové nielen pre kvalitu zverejňovaných informácií, ale aj pre budovanie férovej, transparentnej a zodpovednej ekonomiky.

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Když o etice rozhodují peníze: Jak ekonomický tlak na média ovlivňuje novinářská pravidla

Miroslava Sloupová¹

Abstrakt: Příspěvek analyzuje vztah mezi ekonomickým fungováním médií a etickým rozhodováním novinářů. Vychází ze syntézy odborné literatury z oblasti mediální etiky a ekonomického fungování médií a navazující analýzy případů popsanych v této literatuře. Současné mediální prostředí, charakterizované digitalizací, tlakem na publikační výkon a orientací na metriky pozornosti, proměňuje tradiční novinářské normy. Cílem je identifikovat klíčové oblasti, v nichž ekonomické faktory ovlivňují etiku žurnalistiky, zejména v kontextu rychlosti publikace, výběru témat a způsobu jejich zpracování. Příspěvek ukazuje, že etická dilemata nelze redukovat na individuální selhání, ale je nutné je chápat jako důsledek strukturálních tlaků mediálního trhu.

Klíčová slova: mediální etika, digitalizace médií, prekarizace práce.

1 Úvod

Zpravodajství má ve společnosti zvláštní postavení. Na jedné straně je vnímáno jako běžný produkt mediálního trhu, na druhé straně však plní důležitou veřejnou funkci – poskytuje informace, které lidem umožňují orientovat se ve společnosti a činit informovaná rozhodnutí (Deuze, 2005). Kvalitní žurnalistika tak není důležitá jen z hlediska médií samotných, ale i pro fungování demokracie a veřejné debaty. Právě v tom spočívá určité napětí: ačkoli má žurnalistika význam pro celou společnost, její fungování je závislé na ekonomických podmínkách (Belsey, 1998; Moravec, 2020).

Média musí dlouhodobě hledat způsoby, jak svou činnost financovat, a přizpůsobovat se proměnám trhu. V posledních letech se tato situace výrazně změnila v důsledku digitalizace, poklesu příjmů z reklamy a rostoucí konkurence, zejména ze strany digitálních platform (Albarran, 2023). V tomto kontextu vyvstává otázka, jak tyto ekonomické tlaky ovlivňují novinářskou etiku. Tradiční principy, jako jsou pravdivost, objektivita nebo odpovědnost vůči veřejnosti, sice zůstávají důležitou součástí profesních standardů, jejich naplňování je však stále častěji ovlivňováno praktickými omezeními mediálního provozu.

Cílem tohoto příspěvku je proto analyzovat, jak ekonomické podmínky formují etické rozhodování novinářů a jak se promítají do každodenní mediální praxe. Text se zaměřuje na identifikaci klíčových oblastí, v nichž dochází ke střetu mezi ekonomickými požadavky a normativními ideály žurnalistiky.

2 Metodika

Příspěvek zakládá na syntéze odborné literatury z oblasti mediální etiky a výzkumu ekonomického fungování médií a na následné analýze případů shromážděných v této literatuře. Cílem není empirické testování hypotéz, ale konceptuální uchopení vztahu mezi ekonomickými podmínkami mediální produkce a etickým rozhodováním novinářů.

Analýza probíhala ve třech krocích:

1. Identifikace klíčových ekonomických faktorů, které ovlivňují fungování médií (digitalizace, změna obchodních modelů, tlak na publikační výkon ad.).
2. Analýza jejich dopadu na novinářskou praxi, zejména ve vztahu k výběru témat, způsobu zpracování a tempu publikace.
3. Interpretace těchto změn z hlediska mediální etiky, s důrazem na napětí mezi normativními ideály a reálnou praxí.

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Výsledkem je konceptuální model rozšiřující teoretické ukotvení tématu, který propojuje ekonomické podmínky mediálního prostředí s konkrétními etickými dilematy.

3 Výsledky

Analýza odborné literatury zabývající se vztahem mediální etiky a ekonomické situace médií ukazuje, že etická dilemata současné žurnalistiky nelze chápat izolovaně na úrovni individuálních rozhodnutí. Novináři jednají v rámci institucionálních a ekonomických struktur, které významně ovlivňují jejich možnosti volby. Tradiční normativní přístup, který zdůrazňuje osobní odpovědnost novináře, je proto nutné doplnit o strukturální perspektivu. Etika médií není pouze otázkou profesních pravidel, ale i podmínek, za nichž jsou tato pravidla aplikována.

3.1 Ekonomická povaha žurnalistiky a její důsledky

Analýza ukazuje, že jedním z klíčových faktorů ovlivňujících současnou žurnalistiku je její specifická ekonomická povaha. Zpravodajství nelze chápat jako běžný tržní produkt, protože jeho hodnota přesahuje individuální spotřebu a má širší společenský dopad. Informace publikované jedním médiem se rychle stávají součástí veřejného prostoru, kde jsou dále šířeny, reinterpretovány a využívány dalšími aktéry.

Tato charakteristika je zvláště patrná v případech vlastních zjištění redakcí, zejména investigativní žurnalistiky. Jak upozorňuje Hamilton (2004), redakce, která investuje čas a zdroje do odhalení významného tématu, následně sleduje, jak jsou její zjištění přebírána a dále rozvíjena jinými médii. Tento proces sice přispívá k informovanosti veřejnosti, zároveň však oslabuje ekonomickou návratnost původní investice (Kind & Møen, 2015). Snadná reprodukovatelnost mediálního obsahu vede k rozšířené praxi přebírání informací mezi médii. V online prostředí je tento jev ještě výraznější, a to včetně situací, kdy není původní zdroj adekvátně uveden. Jak uvádějí Albrecht a Andreassen (2014), v žurnalistické praxi se běžně setkáváme s fenoménem „půjček a loupeží“, kdy dochází k využívání cizího obsahu bez odpovídajícího přiznání autorství.

Tento mechanismus má zásadní dopad na strukturu mediální produkce. Nákladná a časově náročná investigativní činnost, která představuje jeden z pilířů kvalitní žurnalistiky, se stává ekonomicky méně atraktivní. Média tak čelí dilematu mezi investicí do originálního obsahu a využíváním již existujících zdrojů.

V důsledku uvedených faktorů se ukazuje, že média nemohou dlouhodobě fungovat pouze na základě produkce vlastního, nákladného obsahu. Pokud by redakce vsadily výhradně na investigativní žurnalistiku, jejich ekonomická udržitelnost by byla výrazně ohrožena. Z tohoto důvodu jsou média dlouhodobě závislá na externích zdrojích financování, jako jsou reklama, předplatné nebo různé formy veřejné či soukromé podpory. Jak shrnuje Pickard (2015), žurnalistika nikdy nebyla plně financovatelná prostřednictvím přímých tržních mechanismů, ale vždy byla do určité míry subvencována.

Tato závislost však přináší další důsledky, které přesahují ekonomickou rovinu. Externí financování může vyvolávat otázky ohledně nezávislosti médií a přispívat k oslabování důvěry ze strany publika (Nelson, Lewis, & Cowley, 2024). Vnímání médií jako aktérů ovlivněných ekonomickými či politickými zájmy tak představuje jeden z klíčových problémů současného mediálního prostředí.

3.2 Proměna obchodních modelů a nástup metrik pozornosti

Na strukturální limity financování žurnalistiky popsané v předchozí kapitole navazuje zásadní proměna mediálního prostředí spojená s digitalizací. Pokles tradičních příjmů, zejména z reklamy, vede média k hledání nových zdrojů financování a k intenzivnějšímu zaměření na publikum jako klíčový ekonomický faktor (Newman et al., 2021).

V tomto kontextu se postupně prosazují tzv. metriky pozornosti, jako jsou zhlédnutí, sdílení či míra zapojení uživatelů, které slouží jako hlavní indikátor úspěšnosti obsahu (Cherubini & Nielsen, 2017). Tyto ukazatele však nepředstavují pouze nástroj měření, ale aktivně vstupují do redakčního rozhodování a ovlivňují, jaký obsah je vytvářen a jakým způsobem je prezentován. Tradiční důraz na společenskou relevanci a význam informací je stále častěji doplňován – a v některých případech nahrazován – jejich schopností generovat publikační odezvu. Jak uvádějí Fischer a Jarren (2024, s.208), kritérium relevance se v digitálním prostředí transformuje do podoby schopnosti obsahu produkovat „kliky, zhlédnutí, lajky a sdílení“. Tento posun se promítá i do formy zpravodajství. Obsah je stále častěji konstruován tak, aby byl rychle konzumovatelný, vizuálně atraktivní a emocionálně působivý. Novináři jsou tak motivováni produkovat sdělení s maximálním dopadem v co nejkratším čase, často za cenu zjednodušení nebo redukce komplexních témat (Fischer & Jarren, 2024).

Proměna redakční logiky je úzce spjata s širším procesem platformizace médií. Digitální platformy se staly klíčovým prostředníkem mezi médii a publikem, čímž zásadně ovlivňují distribuci obsahu i ekonomické fungování redakcí. Jak upozorňuje Habermas (2022), dochází k posunu od médií jako prostoru veřejné debaty k médiím jako produkčním centrům, která jsou řízena logikou distribuce a spotřeby obsahu. Profesní standardy se tak částečně přizpůsobují požadavkům platform a jejich obchodním modelům, které jsou založeny na maximalizaci pozornosti uživatelů. Výsledkem je proměna role redakcí: vedle tradiční funkce výběru a ověřování informací stále více vystupuje do popředí řízení produkce obsahu s ohledem na jeho výkon v digitálním prostředí.

3.3 Etické důsledky ekonomicky podmíněné produkce obsahu

Proměna redakční logiky směrem k maximalizaci pozornosti má přímé důsledky pro etickou dimenzi žurnalistiky. Jedním z nejvýraznějších projevů tohoto trendu je nárůst sensacionalismu a emocionalizace. Témata s vysokým potenciálem přitáhnout pozornost – zejména kriminalita, katastrofy či konflikty – jsou systematicky upřednostňována před méně atraktivními, avšak společensky významnými otázkami. Tento vývoj souvisí nejen s redakčními rozhodnutími, ale i s očekáváními publika, které dlouhodobě vykazuje zvýšený zájem o kriminální obsah (Miller, Purcell, & Rosenstiel, 2012), a to i přesto, že deklarativně preferuje vyváženější zpravodajství (Levin & Wiest, 2018).

Výrazným příkladem propojení ekonomických tlaků a etických dilemat je mediální pokrytí masových střelb. Analýzy ukazují, že pachatelé těchto činů získávají mimořádnou mediální pozornost, která může mít i významnou ekonomickou hodnotu. Podle dat společnosti mediaQuant obdrželi pachatelé sedmi masových útoků mezi lety 2013 a 2017 mediální prostor odpovídající přibližně 75 milionům dolarů v podobě neplacené publicity (Lankford, 2018). V některých případech byla hodnota této pozornosti vyšší než mediální pokrytí známých celebrit. Právě finanční zisk je důvodem, proč mediální korporace váhají s omezením zpravodajství o masových vraždách, přestože tento typ zpravodajství vyvolává širší společenské dopady. Intenzivní a detailní mediální pokrytí takových činů může přispívat k riziku nápodobného jednání, což potvrzují studie poukazující na tzv. copycat efekt (Towers et al., 2015; Kissner, 2016). Média se tak ocitají v etickém dilematu mezi právem veřejnosti na informace a potenciálními negativními důsledky způsobu jejich prezentace.

3.4 Prekarizace práce a oslabení profesní autonomie

Ekonomické změny mediálního prostředí se neprojevují pouze na úrovni obsahu, ale i v pracovních podmínkách novinářů. Rostoucí tlak na výkon, rychlost a kvantitu produkce je často doprovázen nestabilními pracovními podmínkami (Rick & Hanitzsch, 2024). Tato prekarizace může oslabovat profesní autonomii novinářů a jejich schopnost čelit etickým dilematům. Omezený čas na práci, tlak na publikační výsledky a závislost na organizačních strukturách mohou vést k situacím, kdy jsou etické principy upozaděny ve prospěch operativních požadavků mediálního provozu.

Tabulka 1 Vliv ekonomických faktorů na etické aspekty žurnalistiky

Ekonomický faktor	Dopad na praxi	Etický důsledek
pokles příjmů	tlak na výkon	zjednodušování obsahu
konkurence médií	přebírání obsahu	oslabení originality
digitalizace	zrychlení produkce	riziko nepřesností
metriky pozornosti	orientace na publikum	sensacionalismus
prekarizace práce	časový tlak	oslabení autonomie

Zdroj: Vlastní práce

4 Závěr

Tento příspěvek analyzoval vztah mezi ekonomickými podmínkami mediální produkce a etickým rozhodováním novinářů. Ukázal, že současná žurnalistika se nachází v prostředí, které je charakterizováno strukturální nerovnováhou mezi společenskou hodnotou informací a jejich ekonomickou návratností. Zpravodajství jako specifický typ produktu generuje pozitivní externalitu, které oslabují motivaci k produkci nákladného, zejména investigativního obsahu, a zároveň podporují jeho sekundární šíření bez odpovídající kompenzace.

Na tuto strukturální slabinu navazuje transformace mediálních obchodních modelů v digitálním prostředí. Pokles tradičních příjmů vede k posílení závislosti na publiku a k nástupu metrik pozornosti jako klíčového ukazatele úspěšnosti. Tyto metriky však postupně přestávají být pouze nástrojem měření a stávají se faktorem, který aktivně formuje obsah i redakční rozhodování. Výsledkem je posun od žurnalistiky orientované na společenskou relevanci k žurnalistice orientované na výkon obsahu v prostředí digitální distribuce. Tento posun se projevuje nárůstem senzacionalismu, standardizací obsahu, oslabováním originality i proměnou pracovních podmínek novinářů. Etická dilemata, která z tohoto vývoje vyplývají, proto nelze chápat pouze jako individuální selhání, ale jako důsledek systémového nastavení mediálního trhu.

Z ekonomického hlediska lze současnou situaci interpretovat jako konflikt mezi dvěma typy racionality: normativní racionalitou veřejného zájmu a tržní racionalitou maximalizace pozornosti. Zatímco první zdůrazňuje kvalitu, důvěryhodnost a dlouhodobý společenský přínos, druhá upřednostňuje krátkodobý výkon, měřitelný prostřednictvím uživatelských interakcí. Tento konflikt přitom není pouze teoretický, ale má konkrétní důsledky pro fungování demokratické společnosti. Pokud ekonomické podmínky systematicky zvýhodňují obsah, který maximalizuje pozornost na úkor relevance, dochází k postupné erozi jedné z klíčových funkcí médií – poskytování kvalitních a důvěryhodných informací. Závěrem lze konstatovat, že diskuse o etice médií musí být nutně doplněna o ekonomickou perspektivu. Bez reflexe strukturálních podmínek mediální produkce zůstává etika žurnalistiky neúplná a její normativní požadavky obtížně aplikovatelné v praxi.

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Title: When money dictates ethics: How economic pressure on the media influences journalistic standards

Abstract: This paper analyses the relationship between the economic functioning of the media and the ethical decision-making of journalists. It is based on a synthesis of the academic literature in the fields of media ethics and the economic functioning of the media, followed by an analysis of the case studies described in this literature. The current media environment, characterised by digitalisation, pressure to publish and a focus on attention metrics, is transforming traditional journalistic standards. The aim is to identify key areas in which economic factors influence journalistic ethics, particularly in the context of publication speed, the selection of topics and the manner in which they are covered. This paper demonstrates that ethical dilemmas cannot be reduced to individual failings, but must be understood as a consequence of structural pressures within the media market.

Keywords: media ethics, media digitalisation, precarisation of journalism.

Generativní AI ve vzdělávání: pomocník, nebo hrozba akademické integrity?

Stanislav Veselý¹, Vojtěch Stehel², Monika Hrubá³

Abstrakt: Příspěvek se zabývá tím, zda generativní umělá inteligence ve vysokoškolském vzdělávání představuje především podpůrný nástroj, nebo riziko pro akademickou integritu. Vychází z přehledově analytické syntézy sedmnácti zdrojů dohledaných ve Web of Science Core Collection v tematických blocích zaměřených na generativní AI, akademickou integritu, plagiátorství, etiku AI, akademické psaní, hodnocení a vysokoškolské vzdělávání. Text ukazuje, že generativní AI přináší potenciál pro individualizovanou podporu učení, rozvoj AI literacy, proměnu pedagogických postupů a revizi hodnotících procesů. Současně však oslabuje tradiční hranice mezi podporou a náhradou studentské práce, komplikuje autorství, zvyšuje nároky na transparentnost a zpochybňuje spolehlivost dosavadních hodnotících procesů. Závěr příspěvku zdůrazňuje, že generativní AI nelze smysluplně řešit pouze zákazem ani technickou detekcí. Klíčová je kombinace jasných pravidel, přepracovaného hodnocení, vzdělávání v oblasti etiky AI a odpovědného zapojení studentů i pedagogů

Klíčová slova: generativní AI, vzdělávání, akademická integrita, vysoké školy, etika, autorství, plagiátorství

1 Úvod

Generativní AI vysoce ovlivňuje vysokoškolské vzdělávání a mění zavedené způsoby, jak se znalosti předávají, vytvářejí, sdílejí a hodnotí. Vedle toho Laflamme a Bruneault (2025) tvrdí, že tradiční zaměření na plagiátorství a nevhodného chování v rámci umělé inteligence je nedostatečné a je třeba obnovit či pozměnit akademickou integritu napříč akademickou obcí.

Už první akademické reakce proto spojovaly generativní AI s dvojím očekáváním: může pomoci při učení, tvorbě výukových materiálů, zpětné vazbě a individualizaci výuky (Batista et al., 2024; Gallent-Torres et al., 2023; Jensen et al., 2025), ale zároveň může zásadně narušit důvěryhodnost odevzdávaných studentských výkonů (Eke, 2023). Problém není pouze technický. Generativní AI nevytváří jen nový typ nástroje, ale proměňuje podmínky, za nichž se posuzuje samostatnost, autorství a odpovědnost za akademický text. Bozkurt (2024) upozorňuje, že v akademickém psaní vzniká napětí mezi lidskou a syntetickou tvorbou, které se dotýká autorství, vlastnictví, transparentnosti i publikační etiky. Laflamme a Bruneault (2025) proto tvrdí, že tradiční pojetí akademické integrity zaměřené hlavně na prevenci plagiátorství a podvádění je v prostředí generativní AI nedostačující.

Tento příspěvek se ptá, zda generativní AI ve vysokoškolském vzdělávání vystupuje spíše jako pomocník, nebo jako hrozba akademické integrity. Cílem příspěvku je na základě přehledově analytické syntézy vybraných zdrojů z Web of Science Core Collection posoudit, za jakých podmínek může generativní AI ve vysokoškolském vzdělávání fungovat jako podpůrný nástroj učení a kdy naopak představuje riziko pro akademickou integritu, autorství a férovost hodnocení. Cílem je ukázat, za jakých podmínek může být generativní AI podporou učení a kdy se naopak stává rizikem pro původnost, odpovědnost, transparentnost a férovost hodnocení.

2 Metodika

Příspěvek má formu přehledově analytické studie založené na rešerši ve Web of Science Core Collection. Rešerše byla rozdělena do pěti tematických bloků, které odpovídaly hlavním liniím příspěvku: akademická integrita a generativní AI, AI plagiarism, AI-assisted writing a autorství, etika AI a přehledové studie k využití generativní AI ve vysokoškolském vzdělávání.

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Vyhledávání a export záznamů z Web of Science Core Collection byly provedeny dne 23. 4. 2026. Dotazy byly omezeny publikačním obdobím, vzhledem k vývoji tématu se finálně zařazené zdroje soustředily do let 2023-2025.

Byly použity následující tematické dotazy v All fields:

- Blok A: "academic integrity" AND ("generative AI" OR "generative artificial intelligence" OR GenAI OR ChatGPT)
- Blok B: ("AI plagiarism" OR "AI-induced plagiarism") AND education
- Blok C: "AI-assisted writing" AND ("academic writing" OR authorship OR "academic integrity")
- Blok D: ("AI ethics" OR "ethical AI use") AND (ChatGPT OR "generative AI") AND education
- Blok E: "generative AI" AND "higher education" AND ("review" OR "claims" OR "grey literature")

Vyhledávání bylo zaměřeno na tematickou relevanci.

Dotazy v režimu All fields vrátily ve Web of Science Core Collection tyto počty výsledků: blok A 1007 záznamů, blok B 20 záznamů, blok C 45 záznamů, blok D 202 záznamů a blok E 286 záznamů. Celkově tedy tematické dotazy zachytily 1560 výsledků, z nichž byl pro další ruční posouzení vytvořen užší pracovní soubor. Do pracovní analýzy bylo exportováno celkem 180 záznamů ve formátu Clarivate plain text: blok A 50 záznamů, blok B 20 záznamů, blok C 10 záznamů, blok D 50 záznamů a blok E 50 záznamů. Export byl zaměřen na záznamy s nejvyšší tematickou vazbou na cíl příspěvku. Po kontrole duplicit podle DOI a názvu zůstalo v exportovaném pracovním souboru 173 unikátních záznamů. Tento soubor tvořil výchozí bázi pro výběr zdrojů do tematické syntézy.

Redukce pracovního souboru na finální syntézu probíhala ve třech krocích. Nejprve byly posuzovány názvy, abstrakty a autorská klíčová slova z exportů WoS. V této fázi byly vyřazeny záznamy, které se sice týkaly generativní AI nebo vzdělávání, ale nevztahovaly se přímo k vysokoškolskému prostředí, akademické integritě, plagiátorství, etice AI, akademickému psaní, autorství, hodnocení nebo institucionálním pravidlům.

Ve druhém kroku byly přednostně ponechány zdroje, které pokrývaly některou z hlavních tematických linií příspěvku: přínosy generativní AI pro učení a výuku, rizika pro akademickou integritu, otázky autorství a původnosti textu, limity detekce a tradičních hodnotících postupů, etické používání AI a institucionální odpověď vysokých škol. Současně byla zohledněna citační odezva ve WoS, typ dokumentu a metodologická povaha zdroje. Přednost měly přehledové studie, empirické studie a konceptuální texty s přímou vazbou na cíl příspěvku. Nižší citační odezva nebyla automatickým důvodem k vyřazení, pokud zdroj pokrýval tematickou oblast, která by jinak ve finální syntéze chyběla.

Ve třetím kroku byl sestaven finální soubor 17 zdrojů tak, aby pokrýval všechny hlavní části argumentace příspěvku a současně nebyl tematicky nadbytečný. Do finální syntézy proto nebyly zařazené všechny relevantní záznamy, ale pouze ty, které nejlépe podporovaly zaměření článku na otázku, za jakých podmínek je generativní AI ve vysokoškolském vzdělávání pomocníkem a kdy se stává rizikem pro akademickou integritu. U vybraných textů byly informace z exportů doplněny kontrolou dostupných fulltextů, pokud byly k dispozici.

Do finální syntézy bylo zařazeno sedmnáct zdrojů. Vysokou citační odezvu (TC – Times Cited) měly zejména Chiu (2024; TC = 257), Eke (2023; TC = 255), Bozkurt (2024; TC = 88), Batista et al. (2024; TC = 87), Jensen et al. (2025; TC = 60), Gruenhagen et al. (2024; TC = 55), Bittle a El-Gayar (2025; TC = 52), Nguyen (2025; TC = 50), Gallent-Torres et al. (2023; TC = 42), Kofinas et al. (2025; TC = 40), Shailendra et al. (2024; TC = 38) a Rasul et al. (2024; TC = 37). Tyto zdroje byly doplněny tematicky přesnými texty Kovariho (2025), Laflamme a Bruneaulta (2025), Lye a Lim (2024), Moore a Lookadoo (2024) a Mvondo et al. (2025), které pokrývají etické používání ChatGPT, redesign assessmentů, AI ethics, institucionální pravidla a podmínky etického využití LLM chatbotů.

Záměrem nebyla systematická rešerše ve smyslu úplného mapování veškeré literatury ani metaanalýza. Cílem bylo vytvořit argumentačně soudržnou syntézu relevantních WoS zdrojů pro konferenční příspěvek. Limitem je rychlý vývoj tématu, rozdílná metodologická povaha zařazených textů a skutečnost, že část zdrojů je založena na review, konceptuální argumentaci nebo studentských perspektivách, zatímco dlouhodobých empirických studií dopadů generativní AI na učení a integritu je stále méně.

3 Výsledky

3.1 Generativní AI jako podpora vzdělávání

V analyzovaných zdrojích se opakuje představa generativní AI jako nástroje, který může posílit učení, individualizovat podporu a rozšířit možnosti výuky. Eke (2023) připouští, že systémy typu ChatGPT mohou akademické prostředí významně proměnit a současně vytvářejí nové nároky na ochranu akademické integrity. Chiu (2024) spojuje budoucí význam generativní AI s proměnou učebních výstupů, rozvojem AI literacy, interdisciplinárním učením a assessmenty orientovanými na praktické a aktivní činnosti.

Přínosy se týkají jak studentů, tak pedagogů. Batista et al. (2024) ve své systematické rešerši ukazují, že generativní AI je v literatuře spojována s technologickou všestranností, podporou učení a pozitivním přijetím ze strany části studentů. Gallent-Torres et al. (2023) uvádějí jako možné přínosy okamžitou zpětnou vazbu, tvorbu výukových materiálů, adaptivní učení a interaktivitu. Tyto přínosy však ve všech případech vyžadují pedagogické ukotvení, protože samotná dostupnost nástroje ještě nezaručuje kvalitnější učení. Nguyen (2025) tuto pozitivní linii dále konkretizuje: generativní AI může podle něj podporovat kreativitu, efektivitu a personalizované učení, nemá však nahrazovat tradiční učení ani oslabovat kritické myšlení. Důraz klade na spolupráci člověka a AI, rovný přístup, ochranu soukromí, AI literacy a přípravu pedagogů i studentů na odpovědné používání těchto nástrojů. Shailendra et al. (2024) k tomu přidávají institucionální rovinu: zavádění generativní AI do kurikula podle nich vyžaduje vyjasnění rolí managementu, pedagogů, studentů a dalších aktérů, nikoli jen individuální rozhodování jednotlivých vyučujících. Jensen et al. (2025) upozorňují, že raná debata po nástupu ChatGPT často rámovala generativní AI jako katalyzátor již existujících agend, například reformy hodnocení, personalizace a inkluze. Takové pojetí je užitečné, protože generativní AI nepřináší pouze izolovaný technologický problém. Zviditelňuje slabá místa dosavadního vysokoškolského vzdělávání, zejména tam, kde hodnocení stojí na rutinní produkci textu bez dostatečné vazby na proces učení.

Pomocnická role generativní AI je proto podmíněná. Přínos není dán samotnou technologií, ale tím, zda je využití nástroje spojeno s aktivním učením, ověřováním výstupů a reflexí postupu. Pokud student používá generativní AI pouze k tomu, aby rychle získal hotový text, nástroj se z podpory stává náhradou výkonu. Pokud jej však používá k formulaci otázek, porovnání vysvětlení, zpětné vazbě nebo kontrole struktury argumentu, může posilovat proces učení.

3.2 Rizika pro akademickou integritu, autorství a původnost

Vedle přínosů však zdroje jednoznačně upozorňují na rizika pro akademickou integritu. Eke (2023) konstatuje, že generativní AI může akademické prostředí obohatit, ale způsob jejího použití může zároveň podkopávat akademickou integritu. Bittle a El-Gayar (2025) ve své systematické rešerši shrnují, že generativní AI může zvyšovat efektivitu a zapojení studentů, současně však představuje významné riziko akademické nepoctivosti.

Zásadní je posun od tradičního plagiátorství k širším otázkám původnosti a odpovědnosti. Generativní AI dokáže vytvořit text, který nemusí být prostou kopií cizího díla, přesto ale nemusí představovat samostatný výkon studenta. Bozkurt (2024) proto zdůrazňuje potřebu transparentního vykazování použití generativní AI v akademickém psaní a upozorňuje na nejasné hranice mezi spoluprací, spoluautorstvím, editací a syntetickou produkcí textu. Laflamme a Bruneault (2025) rozšiřují tuto debatu o argument, že akademická integrita nemůže být v době generativní AI redukována na kontrolu plagiátorství. Podle nich je třeba rozvíjet kulturu akademické integrity, která zahrnuje kompetence v oblasti etiky AI, schopnost kriticky posuzovat technologické výstupy a vědomí odpovědnosti za použitý obsah. Etické používání AI je tedy otázkou úsudku, nikoli pouze otázkou dodržení formálního zákazu. Rasul et al. (2024) navrhují v této souvislosti celostní rámec akademické integrity pro éru GenAI, který rozlišuje odpovědnost studentů, pedagogů a institucí. Jejich studie zdůrazňuje, že řešení nemá stát na jednom opatření, ale na kombinaci strategií od kolaborativního učení až po komplexní institucionální politiku GenAI. Zároveň upozorňují, že implementace takového rámce naráží na finanční, strategické, provozní a kulturní bariéry. Pro vysoké školy to znamená, že akademickou integritu nelze oddělit od organizačních podmínek, kapacit a kultury dané instituce.

Tento posun je pro vysoké školy zásadní, protože tradiční jazyk akademické integrity často vychází z modelu, v němž je problémem převzetí cizího textu. Generativní AI ale vytváří text nový, a proto se otázka přesouvá k tomu, kdo vykonal intelektuální práci, kdo ručí za výsledek a zda je čtenář nebo hodnotitel informován o technologické asistenci. Právě v tomto bodě se akademická integrita propojuje s etickou kompetencí a transparentností.

3.3 Detekce a limity tradičního hodnocení

Velmi silnou linií analyzovaných zdrojů je problém hodnocení. Gruenhagen et al. (2024) na základě šetření mezi 337 australskými vysokoškolskými studenty ukazují, že více než třetina respondentů použila chatbot jako podporu při posuzování a ne všichni takové použití nutně vnímají jako porušení akademické integrity. Z toho vyplývá, že instituce nemohou spoléhat jen na předpoklad, že hranice mezi dovolenou pomocí a podváděním je studentům samozřejmá.

Kofinas et al. (2025) jdou ještě dál a empiricky zpochybňují představu, že autentické hodnotící metody samy o sobě ochrání akademickou integritu. Jejich zjištění naznačují, že hodnotitelé obecně nedokážou spolehlivě rozlišit práce s generativní AI od prací bez ní a že autenticita úkolu sama nezaručuje ochranu před AI asistencí. Autoři proto doporučují přesun pozornosti od samotného výstupu k procesu, performativním prvkům, sociálně zkušenostnímu učení a relevanci k pracovní praxi. Tento závěr podporují také Chiu (2024) a Batista et al. (2024), kteří upozorňují na potřebu nových typů hodnotících procesů, AI literacy a pedagogických strategií. Detekce může být dílčí součástí institucionální reakce, ale nemůže být jejím jádrem. Pokud lze generativní AI použít k produkci textu, který projde běžným hodnocením, potom je problém hlouběji v designu úloh a v tom, co mají hodnotící procesy ve skutečnosti měřit. Lye a Lim (2024) tento argument zpřesňují v oblasti redesignu hodnocení. Vedle plagiátorství a podvádění upozorňují také na rizika zkreslených, diskriminačních nebo halucinovaných výstupů generativní AI. Navrhují princip *Against, Avoid and Adopt*, tedy rozlišování situací, v nichž je vhodné použití AI odmítnout, obejít vhodným návrhem úlohy, nebo naopak pedagogicky začlenit. Důležité je jejich varování, že závod ve zbrojení proti generativní AI a pouhé policejní pojetí kontroly neřeší základní slabiny hodnocení.

Praktickým důsledkem je nutnost odlišit tři roviny institucionální reakce. První rovinou je formulace pravidel: studenti musí vědět, kdy je použití AI dovoleno, kdy je nepřijatelné a jak má být přiznáno. Druhou rovinou je návrh úloh: zadání má směřovat k procesu, kontextu, argumentaci a obhajobě postupu. Třetí rovinou je vzdělávání: studenti i pedagogové potřebují rozumět limitům generovaných výstupů, riziku chyb a odpovědnosti za převzaté návrhy.

3.4 Etika AI a institucionální odpověď vysokých škol

Institucionální odpověď by proto neměla být založena pouze na zákazech. Kovari (2025) v textu zaměřeném na etické používání ChatGPT zdůrazňuje potřebu jasných pravidel, úpravy zadání, kreativních a personalizovaných úloh a promyšlených assessmentů. Podobně Gallent-Torres et al. (2023) spojují integraci generativní AI s nutností sladit inovaci, etická pravidla a politiky akademické integrity.

Mvondo et al. (2025) ukazují, že etické používání LLM chatbotů v prostředí vysokých škol není určováno pouze znalostí pravidel. Ve svém modelu pracují s etickým klimatem, etickým dohledem, morálním vědomím, sebedůvěrou při používání chatbotů, povědomím o pravidlech a vnímaným rizikem detekce nebo sankcí. Jejich zjištění podporují širší závěr, že etické jednání se nevytváří pouhou existencí pravidel, ale kombinací prostředí, kompetencí, dohledu a osobního úsudku. Bittle a El-Gayar (2025) doporučují posílit digitální gramotnost a rozvíjet robustní nástroje pro řízení dvojího dopadu generativní AI. Laflamme a Bruneault (2025) pak tento požadavek posouvají směrem k etické kompetenci celé akademické komunity. Vysoké školy by tedy měly vytvářet pravidla, která nejen zakazují nepřijatelné použití, ale zároveň vysvětlují, kdy je AI legitimní podporou, jak má být použití přiznáno a kdo nese odpovědnost za výsledný text. Moore a Lookadoo (2024) doplňují tuto rovinu praktickým důrazem na komunikaci pravidel. Analýza sylabových a institucionálních politik podle nich ukazuje, že pravidla mají být psána s ohledem na cílové publikum, srozumitelně a opřená o strategie podporující etické využívání AI v akademickém i profesním prostředí. Nguyen (2025) k tomu přidává, že vysoké školy musí současně chránit akademickou integritu, soukromí a rovný přístup a rozvíjet AI literacy. Nestačí tedy mít pravidlo v dokumentu; pravidlo musí být pedagogicky vysvětlené, použitelné v konkrétních kurzech a doplněné podporou pro vyučující.

Instituce proto stojí před úkolem vytvořit spíše kulturu odpovědného užívání než jen katalog zákazů. Zákaz může být v některých situacích oprávněný, například u úloh, jejichž cílem je ověřit samostatné zvládnutí konkrétní dovednosti. Obecně však nestačí, protože studenti se s generativní AI setkávají mimo výuku a budou ji používat i v profesním prostředí. Smysluplnější je naučit je rozlišovat mezi podporou, spoluprací, editací a nepřiznanou náhradou vlastní práce.

4 Závěr

Výsledkem příspěvku je zjištění, že generativní AI sama o sobě nepředstavuje ani jednoznačný přínos, ani jednoznačnou hrozbu, rozhodující je způsob jejího začlenění do výuky, transparentnost jejího použití, podoba

hodnotících úloh a úroveň etické a digitální kompetence studentů i pedagogů. Z analyzovaných WoS zdrojů vyplývá, že její dopad závisí na kontextu použití, typu úlohy, kvalitě institucionálních pravidel, úrovni AI literacy a schopnosti studentů i pedagogů reflektovat etické důsledky technologické asistence. Pokud je AI používána transparentně, pedagogicky ukotveně a s odpovědností za výsledný obsah, může podporovat učení, zpětnou vazbu a rozvoj nových kompetencí. Riziko vzniká tehdy, když generativní AI nahrazuje vlastní intelektuální výkon studenta, když není její použití přiznáno nebo když instituce zachovávají hodnotící způsoby, které lze snadno obejít produkcí přesvědčivého textového výstupu. V takovém prostředí se akademická integrita neoslabuje jen jednotlivým podvodem, ale i ztrátou důvěry v to, co odevzdaná práce skutečně vypovídá o znalostech a schopnostech studenta.

Nejpřesvědčivější odpovědí proto není prostý zákaz ani víra v technickou detekci. Vysoké školy potřebují kombinaci jasných pravidel, transparentního přiznávání AI asistence, změny hodnotících procesů, důrazu na proces učení, systematického vzdělávání v oblasti etiky AI a podpory pedagogů při přepracování zadání. Generativní AI tak může být pomocníkem pouze tehdy, pokud je začleněna do akademické praxe jako nástroj podřízený učení, odpovědnosti a kultuře akademické integrity.

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Title: Generative AI in education: helper, or threat to academic integrity?

Abstract: The paper addresses whether generative artificial intelligence in higher education primarily represents a supportive tool or a risk to academic integrity. It is based on a review-analytical synthesis of seventeen sources retrieved from the Web of Science Core Collection in thematic blocks focused on generative AI, academic integrity, plagiarism, AI ethics, academic writing, assessment and higher education. The text shows that generative AI brings potential for individualized learning support, the development of AI literacy, the transformation of pedagogical practices and the revision of assessment processes. At the same time, however, it weakens traditional boundaries between support and replacement of student work, complicates authorship, increases demands for transparency and calls into question the reliability of existing assessment processes. The conclusion of the paper emphasizes that generative AI cannot be meaningfully addressed solely through prohibition or technical detection. A combination of clear rules, redesigned assessment, education in AI ethics and responsible involvement of both students and educators is key

Keywords: generative AI, education, academic integrity, higher education institutions, ethics, authorship, plagiarism

Ethical Aspects of Digital Marketing in the Fast Fashion Industry: A Consumer Behaviour Perspective

Lucia Almaksus¹

Abstract: The paper analyses ethical aspects of digital marketing in the fast fashion segment in the context of consumer behaviour. The aim is to identify ethical implications of marketing tools and examine the gap between declared consumer attitudes and actual behaviour. The research is based on a quantitative survey conducted on a sample of 2210 respondents and is complemented by examples of selected brands. The results indicate a significant influence of influencer marketing, personalization, and social media on purchasing decisions, confirming the existence of a gap between sustainability preferences and price-oriented behaviour. The paper identifies key ethical challenges, including manipulation, lack of transparency, and greenwashing, and outlines implications for future development.

Keywords: Digital marketing · Fast Fashion · Consumer Behaviour · Ethical issues

1 Introduction

Digital marketing currently represents one of the most significant factors influencing consumer behaviour within the fashion industry (Ewis & Abdou, 2025). The development of social media, influencer marketing, algorithmic advertising, personalization, and data-driven communication has fundamentally transformed the relationship between brands and consumers. These changes have become particularly evident within the fast fashion segment, which is characterized by high trend sensitivity, short product life cycles, and intensive use of digital communication channels (Chaffey & Chadwick, 2022).

Companies such as Shein, H&M, and the Inditex Group (Zara, Bershka, Stradivarius, Oysho, and Massimo Dutti) no longer compete solely through pricing strategies, but increasingly through the effectiveness of their digital marketing strategies. Current marketing activities within these companies are based on influencer marketing, behavioural targeting, algorithmic product recommendations, personalized content, and emotionally oriented communication, reflecting the latest trends outlined in the Marketing 6.0 framework (Kotler et al., 2025).

With the growing importance of digital marketing, ethical aspects of marketing communication have also become increasingly significant. Academic discussion is progressively focused on issues related to consumer behaviour manipulation, greenwashing, insufficient transparency of production processes, promotion of excessive consumption, and conflicts between brands' declared values and their actual business practices (Uchanska, Bieniusiewicz & Obloj, 2023).

Contemporary consumers increasingly declare interest in sustainability, transparency, and corporate social responsibility. However, the economic performance of companies operating within the fast fashion segment suggests that consumer purchasing decisions continue to be strongly determined by price, trend relevance, product accessibility, and the intensity of digital marketing communication (Gardarsdóttir, Andradóttir & Thorsteinsson, 2020). In academic literature, this phenomenon is referred to as the "value–action gap," describing the discrepancy between consumers' declared values and their actual purchasing behaviour (Peeters, van der Werff & Tromp, 2022). The fast fashion segment therefore represents an appropriate empirical environment for examining the extent of value conflict. If companies emphasizing sustainability communication do not achieve relatively stronger economic performance compared to price-oriented competitors, it may be assumed that consumers' price rationality outweighs the normative influence of sustainability communication.

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The aim of the paper is to analyse ethical aspects of digital marketing within the fast fashion segment in the context of consumer behaviour and to identify the factors that most significantly influence consumer purchasing decisions. The paper also includes a comparison of selected global fashion brands and an interpretation of the discrepancy between consumers' declared attitudes and the economic reality of the market.

The theoretical background provides a foundation for the empirical examination of the relationship between the declared importance of brand value attributes and the actual determinants of consumer behaviour within the digital environment. Despite the growing number of studies focused on sustainable consumption and digital marketing, the effectiveness of sustainability communication in price-oriented markets remains insufficiently explored. Existing studies primarily concentrate on individual determinants of consumer value conflict, while less attention is devoted to segments characterized by high price elasticity and intensive competition. Within such market conditions, the effectiveness of sustainability communication may be significantly constrained by economically rational consumer behaviour and the dominance of price-related factors in purchasing decisions. This identified theoretical gap therefore creates space for empirical verification of the relationship between consumers' declared values and their actual position within the purchasing decision-making process in the fast fashion segment.

2 Aim and methods

The research focuses on examining the relationship between the declared importance of brand values, including environmental and social responsibility, and the actual determinants of purchasing behaviour in the digital environment.

The study is based on four main research questions:

- **RQ1:** Does digital marketing influence purchasing decision-making within the fast fashion segment?
- **RQ2:** Do ethical values and sustainability represent significant factors in consumer purchasing decisions?
- **RQ3:** Which fashion brands are perceived by consumers as the strongest in the field of digital marketing?
- **RQ4:** Is there a discrepancy between consumers' declared values and their actual purchasing behaviour?

The empirical part of the study is based on quantitative research conducted through an online questionnaire survey aimed at examining the influence of digital marketing on consumer behaviour within the fast fashion segment. The research was carried out in 2025 using an electronic questionnaire distributed through social media platforms and digital communication channels. The study focused on identifying factors influencing consumer purchasing decisions, perceptions of authenticity in marketing communication, the significance of influencer marketing, and respondents' attitudes toward ethics, transparency, and sustainability of fashion brands. The questionnaire consisted primarily of closed-ended questions and Likert-scale items. One open-ended question was also included.

The research additionally incorporated a comparison of selected global fast fashion companies — Shein, H&M, and the Inditex Group — in the context of digital marketing, brand reputation, and consumer perception.

Research Sample

The research sample consisted of 2,210 respondents. The majority of participants were women, representing 98% of the sample. The dominant age categories were respondents aged 26–30 years (31.8%) and 21–25 years (30.5%). The predominance of female respondents is related to both the nature of the examined issue and the method of questionnaire distribution. The fast fashion segment has long been primarily oriented toward female consumers, while women also represent a key target group for fashion brands and influencer marketing within social media environments. The higher representation of women also corresponds with current digital marketing trends, where women demonstrate higher levels of interaction with fashion-related content, influencers, and online shopping platforms. Despite the dominance of female respondents, the research sample can be considered relevant given the nature of the examined topic and the specific characteristics of the fast fashion segment.

In terms of educational structure, the most significant groups consisted of respondents with completed secondary education with graduation examination (38.9%) and respondents with university education at the second-degree level or higher (38.9%). Participants were selected using convenience sampling through social media environments and the digital channels of a female influencer operating in the Slovak Republic. The research

sample primarily consisted of consumers actively using social media and online shopping platforms, which corresponds with the nature of the research topic.

Data Processing and Interpretation

Descriptive statistical methods were used for data evaluation. To assess the extent of value conflict, a comparative analysis was conducted between respondents' declared interest in brand values and indicators of actual purchasing behaviour. Relationships between selected variables were analysed using cross-tabulation and correlation analysis.

The questionnaire also included one open-ended question, the responses to which were subsequently processed through manual categorization according to brand names. Different graphical or linguistic variations of brand names were unified and aggregated into single categories.

The interpretation of the findings also included a comparative analysis of selected fast fashion companies in terms of their digital marketing strategies, brand reputation, and economic performance. The results were further interpreted in relation to the discrepancy between respondents' declared attitudes and their actual consumer behaviour within the context of the "value–action gap" phenomenon.

3 Results

The research findings were interpreted in the context of the four research questions formulated in the methodological section of the paper. At the same time, the interpretation of the results connects the quantitative findings with the current economic reality of the fast fashion market and the digital marketing strategies of selected companies.

RQ1: Does digital marketing influence purchasing decision-making within the fast fashion segment?

The findings confirmed that digital marketing represents a significant factor influencing consumer purchasing decisions in the fast fashion segment. A total of 46.7% of respondents stated that they purchase fashion products through a combination of online and offline channels, while 39% primarily prefer online shopping. These results indicate the growing importance of digitalization within the purchasing process and the increasing relevance of omnichannel strategies in the fashion industry.

The research also demonstrated a high level of exposure to digital advertising among respondents. Nearly half of the respondents (46.9%) reported that they occasionally purchase products based on digital advertising. At the same time, 43.7% of respondents declared regular interaction with products or brands through digital marketing content.

Influencer marketing was identified as the most significant digital marketing tool. The findings further suggest that consumers do not automatically perceive the largest influencers as the most trustworthy. As shown in Table 1, the strongest influence on purchasing decisions was associated with influencers with audiences ranging from 50,000 to 250,000 followers (32.9%). This finding highlights the growing importance of authenticity, credibility, and relatability in digital marketing communication.

Table 1 Correlation between influencer size and frequency of clicks/purchases

Variables	r	p- value	Interpretation
Influencer size x click frequency	0,06	< 0,05	Weak but statistically significant relationship
Influencer size x purchase after advertisement	0,04	< 0,05	Weak but statistically significant relationship

Source: Own processing based on quantitative research, 2025

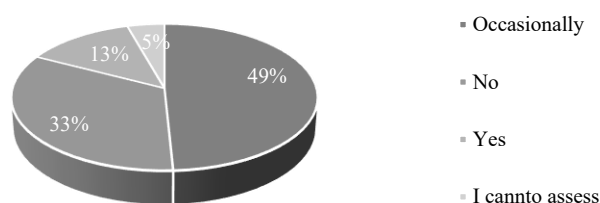
Based on the findings, it can be concluded that digital marketing significantly influences consumer decision-making within the fast fashion segment and represents one of the key determinants of fashion brands' competitiveness.

RQ2: Do ethical values and sustainability represent significant factors in consumer purchasing decisions?

The research findings suggest that respondents declare an increasing interest in ethics, transparency, and sustainability; however, these factors do not yet represent dominant determinants of actual purchasing behaviour.

As illustrated in Figure 1, only 13% of respondents stated that they actively monitor brand values such as sustainability, transparency, corporate social responsibility, or overall company orientation. Nearly half of the respondents reported paying attention to these factors only occasionally (49.2%).

Figure 1 Consumer Interest in Brand Values and Sustainability Activities



Source: Own processing based on quantitative research, 2025.

A significant finding of the research was that, despite respondents' declared interest in ethics and sustainability, consumer preferences continue to be primarily influenced by trendiness, price, emotional attractiveness, and product accessibility. The findings therefore indicate the existence of a discrepancy between consumers' declared values and their actual purchasing decisions. This phenomenon corresponds with the concept of the "value-action gap," referring to the inconsistency between consumers' stated attitudes and their real market behaviour. Although consumers express growing concern for ethical and environmental aspects of the fashion industry, the economic reality of the market suggests that these factors are not yet decisive determinants in the purchasing process. The results further indicate that marketing communication focused exclusively on sustainability does not automatically lead to stronger brand preference or increased market competitiveness.

RQ3: Which fashion brands are perceived by consumers as the strongest in digital marketing?

Zara/Inditex achieved the highest evaluation of digital marketing effectiveness, with an average rating of 2.75. Respondents perceived the group's marketing communication as more aesthetically consistent, trend-oriented, and visually attractive compared to competitors.

H&M achieved an average rating of 2.58. The findings suggest that despite the company's strong emphasis on sustainability and reputational repositioning, it struggles to maintain the same growth dynamics as more trend-driven and agile competitors.

The lowest digital marketing rating was assigned to Shein (2.28), despite the company being one of the most economically successful entities within the online fashion segment. Respondents frequently associated the brand with negative perceptions related to fast fashion, greenwashing, and a lack of transparency in production processes.

The comparative findings further indicate that consumers respond more positively to brands capable of effectively combining trend relevance, aesthetics, emotional branding, and strong digital visibility.

RQ4: Is there a discrepancy between consumers' declared values and their actual purchasing behaviour?

The research findings confirmed the existence of a significant discrepancy between consumers' declared values and their actual purchasing behaviour. This paradox was most visible in the case of Shein. Although respondents expressed negative attitudes toward the fast fashion segment, greenwashing, and non-transparent production practices, Shein simultaneously remains one of the most economically successful fashion companies in the online environment and represents a dominant actor within the ultra-fast fashion segment in 2025.

In contrast, H&M, which has long built its communication strategy around sustainability, transparency, and corporate social responsibility, has gradually been losing momentum compared to more aggressive and trend-oriented competitors. The findings therefore suggest that consumer decision-making continues to be significantly

determined by price, trendiness, emotional marketing appeal, and the digital visibility of brands, while ethical aspects of marketing communication do not yet represent dominant purchasing determinants.

The research conducted on a sample of 2,210 respondents thus confirmed the existence of the “value–action gap” phenomenon within the fast fashion segment and highlighted the conflict between consumers’ declared attitudes and the economic reality of the fashion market.

4 Conclusion

The research findings revealed a significant discrepancy between consumers’ declared values and their actual purchasing behaviour within the fast fashion segment. Despite the growing public discourse surrounding sustainability, ethics, and transparency in the fashion industry, consumer decision-making continues to be largely driven by price, trend relevance, emotional attractiveness, and the intensity of digital marketing communication.

The sample of 2,210 respondents confirmed that digital marketing represents a dominant factor influencing consumer behaviour in the online environment. Influencer marketing and personalized digital content play a particularly important role, while respondents showed a preference for communication perceived as authentic and for influencers with medium-sized audiences. An important finding of the study is the identification of a paradox between the reputational perception of brands and their economic performance. The continuously increasing online sales performance of Shein does not fully correspond with current digital marketing trends emphasizing transparency, ethics, and reputational credibility. In contrast, H&M allocates considerable attention to reputational repositioning; however, it does not achieve comparable growth dynamics to more trend-oriented competitors.

The findings therefore suggest that the currently dominant trends in digital marketing within the fast fashion segment do not yet create substantial pressure toward transforming consumer behaviour in favour of more sustainable consumption. Although consumers increasingly declare interest in ethical and sustainability-related aspects, these values do not yet represent decisive determinants in the purchasing process of fashion products.

The contribution of the paper lies in connecting ethical aspects of digital marketing with an empirical analysis of consumer behaviour and the economic realities of the fast fashion market. At the same time, the paper highlights the need for deeper examination of the “value–action gap” phenomenon within the digital environment of social media and influencer marketing.

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Digital Surveillance and Employee Autonomy as an Ethical Challenge of Industry 5.0

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Abstract: Industry 5.0 places human-centricity at the core of the digital transformation of work, yet workplace digitalisation simultaneously creates tension between employee autonomy and digital surveillance. This cross-sectional quantitative study (N = 286 organisations) examines the perceived impact of information and communication technologies (ICT) on workload, work pace, autonomy, surveillance, and work–life balance, the factor structure of psychosocial risks, and the integration of the ethical dimension into occupational safety and health (OSH) policy. The findings reveal a paradox of surveilled autonomy, in which perceived autonomy and perceived surveillance increase jointly, and show that an ethical infrastructure in the form of OSH policy remains a minority practice formalised predominantly in large organisations.

Keywords: Industry 5.0 · digital surveillance · employee autonomy · technostress · OSH policy · ethics of digitalisation

1 Introduction

Industry 5.0 emerged in the European discourse as a normative response to the technologically deterministic framework of Industry 4.0 and places three interrelated pillars at its core: human-centricity, sustainability, and resilience (Breque, De Nul, & Petridis, 2021; European Commission, 2021). The principle of human-centricity shifts the focus from technological modernisation to a value-oriented transformation in which technologies should serve socially and organisationally desirable goals (Xu, Lu, Vogel-Heuser, & Wang, 2021; Nahavandi, 2019). From an ethical perspective, this principle implies a normative commitment to respect the autonomy, dignity, and psychosocial well-being of employees (Longo, Padovano, & Umbrello, 2020; Kadir, Broberg, & da Conceição, 2021).

Alongside this growing normative commitment, however, the opposite movement is intensifying in organisational practice: digitalisation brings unprecedented opportunities for monitoring work performance and for algorithmic management of decision-making (Kellogg, Valentine, & Christin, 2020; Ajunwa, 2020). Algorithmic management is conceptualised as a regime in which decisions traditionally made by human managers are delegated to software systems. Meta-analyses of electronic performance monitoring consistently document its negative impact on job satisfaction and its positive impact on work-related stress (Ravid, White, Tomczak, Miles, & Behrend, 2023; Siegel, König, & Lazar, 2022).

The relationship between digital surveillance and autonomy is, however, not straightforwardly negative. Mazmanian, Orlikowski, and Yates (2013) formulated the concept of the autonomy paradox: mobile technologies provide employees with greater control over the place and time of work, but at the same time expand the expectation of permanent availability, thereby reducing autonomy in practice. Perceived autonomy and perceived surveillance therefore need not be negatively correlated; they may rise jointly, which poses a challenge for classical models of work-related stress (Karasek, 1979; Bakker & Demerouti, 2007). A specific form of work-related stress induced by digital technologies is technostress (Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan, 2007; Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008), whose consistently negative effects are confirmed by meta-analytic evidence (Nastjuk, Trang, Grummeck-Braamt, Adam, & Tarafdar, 2023).

From an ethical perspective, what is decisive is whether and how organisations translate the principle of human-centricity into institutionalised practices. OSH policy has traditionally reflected physical and chemical risks, but the past two decades have brought a gradual incorporation of psychosocial risks into regulatory frameworks (EU-

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OSHA, 2023; ILO, 2024). The integration of digital technologies into OSH policy represents a measurable indicator of an organisation's real, and not merely declared, ethical infrastructure.

Although the autonomy paradox (Mazmanian et al., 2013) and the consequences of electronic monitoring (Ravid et al., 2023) are empirically documented predominantly in the North American and Western European context, in the post-transition Slovak environment, where the digitalisation of organisations accelerates faster than their ethical infrastructure, this relationship remains systematically unexamined. The present study addresses this gap through an empirical analysis based on a sample of Slovak organisations.

The aim of this paper is to empirically examine the relationships between perceived characteristics of digital work, psychosocial risks, and the ethical infrastructure of organisations. Given that data were collected from a single organisational informant, variables Q23–Q27 reflect the managerial perception of the impact of ICT on employees, not a representative employee experience; this framing is applied consistently throughout the text. Three hypotheses are formulated:

H1 (paradox of surveilled autonomy). Drawing on the perspective of the autonomy paradox (Mazmanian et al., 2013) and algorithmic governance (Kellogg et al., 2020), we expect that digital technologies simultaneously provide higher perceived autonomy (control over the organisation of work) and higher perceived surveillance (performance monitoring). Perceived digital surveillance is positively associated with perceived autonomy.

H2a and H2b (Job Demands–Resources). In line with the JD-R framework (Bakker & Demerouti, 2007; Scholze & Hecker, 2024), perceived digital job demands (workload, pace, surveillance) (H2a) positively predict technostress, while perceived digital resources (autonomy, work–life balance) (H2b) reduce it.

H3 (institutional ethical infrastructure). From the perspective of institutional theory (DiMaggio & Powell, 1983), larger organisations have higher resources, more formal procedures, and stronger regulatory pressure supporting the institutionalisation of new risk domains; the integration of digital technologies into OSH policy is therefore positively associated with organisational size.

2 Aim and methods

The study is designed as a quantitative cross-sectional analysis based on questionnaire-based data collection at the organisational level. The unit of observation is the organisation; the unit of measurement is a single key informant (manager, IT manager, or owner). Data were collected from September 2025 to February 2026 via a standardised questionnaire distributed to organisations operating in the Slovak Republic. After data cleaning, the final research sample comprises 286 organisations. In terms of industry, manufacturing (13.6%), other activities (12.9%), wholesale and retail trade (11.2%), and information and communication (8.0%) prevail. In terms of size, micro-organisations (0–9 employees) account for 21.0%, small (10–49) for 29.7%, medium-sized (50–249) for 23.8%, and large (250+) for 25.5% of the sample.

Variables. Perceived characteristics of digital work are measured by five bipolar 1–5 Likert scales capturing the perceived impact of ICT on workload (Q23), work pace (Q24), autonomy (Q25), surveillance/control (Q26), and work–life balance (Q27). Psychosocial risks of digital technologies are measured by a set of 24 items (Q30) on a 0–6 scale, of which the five items conceptually closest to the technostressor form the composite **Technostress-Overload** index (time pressure, work intensity, stress, boundlessness of working time, work–life imbalance). The ethical infrastructure of the organisation is examined through item Q28 (1 = not considered and not planned; 5 = yes, the impact of digital technologies has been incorporated into OSH policy). This indicator represents a narrow empirical proxy for one aspect of ethical infrastructure; a broader construct would also include internal guidelines, training, and participatory mechanisms. The natural logarithm of the number of employees ($\ln N+1$) and industry are included as control variables.

Analytical procedure. The analysis consists of four steps. (1) Descriptive statistics and the Shapiro–Wilk test of normality. (2) Reliability of the composite index (Cronbach's α , McDonald's ω) and exploratory factor analysis of the 24 Q30 items (principal axis factoring, oblimin rotation, Bartlett's test, Kaiser–Meyer–Olkin measure). (3) Pearson and Spearman correlations of the main variables. (4) Hierarchical linear regression testing H2 (DV = Technostress-Overload; Block 1 = $\ln N+1$; Block 2 = digital demands Q23, Q24, Q26; Block 3 = digital resources Q25, Q27), and separate regression models for H1 (DV = Q25) and H3 (DV = Q28). As robustness checks we apply: (a) an extended H1 regression controlling for Q24, which is strongly correlated with both Q25 and Q26; (b) a Q25 $\times$ Q26 interaction test in Model 3 of H2; (c) a cumulative logit ordinal regression model for H3 as an alternative to OLS for an ordinal DV; and (d) Harman's single-factor test as an indicator of common-method

variance. Given that a five-point Likert scale behaves robustly under linear regression (Norman, 2010), the DV Q28 is treated as quasi-continuous in the testing of H3. All analyses were conducted in Jamovi 2.7.

3 Results

Reliability and factor structure. The composite Technostress-Overload index (5 items) achieved high internal consistency ($\alpha = 0.89$; $\omega = 0.89$). The EFA of the 24 Q30 items met the statistical assumptions (Bartlett's test $\chi^2 = 4,244$; $df = 276$; $p < 0.001$; $KMO = 0.925$) and identified three interpretable factors. For transparency we list all items with loadings > 0.30 , including cross-loadings: (F1) *organisational–institutional dysfunction* – NoConsultation (0.75), TechShortfall (0.68), JobInsecurity (0.68), ToolChanges (0.66), SocialOutage (0.61), CommBarriers (0.57), ValueMismatch (0.54), PaceVariance (0.45), AutonomyRestrict (0.42; cross-loading on F2 = 0.34), WorseSafety (0.43; cross-loading on F3 = 0.32), FearOutage (0.42), FalseInfo (0.40; cross-loading on F3 = 0.42), HigherCosts (0.41), SkillLoss (0.39; primarily on F3 = 0.56), OverReliance (0.33); (F2) *technostress-overload* – TimePressure (0.75), WorkIntensity (0.83), Stress (0.83), Boundlessness (0.64), WLBmismatch (0.63); (F3) *digital health risks* – EyeStrain (0.77), SleepDisrupt (0.66), ADHDworsening (0.63), TechAddiction (0.38). Four items show non-negligible cross-loadings (AutonomyRestrict, SkillLoss, FalseInfo, WorseSafety), signalling conceptual ambivalence between the institutional-dysfunction domain and the digital-health-risk domain. Confirmation of the factor structure on an independent sample is recommended as a target for further research.

Test of H1 – paradox of surveilled autonomy. The relationship between perceived digital surveillance (Q26) and perceived autonomy (Q25) is positive and statistically highly significant ($r = 0.38$; $p < 0.001$). In a baseline regression controlling for organisational size, the effect remains robust ($\beta = 0.376$; $t = 6.87$; $p < 0.001$; $R^2 = 0.156$). Because Q24 (pace) is strongly correlated with both Q25 ($r = 0.468$) and Q26 ($r = 0.424$), we estimated an extended regression controlling for Q24 and $\ln(N+1)$: the effect of $Q26 \rightarrow Q25$ remains significant but decreases by approximately one-third ($\beta = 0.233$; $t = 3.99$; $p < 0.001$; $R^2 = 0.263$). The partial correlation of Q25–Q26, controlling for Q23, Q24, and Q27, is $r = 0.225$ ($p < 0.001$). H1 is therefore supported, although part of the original association represents shared variance with perceived work pace; that is, higher perceived work pace is associated with higher perceived autonomy and surveillance alike.

Test of H2 – digital demands and resources vs. technostress. Using hierarchical regression, the relationships were tested across three blocks. Model 1 explained 1.0% of the variability in technostress (n.s.); Model 2 explained 8.8% ($\Delta R^2 = 0.078$; $F(3, 281) = 8.01$; $p < 0.001$); Model 3 explained 13.8% ($\Delta R^2 = 0.049$; $F(2, 279) = 7.97$; $p < 0.001$). In Model 3, the only robust predictor among digital demands was perceived workload ($\beta = 0.235$; $p < 0.001$), while pace ($\beta = 0.090$; $p = 0.210$) and surveillance ($\beta = 0.070$; $p = 0.270$) did not retain an independent effect. On the side of digital resources, work–life balance had the expected attenuating effect ($\beta = -0.184$; $p = 0.001$), while autonomy showed a paradoxical positive effect ($\beta = 0.147$; $p = 0.024$). A supplementary Q25 $\times$ Q26 interaction test in Model 3 revealed a significant negative moderating effect ($\beta = -0.242$; $p = 0.002$; R^2 rose to 0.167): the paradoxical stress-inducing effect of perceived autonomy is attenuated at higher levels of perceived surveillance. H2a is partially supported (confirmed only for workload); H2b is supported for WLB but paradoxically refuted for autonomy.

Test of H3 – organisational size and ethical infrastructure. Pearson and Spearman coefficients indicated a strong relationship between the natural logarithm of organisational size and the integration of digital technologies into OSH policy ($r = 0.388$; $p = 0.405$; $p < 0.001$). A linear regression with DV = Q28 and predictor $\ln(N+1)$ confirms the relationship ($\beta = 0.388$; $p < 0.001$; $R^2 \approx 0.150$). As a robustness check, we estimated a cumulative logit model: the coefficient for Size_log = 0.359 ($p < 0.001$), with McFadden's pseudo $R^2 = 0.054$, which is consistent in direction and significance with the OLS estimate. H3 is supported.

Common-method variance check. Harman's single-factor test (unrotated PCA on all 24 Q30 items) showed that the first unrotated component explains 43.3% of variance; when all scales (Q23–Q28 + Q30) are included, the share of the first component drops to 34.9%. Both values are below the conventional 50% threshold, indicating that CMV is not a critical threat to the interpretation of the relationships identified.

Table 1 Descriptive statistics and key correlations of the main variables ($N = 286$)

Variable	M	SD	r with Q25	r with Overload	r with Q28
Q23 workload (1–5)	2.34	1.01	–0.06	0.22***	–0.05
Q24 pace (1–5)	3.87	0.93	0.47***	0.09	0.28***
Q25 autonomy (1–5)	3.77	0.96	—	0.20***	0.20***
Q26 surveillance (1–5)	3.81	0.93	0.38***	0.15*	0.14*
Q27 WLB (1–5)	3.19	1.01	0.07	–0.18**	0.05
Q28 OSH integration (1–5)	3.21	1.37	0.20***	0.07	—
Technostress-Overload (0–6)	2.96	1.45	0.20***	—	0.07
$\ln(\text{size}) \times \text{Q28}$	—	—	—	—	0.39***

Source: Authors' own elaboration in Jamovi 2.7. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. α (Technostress-Overload) = 0.89; ω = 0.89.

Table 2 Summary of hypothesis testing

Hyp.	Statement	Statistical result	Conclusion
H1	Perceived digital surveillance is positively associated with perceived autonomy.	$r(\text{Q26}, \text{Q25}) = 0.38$; $\beta = 0.376$ (controlling for Size); after controlling for Q24: $\beta = 0.233$; $p < 0.001$	Supported
H2a	Digital demands positively predict technostress.	Q23: $\beta = 0.235***$; Q24, Q26 n.s. (Model 3)	Partially supported
H2b	Digital resources negatively predict technostress.	Q27: $\beta = -0.184**$; Q25: $\beta = +0.147*$ (paradox); Q25 $\times$ Q26 interaction $\beta = -0.242**$	Partially supported; autonomy paradox
H3	Organisational size is positively associated with the integration of digital technologies into OSH policy.	$r = 0.388$; $\rho = 0.405$; $\beta = 0.388$; $R^2 \approx 0.150$; ord. logit: $\beta = 0.359$; $p < 0.001$	Supported

Source: Authors' own elaboration.

4 Conclusion

The paper empirically examined the relationships between perceived characteristics of digital work, psychosocial risks, and the ethical infrastructure of organisations on a sample of 286 Slovak organisations. The results support the existence of the paradox of surveilled autonomy: perceived digital surveillance and perceived autonomy are positively associated (H1), even after controlling for work pace, although at a somewhat reduced intensity. The differentiated role of digital demands and resources in predicting technostress (H2) is partially confirmed: perceived ICT-related workload exhibits the strongest predictive power, while work–life balance has a negative (attenuating) effect. The empirically most provocative finding is the paradoxical positive effect of perceived autonomy on technostress ($\beta = 0.147$); the significant negative Q25 $\times$ Q26 interaction ($\beta = -0.242$) reveals that

this effect is attenuated at higher levels of surveillance. These findings are consistent with the autonomy paradox (Mazmanian et al., 2013) and empirically extend the JD-R framework by adding a moderating dynamic specific to the digitalised workplace.

The ethical infrastructure of organisations remains a minority practice: only 28.3% of the surveyed organisations have actually incorporated the impact of digital technologies into OSH policy, and the integration is structurally conditioned by organisational size (H3). From a practical perspective, these findings suggest that (1) HR and IT managers, when designing digital tools, should anticipate that growing autonomy without a transparently set framework of surveillance may paradoxically increase the burden on employees; and (2) regulators and OSH inspection should focus on the segment of small and medium-sized enterprises, where the institutionalisation of digital risks in OSH policy is lagging. The declared human-centric orientation of Industry 5.0 thus requires not only technological modernisation but also sector-level support for ethical infrastructure.

Limitations. The cross-sectional nature of the data does not allow causal interpretation (Spector, 2019); all the associations reported are correlational. The sample was assembled through convenience sampling and does not represent a probability sample of Slovak organisations. The most important limitation is that the questionnaire was completed by a single respondent per organisation; therefore, variables Q23–Q27 reflect a managerial perception rather than a representative employee experience, and statements about the perceived situation of employees are subject to this framing. The five bipolar Q23–Q27 Likert scales do not originate from psychometrically validated instruments of the Technostress Creators Scale type (Ragu-Nathan et al., 2008). Ethical infrastructure is measured by a single item (Q28), which represents a narrow operationalisation of a complex construct. Self-report bias and CMV are mitigated but not eliminated (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The three-factor structure of Q30 is identified exploratorily; confirmation would require a confirmatory factor analysis on an independent subsample. Future research should employ polynomial regression with response-surface analysis to capture the paradox of surveilled autonomy in more detail, and longitudinal designs to test causal mechanisms.

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Emission Allowances from the Perspective of Public Budgets in the Czech Republic

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Abstract: The article concerns revenues from the sale of emission allowances from the perspective of public budgets in the Czech Republic. It is not only a sanction mechanism for polluters, but above all an investment instrument. The aim of the article is to identify the main factors influencing the amount of revenues and to assess their stability from the point of view of public budgets. The results confirm that the fiscal importance of auction yields is increasing. The EU ETS is more fiscally significant than environmental taxes. The introduction of the new EU ETS 2 would increase the fiscal importance of revenues several times over.

Keywords: Emission Allowance · Public Budget · Ecological Fees · EU ETS · EU ETS 2

1 Introduction

The article concerns the evaluation of revenues from the sale of emission allowances from the perspective of public budgets in the Czech Republic. The original EU ETS (European Union Emission Trading System; European Union n.d.), established in 2005, charges for negative externalities associated with greenhouse gas emissions into the atmosphere. Allowances are primarily auctioned, with a large part of the auction proceeds going to individual EU member states to support the transition to low-emission technologies. In the Czech Republic, these revenues help finance various subsidy programs, such as the New Green Savings or, more recently, the modernization of railway lines. Ultimately, it is not only a sanction mechanism for polluters, but above all an investment instrument that helps individual states finance green policy. Although the system is often perceived primarily as a tool of climate policy, its fiscal importance is often neglected in the professional and public debate. Therefore, this article focuses on the analysis of auction revenues from emission allowances and their importance for the public budgets of the Czech Republic.

The development of relative indicators shows that the fiscal importance of auction yields is increasing. Thus, under environmental instruments, EU ETS (European Union, n.d.) is fiscally more significant than traditional environmental taxes. However, it is clear that the introduction of the new EU ETS 2 (European Commission, n.d.) would increase the fiscal importance of revenues. Specifically, if all greenhouse gases in 2023 in the residential and transport sectors are included, the revenues at the price of allowances, which the CNB estimated for 2027 at EUR 57, would amount to less than CZK 40 billion from the new system, see Hošek, J., Netušilová, P., & Šnobl, R. (2025). This estimated yield represents significant scope for social compensation. However, it is necessary to mention that not all revenues from the EU ETS 2 auctions will be redistributed among countries, as part of the revenues will go to the Social Climate Fund. The following directives of the European Parliament and of the Council of the EU 2018/410, 2023/958, 2023/959, 2003/87/ES are relevant to the issue at hand.

2 Aim and methods

Data on auction yields of emission allowances in the Czech Republic were drawn mainly from the databases of the European Energy Exchange (EEX; European Environment Agency, n.d.), the Ministry of the Environment (2025) and the Czech Statistical Office (CSO, 2009 and CSO, 2025). The aim is to identify the main factors influencing the amount of these revenues and to assess their stability from the perspective of public budgets. The following analysis is based on data on auction yields of emission allowances in the Czech Republic.

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The assessment of the fiscal significance of revenues is based on the use of relative indicators, namely the share of revenues from auctions of emission allowances in total and tax revenues of the state budget, per capita and the share in gross domestic product.

The first indicator is the share of revenues from auctioning of allowances in total state budget revenues, which expresses the relative importance of EU ETS revenues within the budget structure. The following formula is used to calculate this indicator:

$$\text{Share in total revenues of the state budget (\%)} = \frac{\text{EU ETS Revenues}}{\text{Total state budget revenues}} \times 100 \quad (1)$$

This indicator is then supplemented by the share of revenue from auctions of allowances in tax revenues. The indicator allows for a comparison of the relevance of the EU ETS in relation to traditional tax instruments. The following formula is used for the calculation:

$$\text{Share in state budget tax revenues (\%)} = \frac{\text{EU ETS Revenues}}{\text{State budget tax revenues}} \times 100 \quad (2)$$

Another indicator that is used to increase comparability over time and to refine the fiscal significance of EU ETS revenues is the per capita conversion of EU ETS revenues. This indicator is based on the following formula:

$$\text{Revenue per capita} = \frac{\text{EU ETS Revenues}}{\text{Number of inhabitants of the Czech Republic}} \quad (3)$$

The last indicator in this section is the share of EU ETS revenues in gross domestic product, which allows their importance to be placed in a macroeconomic context. The following formula is used to calculate the partial tax quota:

$$\text{Share of EU ETS revenues in GDP (\%)} = \frac{\text{EU ETS Revenues}}{\text{GDP (in current prices)}} \times 100 \quad (4)$$

These indicators make it possible to assess the relevance of the EU ETS revenues both within the budgetary structure and in the broader macroeconomic context. Attention is also paid to the relationship between auction revenues and the market price of emission allowances, while these variables are subjected to descriptive statistics and correlation analysis. Furthermore, a correlation analysis is also performed on the relationship between revenues and gross domestic product (GDP). To avoid false positives, both correlation analyses are performed on year-on-year changes in the monitored variables. Furthermore, a logarithmic decomposition of EU ETS revenues into price and volume effects is performed. Finally, a rough estimate of the revenues of the EU ETS 2 system in the Czech Republic is made, which is based on emissions data in the residential, commercial and transport sectors from 2023. This estimate allows for a better approximation of the possible fiscal impacts of the introduction of this system.

In the next part, a series of statistical tests are performed. First, however, some variables are subjected to basic descriptive statistics. This includes in particular the calculation of the mean, standard deviation and coefficient of variability. The coefficient of variability allows you to assess the relative degree of variability of individual variables over time and facilitates their mutual comparison. The coefficient of variability is calculated according to the following relation:

$$V = \frac{\sigma}{\mu} \times 100 \quad (5)$$

Where:

- σ represents standard deviation
- μ arithmetic mean of the variable under consideration

The first of the statistical tests carried out is a correlation analysis between the revenues from the auctions of EU ETS emission allowances and selected economic factors. The aim of this analysis is to verify whether the EU ETS revenues are influenced by the development of the market price of emission allowances or by the macroeconomic development of the Czech economy.

For the purposes of this and other analyses, the following variables were used:

Table 1 Variables used in econometric analysis

Variable	Description
Revenues	Revenues of the Czech Republic from the auctions of EU ETS emission allowances
Stories	Average annual auction price of an EUA emission allowance
GDP	Gross domestic product of the Czech Republic (at current prices)
Volume	Volume of allowances sold in the Czech Republic

Source: Own Processing

First, a correlation analysis was carried out between the EU ETS revenues and the average annual price of the emission allowance. This relationship makes it possible to assess the extent to which revenues from auctioning emission allowances are dependent on the market price of emission allowances. Subsequently, the correlation between EU ETS revenues and the gross domestic product of the Czech Republic was analysed. The aim of this analysis is to verify whether the EU ETS yields are significantly affected by the business cycle of the domestic economy.

Subsequently, to complement the correlation analysis, a logarithmic regression model is estimated, which allows to express the elasticity of EU ETS revenues to changes in the price of emission allowances. This regression model is estimated using the least squares method (OLS) and is constructed as follows:

$$\ln(\text{Revenue}_t) = \beta_0 + \beta_1 \ln(\text{Price}_t) + u_t \quad (6)$$

Where:

- $\ln(\text{Revenue}_t)$ represents the natural logarithm of the Czech Republic's revenues from the auctioning of EU ETS emission allowances in year t ,
- $\ln(\text{Price}_t)$ is the natural logarithm of the average annual price of the EUA in year t ,
- β_0 is the constant of the model.
- β_1 is the elasticity coefficient expressing the percentage change in EU ETS revenues with a one percent change in the price of emission allowances,
- u_t is a random component of the model capturing other factors affecting revenues from auctioning emission allowances that are not explicitly included in the model

The model is specified in logarithmic form, among other things, in order to be able to interpret the β coefficient directly as elasticity, i.e. the percentage change in EU ETS revenues with a one-percent change in the price of emission allowances. The main reason for this is that the logarithmic specification helps to reduce the influence of extreme values and partially stabilizes the variance of time series. For better interpretation, the properties of the model will be further tested, specifically the autocorrelation test, heteroscedasticity, and the unit root test will be performed for individual variables.

The autocorrelation test is tested according to the following hypotheses:

$$H_0: \text{Autocorrelation is not present.}$$

$$H_A: \text{Autocorrelation is present.}$$

Heteroscedasticity is tested on the basis of the Breusch-Pagan test using the following hypotheses:

$$H_0: \text{Homoscedasticity}$$

$$H_A: \text{Heteroscedasticity}$$

Both variables are then subjected to an extended Dickey-Fuller test per unit root, where the following hypotheses are tested:

$$H_0: \text{The series is non – stationary (contains a unit root).}$$

$$H_A: \text{The series is stationary (does not contain a unit root).}$$

These tests are performed in the statistical program "Gretl". They are tested at the level of significance α , which according to Cipra (2013) means that an error of the first kind (that is, that I reject the null hypothesis even though it is valid) can occur with such a high probability that α it is equal to itself.

After the test, it is evaluated whether the null hypothesis is rejected or not based on the p-value. The P-value according to Cipra indicates the minimum significance level at which the null hypothesis (H0) can still be rejected. (Cipra, 2013)

Subsequently, this data will be put to a test to demonstrate how EU ETS yields respond to negative economic shocks. Specifically, dummy variables for the ³period of Covid-19 and the energy crisis are created. Again, the estimation is made using the least squares method (OLS) and is specified as follows:

$$\ln(Revenue_t) = \beta_0 + \beta_1 \ln(Price_t) + \beta_2 Covid_t + \beta_3 Energy_t + u_t \quad (7)$$

The COVID variable takes on a value of 1 in 2020-2021, when there was a significant economic shock caused by this pandemic, and a value of 0 in other years. The ENERGY variable takes on a value of 1 in the years 2022-2023, which are associated with the energy crisis in Europe, and a value of 0 in other years. Subsequently, this analysis will again be subjected to tests for heteroscedasticity, autocorrelation and variables will be subjected to a unit root test, following the same hypothesis as in the previous case.

In the next part of the diploma thesis, the EU ETS revenues will be broken down into the price effect and the volume effect. As complete annual data on the volume of auctions for the Czech Republic are not publicly available, the volume of allowances was derived from the following basic relationship:

$$Revenue_t = Price_t \times Volume_t \quad (8)$$

The volume was therefore calculated from EEX data as a ratio of annual auction revenues (in euros) and the average auction price of the emission allowance (in euros). Based on the data obtained in this way, a logarithmic distribution of revenues is then performed:

$$\Delta \ln(Revenue_t) = \Delta \ln(Price_t) + \Delta \ln(Volume_t) \quad (9)$$

This analysis helps to determine the effect of the price of allowances and the volume of allowances sold on the change in yield, while allowing to evaluate the evolution of these effects over time.

Furthermore, a descriptive analysis is carried out, focused on the use of revenues from the EU ETS. The analysis is carried out on data from Reportnet and the Ministry of the Environment, and is carried out mainly using graphs showing the development of use or non-use over time, but also using a pie chart.

Finally, an estimate of the revenues that would potentially flow to the Czech Republic (CZ) from EU ETS 2 is made. The estimate is based on 2023 residential, private and transport sector emissions data. It is primarily in these sectors that greenhouse gas emissions are to be charged in the EU ETS 2 system. To determine the yields, the model price of the allowance of EUR 45 will be used, followed by the CNB's estimate of EUR 57. The estimate will be made based on 2 scenarios. One will include all greenhouse gases from 2023 in the estimate, and the other will only include CO2 emissions.

$$EU\ ETS\ 2\ revenues_{CZ} = + EU\ ETS\ 2\ Emmission_{CZ} \times Price\ of\ allowance \quad (10)$$

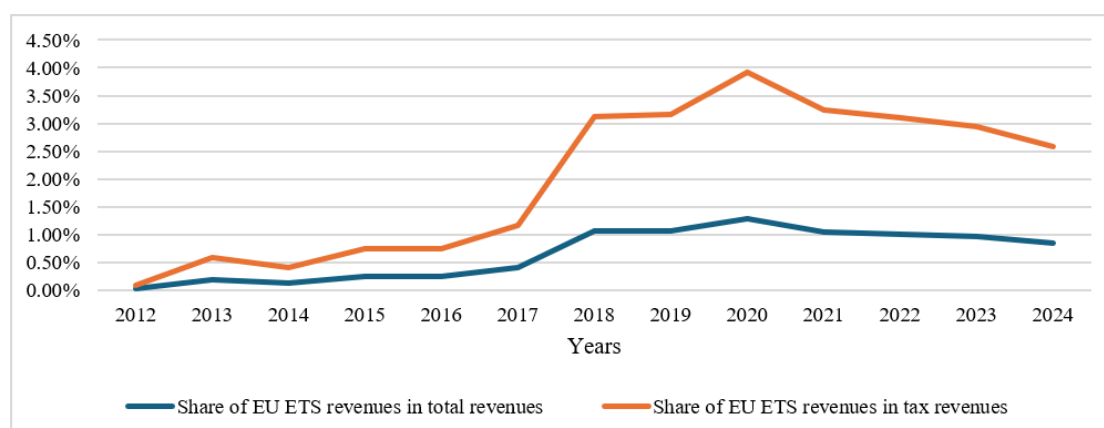
This calculation allows only a rough estimate, as the actual fiscal income will depend on the price of the allowance and the evolution of the volume of emissions emitted in the sectors concerned. The calculated potential yield will then be distributed among the inhabitants according to the formula mentioned above.

3 Results

The development of relative indicators shows that the fiscal importance of auction yields is increasing. All three indicators have a common jump in growth between 2017 and 2018, and this jump is caused by a rapid increase in auction revenues from CZK 5 billion to less than CZK 15 billion.

³ Dummy variables are used in econometric modeling for various types of variables, among others for two-character variables, which in this case are binary, i.e. they take the values 0 and 1. The occurrence of the investigated property for a variable represents a value of 1, otherwise a value of 0.

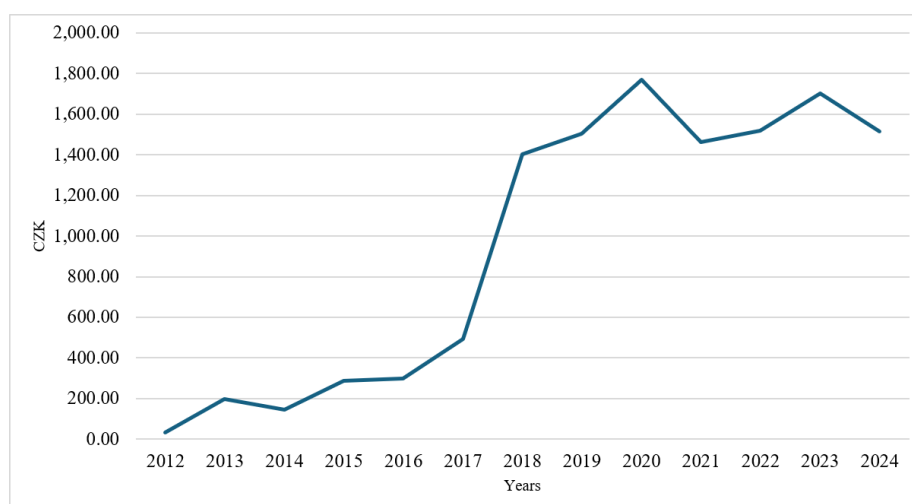
Figure 1 Relative importance of revenues from auctions of emission allowances in relation to state budget revenues in 2012–2024



Source: own processing based on data from the Ministry of the Environment and the Ministry of the Environment of the Czech Republic

This chart shows the evolution of the share of EU ETS revenues in total and tax revenues. Even though tax and total revenues grew in the period under review, this indicator also showed an increase in most of the years under review. This means that auction revenues grew faster than state budget revenues. Specifically, in the most significant increase between 2017 and 2018, state budget revenues increased by 10% and auction revenues increased by 180%. The peak of the increase was recorded in 2020, when the share of auction revenues in total revenues was 1.28% and in tax revenues was 2.64%. In recent years, this indicator has stabilised and the share of revenues from auctions of allowances is about 1% of total state budget revenues and about 2% of tax revenues. For comparison, the share of environmental taxes⁴ in total revenues in 2024 was 0.17% and the share of auction revenues in total revenues was 0.85%. Thus, under environmental instruments, the EU ETS is fiscally more significant than traditional environmental taxes.

Figure 2 EU ETS revenues per capita (in CZK) in 2012–2024



Source: own processing based on data from the Ministry of the Environment and the Czech Statistical Office

The graph shows the development of the yield from the auction of emission allowances per capita. This indicator can also be understood as a potential climate dividend that could be paid to citizens as compensation for higher costs under full redistribution of revenues. This principle worked, for example, in Austria between 2022 and 2024, and this system was financed not only by revenues from the EU ETS, but also by other sources.

⁴ Environmental taxes in the Czech Republic include the tax on natural gas and some other gases, the tax on solid fuels and the tax on electricity (introduced by Act No. 261/2007 Coll., on the stabilization of public budgets).

The development of auction revenues per capita in the Czech Republic shows an increase in the period under review. At the beginning of the monitored period, the yield was only CZK 32 per capita, in the peak year of 2020 it was CZK 1,769 per capita and subsequently stabilized at about CZK 1,500 per person. Compared to Austria's climate dividend, which in 2024 amounted to CZK 4,898 to CZK 7,284, it is clear that a dividend paid in the Czech Republic only from auction sources could not compete with foreign ones.

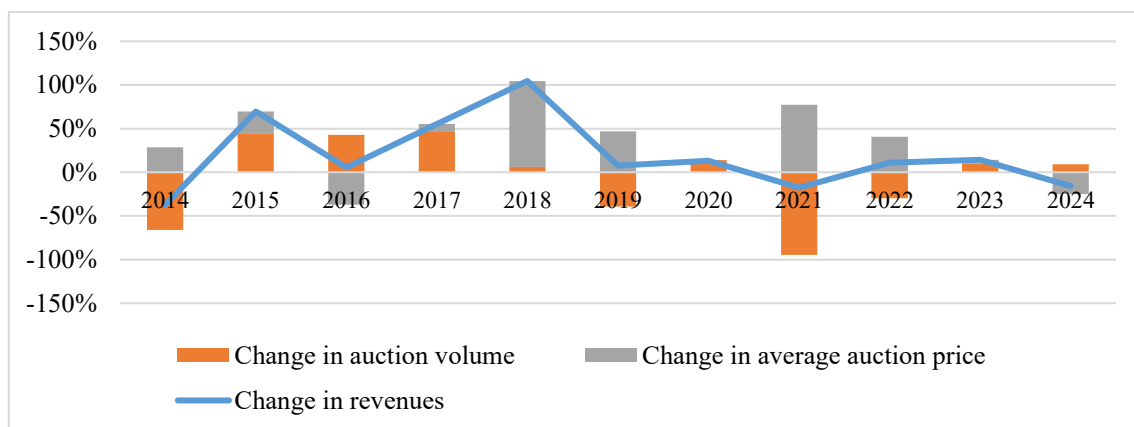
The share of revenues in GDP shows that the macroeconomic importance of auction yields is marginal. In the peak year of 2020, this indicator was only 0.32%, which is a very low value compared to the partial tax quota, which was 36% this year. The indicator has fallen in recent years and stood at 0.21% in 2024. Compared to the share of energy taxes in GDP, which was 0.04% in 2024, it can again be seen that in the area of environmental instruments, revenues from the EU ETS exceed traditional environmental taxes.

Furthermore, descriptive statistics have been carried out showing that revenues show high volatility (coefficient of variability 74%), which limits their use as a stable budgetary source. This variability is probably caused by the volatility of the average price of allowances, as it has a coefficient of variability of 98% and the volume of auctions is thus a more stable variable in this relationship.

A correlation analysis of year-on-year changes between EU ETS revenues and the price of allowances confirmed that revenues are moderately dependent on the market price of allowances ($r=0.52$), which confirms that revenues are largely determined by the price of allowances, which cannot be influenced by the state and is thus an unstable and unpredictable source of the state budget. Nevertheless, the revenues from the EU ETS are gaining fiscal importance. Furthermore, a correlation analysis of year-on-year changes between EU ETS revenues and GDP was carried out, and it turned out that EU ETS revenues are not directly dependent on the domestic business cycle, on the contrary, they even act countercyclically in some years ($r=-0.41$). However, it must be stated that the results of correlation analysis should be interpreted with caution due to the limited number of observations.

The logarithmic decomposition into the effect of the price of allowances and the effect of volume showed that although initially the volume effect influenced revenues, in recent years the price of emission allowances has become the dominant factor in the development of revenues. This confirms that the fiscal importance of EU ETS revenues is thus increasingly dependent on the market price of emission allowances.

Figure 3 Decomposition of the year-on-year change in EU ETS revenues to changes in the price and volume of auctions in the Czech Republic between 2014 and 2024



Source: own processing based on EEX data

It can therefore be stated that revenues from the EU ETS are an increasingly important fiscal source, although their amount is increasingly influenced by the relatively volatile price of emission allowances. However, it is clear that the introduction of the new EU ETS 2 would increase the fiscal importance of revenues. Specifically, if all greenhouse gases in 2023 in the residential and transport sectors are included, the revenues at the price of allowances, which the CNB estimated for 2027 at EUR 57, would amount to less than CZK 40 billion from the new system. The potential climate dividend that could be paid out from the new system would amount to CZK 3,634 per person. According to the IDEA study, the estimated costs associated with the introduction of the EU ETS 2 system per average household is approximately CZK 4,975. Thus, when converted to an average household, which, according to the Czech Statistical Office, has an average of 2.3 members, the full redistribution of revenues

could cover the costs of households. However, it should be noted that this is an indicative estimate that does not take into account all the regulatory mechanisms of the system.

4 Conclusion

The analysis confirms that the EU ETS system in the Czech Republic has undergone a transformation from a purely regulatory instrument to an essential source of public budgets in the field of climate policy. A key finding is the growing dependence of these revenues on the market price of the allowance, which carries a risk of high volatility and complicates long-term budgetary planning.

With the planned extension of the system to include the EU ETS 2, the fiscal importance of allowances will be multiplied even more. The estimated revenue of around CZK 40 billion represents a significant space for social compensation. However, it is necessary to mention that not all revenues from the EU ETS 2 auctions will be redistributed among countries, as part of the revenues will go to the Social Climate Fund. It is the Social Climate Fund that is supposed to provide assistance to entities that are most affected by higher costs. This raises the question of whether any compensation prepared under this fund will be able to cover the financial distress of low-income households caused by the introduction of the EU ETS system.

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Pluralism in Economic Thought as a Public Arena

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Antonín Hořčica⁴

Abstract: This paper examines the issue of pluralism in economic thought through the perspective of Public Arena theory. We argue that economic discourse is structurally constrained by the dominance of neoclassical economics, which is reflected not only in public debate but also in higher education. Based on our experience teaching the course “Pluralism in Economic Thought,” we highlight the tension between universities’ professed pluralism and the actual content of their teaching. The paper further presents alternative topics (e.g., inequality, ecological economics, solidarity economy, and degrowth) that broaden economic discourse. The aim is to open a debate on the conditions for truly pluralistic economic education.

Keywords: heterodox economics · pluralism · public arena · sustainable development

1 Introduction

Neoclassical economics, which is taught in formal education, dominates current economic discourse. The reason neoclassical economics is criticized for failing to adequately address current global challenges is the existence of negative externalities, which are particularly evident in the form of climate change resulting from excessive economic growth beyond planetary limits (Meadows & Club of Rome, 1972; Richardson et al., 2023). Publications such as *The Limits to Growth* highlighted the need to define a new, alternative economic paradigm that would address the shortcomings in the form of negative externalities arising from environmental impacts. This led to the definition of sustainable development (World Commission on Environment and Development, 1987), which has become the goal for new economic approaches that fully reflect current global challenges.

Now we might ask ourselves how it is that issues such as climate change and other environmental problems have found their way into economic discourse. When did economic discourse begin to address these issues? If we look at this from the perspective of social problems and their severity, the severity lies primarily in how a social problem is defined and understood in society. They are, therefore, more a manifestation of collective sentiments than a mere reflection of objective conditions (Blumer, 1971). If individuals define situations as real, they are real in their consequences. Thomas’s theorem shows that problems are not neutral facts, but are defined and interpreted. This thesis can thus serve as a theoretical basis for the claim that pluralism is not merely about the existence of various theories, but about which of them are recognized as legitimate “problems” in discourse (Thomas, 1928).

In simple terms, the public arena can be represented by the media, politics, science, the courts, and so on. Why do some social issues take centre stage, while others remain on the sidelines, regardless of their severity? Social issues exist in public arenas, where they compete for limited attention. However, the capacity of this arena is limited, and a problem’s success depends on how it is presented and who advocates for it (Hilgartner and Bosk, 1988). Economic issues are not selected for the public arena in a neutral manner. Rather, those that make it there are the ones that: fit the neoclassical paradigm and are compatible with institutions. The lack of pluralism in economics may thus be a consequence of structural selection.

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2 Pluralism in the Teaching of Economics

In 2014, students from more than 30 countries spoke out against the way economics was taught. This led to the creation of The International Student Initiative for Pluralism in Economics (ISIPE), which captured the attention of the academic debate at the time. Critics argued that the world, from an economic perspective, was portrayed through a single universal theory. The teaching was criticized for suggesting that economic phenomena could only be observed, explained, and predicted. However, this proved ineffective in light of the economic crisis at the time. Graduate programs were also subject to thorough scrutiny, facing renewed criticism for the excessive emphasis they placed on statistics and applied mathematics alone (Morgan, 2014).

In its statement, ISIPE primarily criticizes the current curriculum. It states that they are concerned: "We are dissatisfied with the streamlining of the curriculum that has taken place over the past few decades." According to them, this has subsequently had a negative impact on science and research. The participating students argue that the world is facing challenges across various sectors, ranging from climate change and food security to overall financial stability. In their view, the curriculum does not reflect the real world. As a result, pluralism could reshape economics education so that it better addresses current social issues. Consequently, economics education could also become much more attractive (ISIPE, 2014).

3 Teaching Pluralism in Economic Thought: An Experience from the Faculty of Economics at the University of South Bohemia

The course "Pluralism in Economic Thought" is currently in its third year at the Faculty of Economics at the University of South Bohemia. The aim of the course is to familiarize students with current trends and pluralistic thinking in economics across three areas: economic theory, methodology, and interdisciplinarity. The course combines lectures and seminars led by faculty members from various departments and socio-economic disciplines. The curriculum also includes lectures by external experts from the professional field. The course was created in response to the international student initiative "Pluralism in Economics," which the Faculty of Economics at the University of South Bohemia was the first Czech economics faculty to join in 2015. The faculty's commitment to pluralism was also linked to an annual event—the Czech Budweis Economics Days. The event provided a platform for several entrepreneurs and representatives from the academic community who focus on this issue.

The course "Pluralism in Economic Thought" has been taught at the Faculty of Economics for the third year. During this time, the course has featured a number of guest lecturers who have explored various perspectives that challenge mainstream economic thought. In 2024, the lectures focused on topics such as the concept of public arenas and the emergence of pluralism in economics, housing affordability in the Czechia, the socioeconomic transformation of food systems, economic inequalities, and degrowth within the framework of ecological economics. In 2025, the course expanded to include reflections on the narrative of 21st-century economics, global inequalities, and fair trade with a focus on Latin America, as well as practical approaches to the solidarity economy. In 2026, the program continued to develop these themes, with a particular emphasis on the commons, the solidarity economy, and critical perspectives on the consolidation of public finances.

These topics were identified through a joint discussion of issues that are relevant to students in this field; their selection also reflects students' interest in these topics, as evidenced by the essays they write at the end of each course, which also reveal their preferences. Based on this, it is also possible to determine the relative importance of the topics.

The topics covered in the course can be viewed through the public arena model, as they reflect both the selective nature of economic discourse and an effort to incorporate perspectives that are often marginalized within mainstream neoclassical economics. It is thus a combination of both, though it is immediately apparent that some topics have not yet entered the public arena within society.

We have witnessed the mechanisms that prevent a new paradigm from entering the public arena. Institutional dominance in teaching. Most economics programmes are based on orthodox models, with alternatives being marginal or optional. There is also standardisation of textbooks, exams and qualification mechanisms. Mechanisms within academic publishing that exclude 'something different'. Methodological defence — arguments about "unscientificness". Orthodoxy often insists on methodological individualism and equilibrium models,

reducing complexity. Heterodoxy is framed as a marginal phenomenon. Alternative approaches are recognised only after a delay — orthodoxy sometimes 'absorbs' only partial elements from heterodoxy, framing them as its own innovations.

The most important mechanism, which is practically never mentioned, is instilling fear of a new paradigm, which is seen as leading to the collapse of the world, the breakdown of moral values and a threat to the very essence of economics.

4 Key Topics of Pluralism in Economic Thought

Degrowth

Fraňková & Johanisová (2013) state that the current discourse on sustainable development is divided into two schools of thought. The first is “weak sustainability,” which holds that it is possible to reduce negative environmental impacts while maintaining economic growth. In contrast, there is “strong sustainability,” which argues that any growth is always associated with irreversible loss of ecosystems. This suggests that there has long been a debate among academics over whether economic growth is compatible with the concept of sustainable development. This has created an opening for the emergence of movements that have explicitly embraced the idea of degrowth in their titles. According to Heikkurinen (2021) degrowth can also be described as a call for a radical reduction in the flow of matter and energy in cultures characterized by excessive production and consumption.

The main focus of the degrowth movement is not on criticizing endless growth or calling for its curtailment, including reductions in consumption or production. The new perspective on this issue lies primarily in the fact that it is a call to change our approach to the key variables used to explain economic relationships and the economy as a system (Fournier, 2008). In other words, degrowth certainly does not mean a recession, but rather a shift in how we view the ultimate goal of industrial activity. This is also linked to criticism of GDP as a universal indicator of our well-being. Given the negative impacts of growth on the biosphere, GDP can no longer be considered a key indicator (Pallante, 2014).

The potential of the degrowth movement lies in its advocacy for progressive socio-ecological transformation. In line with this, specific activities associated with the movement are often highlighted: non-monetary exchanges and the restoration of common property, which prioritize socio-ecological sustainability over profit maximization. However, one criticism of the degrowth movement is that, so far, not enough effort has been devoted to the structural hierarchy of the global political economy. Uneven development within and between countries is also not given sufficient consideration, which may pose a barrier in the future (Chiengkul, 2018).

Based on a review of the literature, we identify the key conditions that most authors agree are necessary for a transition toward degrowth. Most proposals revolve around the need to reduce the impact of human activity on the environment. Other initiatives are based on the redistribution of income and wealth both within and among countries. In addition, it is also essential to support the transition from a materialistic society to a friendly and participatory society (Cosme et al., 2017).

Building on the degrowth movement and ecological economics, postgrowth perspectives are increasingly elaborated by theorists and practitioners such as Hickel (2020) and Kallis (2018), whose work develops the economic foundations for postgrowth transitions beyond critique of growth toward concrete alternative frameworks. A related contribution comes from Raworth's (2017) Doughnut Economics, which redefines the goal of economic activity as meeting human needs within planetary limits, combining social foundations with ecological ceilings as a framework for sustainable economic organization. These theoretical developments are no longer limited to academic heterodoxy — they are increasingly reflected in mainstream research funding and policy discourse. This is evidenced by several EU-funded research projects, such as REAL – A Post-Growth Deal and MAPS – Models, Assessment, and Policies for Sustainability, as well as the Beyond Growth conference held at the European Parliament in 2023 (European Parliament, 2023).

Ecological economics

Along with the rise in environmental awareness, which can be traced back to the 1970s, new economic theories emerged that focused on the environment. In the context of the changes at that time, this was a response to energy crises and the deteriorating state of the environment. Among the fundamental variables that economists of the time addressed were the limits of economic growth and biophysical limits. Ecological economics adds a biophysical and energy-based concept of the interrelationships between the economy and nature to the discourse. In line with

the concept of sustainable development, it seeks to determine the optimal size of the economy in relation to the biosphere and to distribute resources equitably (Cudlínová, 2018). Ecological economics is often cited as a major heterodox school of thought that views the economy within the context of social systems, but above all as a system that is part of the biophysical universe. Among its major advantages are its holistic approach and its scientific basis (Gowdy, 2005). Boulding's 1966 study on the economy of Spaceship Earth was significant for ecological economics. To help visualize this, a diagram is used in which the economy is depicted as an open subsystem within a closed biosphere. This represents a macro-perspective on economic growth and challenges the notion of economic growth as the key objective that guides all other objectives (Victor, 2010). But how does ecological economics differ, in particular, from later concepts such as the green economy? The main difference lies, once again, in the underlying philosophy, as these later concepts prioritize economic growth over development. Economic development, however, is a fundamental prerequisite for sustainable development (Cudlínová et al., 2015).

Solidarity economy

Unrestricted economic growth that disregards the biosphere is linked not only to environmental problems but also to a wide range of social challenges. An alternative model of consumption and production—the solidarity economy—offers a response to these challenges. This term encompasses all entities, particularly businesses, that prioritize social well-being and cooperation over economic profit. This includes, in particular, activities such as cooperatives and other social enterprises, unions for workers in the informal economy, and Fair Trade networks (Utting et al., 2014). Unlike conventional economic activity, the solidarity economy takes a different path. The fundamental prerequisite for its functioning is people's creativity and their ability to develop their own solutions to economic problems. These solutions are not universal but are rooted in the local context. The goal is to identify alternative economic solutions, connect them, and build a cohesive social movement. Based on this, it is clear that it differs slightly from other economic models. It is not a model, but rather a process of economic organization (Miller, 2010).

What are the positive impacts of the solidarity economy? One of the most visible impacts is the creation and preservation of jobs in traditional sectors and the promotion of decent work. Compared to other jobs, these positions are often more stable and less susceptible to fluctuations in the labor market. In the context of labor market issues, it is also important to note that another positive impact is easier access to the workforce for disadvantaged groups. In addition, jobs may also be created in emerging sectors within the so-called “silver economy.” This fact can have a particularly positive impact on the labor market given future demographic trends and rising employment in the service sector (Borzaga et al., 2019). If we focus specifically on enterprises operating within the solidarity economy, we can identify a few key characteristics based on empirical findings. The size of these enterprises does not affect their efforts to be sustainable in environmental and social terms. The use of external financing, the participation of women, and networking with other enterprises often have a positive impact on sustainability (Marconatto et al., 2019).

Fair Trade

Fair Trade is an ethical label recognized worldwide. This label strives to ensure fairer trade for the people who grow our food. It is part of the global Fair trade movement, which includes businesses, nonprofit organizations, and consumers. It has been active for more than three decades. Its goal is to support and encourage businesses and governments and to connect farmers and workers with the people who buy their products (Fairtrade International, n. d.). It has been empirically demonstrated that consumer engagement with fair trade positively influences ethical behavior related to the circular economy (Kutaula et al., 2022). The influence of knowledge about fair trade on interest in a product can also be empirically proven (Robichaud & Yu, 2021).

To illustrate where Fair Trade is most widespread, we can use the findings from 2020, when the total number of producer organizations in the Fair Trade system was 1880, of which 950 were registered in Latin America and the Caribbean. At the EU level, Fair Trade is widespread. This is because a high standard of living also means a greater interest in purchasing these products (Sterie & Ion, 2022). According to data from UNCTAD (2020) Fair Trade is globally spread as follows. It includes over 2.5 million producers and workers from 70 countries, over 500 specialized importers, 4,000 stores worldwide and more than 100,000 volunteers. In terms of financial flow, global sales of Fair trade certified goods increased by 15% in 2018 to reach 9.8 billion euros (\$10.9 billion).

Ultimately, Fair Trade can be understood not only as a mechanism for improving the livelihoods of farmers through fair prices and partnerships, but also as part of a broader shift toward more equitable and participatory

economic arrangements (Fairtrade Česko a Slovensko, 2026). In this sense, Fair Trade does not represent a separate economic paradigm, but rather an applied dimension of the solidarity economy — translating its core values of equity, cooperation, and democratic organization into concrete trading relationships across global value chains.

5 Conclusion

In conclusion, it is important to emphasize that economic discourse is selective. Often, the issue is not merely the plurality of economic theories, but the conditions under which they enter the arena. It follows that pluralism is more of a structural problem than a substantive one.

Several topics were presented in this paper. The Degrowth movement challenges economic growth as the key norm guiding economies. Ecological economics seeks to redefine the relationship between the economy and the biosphere and, on a strong scientific foundation, shift the paradigm toward sustainable development. Solidarity economy and Fair Trade, in turn, directly offer practical alternatives that have proven to be functional. These topics may seem marginal to the Public Arena, but if we examine them more closely, it becomes clear that they have the potential to transform the Public Arena.

Finally, it is important to mention the role of universities. They are not merely institutions for the transmission of knowledge; in a sense, they also serve as an important public arena. Pluralistic teaching can shift the dominance of economic topics and provide space for alternative perspectives.

Kuhn (2008) a leading figure in postmodern epistemology, clearly demonstrates the potential for paradigms to alternate or coexist alongside one another. If scientific knowledge were a straightforward path to truth from the outset, we would simply add more facts to the existing body of knowledge across generations of scientists. However, this is not the case. If science aspires to this designation at all, it has — like other human activities — its cultural, historical, institutional, social and psychological dimensions. Therefore, scientific findings themselves are historically conditioned and reflect the spirit of a given era. They are subject to a shared paradigm.

Today, we see the failure of the old paradigm of growth in every aspect, from growing social inequality to the massive destruction of the natural environment. This paradigm has not only failed to solve many of these problems but has added global ones on top of them. Without respect to biosphere, despite the fact whether it is orthodox or heterodox paradigm, it has exhausted itself and is turning against our sustainable existence on this planet. The experience with the course *Pluralism in Economic Thought* demonstrates that teaching can actively contribute to broadening the range of perspectives to which students are exposed.

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Perceptions of Environmental Education among Lower- and Upper-Secondary Students

Roman Buchtele¹, Petra Matoušková²

Abstract: Environmental education is an integral part of the overall effort to achieve sustainability. Its role is also included in the European Green Deal. This study aims to compare lower- and upper-secondary students' perceptions of environmental education. A quantitative study was conducted among lower- and upper-secondary students. A total of 236 questionnaires were collected. It was found that, overall, students acquire environmental knowledge through formal education; however, they themselves assess this as insufficient. Statistically significant differences between the two groups of respondents were observed particularly in their perceptions of the importance of teaching environmental topics and in the sources of environmental knowledge.

Keywords: Environmental education · Environmental knowledge · Students · Quantitative research

1 Introduction

In response to escalating environmental challenges, sustainable development has become a central framework for addressing the complex interplay between economic, social, and ecological systems (World Commission on Environment and Development, 1987). Accordingly, the European Union views education as a priority in line with its vision of a green and sustainable future, including students with environmental competencies (European Commission, n. d.). The role of educational institutions within the European Green Deal is described in Section 2.2.4. (Activating education and training), where their role is outlined in terms of their influence on students, parents, and the wider community to engage in sustainable change (European Commission, 2019). Climate change education can be understood as a specific subset of environmental education, focusing explicitly on the causes, impacts, and responses to climate change in terms of knowledge, skills, values and attitudes (UNESCO, n. d.). This approach to education is currently characterized by a focus on personally relevant and meaningful information and environmental knowledge, as well as the use of active and engaging teaching methods (Monroe et al., 2017).

Teaching environmental topics in elementary school is critical because it establishes foundational values, knowledge, and sustainable behaviours that shape children's lifelong environmental responsibility and decision-making. The evidence base is substantial across multiple recent studies. Lamanauskas (2023) demonstrates that early environmental education forms the foundations of personality and positive attitudes toward nature, with primary school being a "suitable and favourable environment" for developing environmental awareness and sustainable lifestyles. Ilham et al. (2023) found that integrated environmental education in elementary curricula increases students' awareness of environmental issues and produces measurable improvements in sustainable actions, including reduced water/energy use and better waste management. Moiseeva and Anisimova (2024) emphasize that children who receive environmental education develop into ecologically conscious adults who actively seek solutions to environmental problems across various professions.

The evidence is robust across multiple recent studies. Paranhos Santos Marcelino et al. (2024) found that environmental education raises awareness of environmental challenges, provides tools for sustainable daily practices, and enables citizens to actively participate in environmental issues and support sustainable policies. Naydenov et al. (2025) demonstrated that such education develops critical thinking skills necessary for analysing

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complex environmental problems. Salazar-Alcivar et al. (2024) confirmed that environmental education strengthens ecological awareness and promotes adoption of sustainable behaviours in high school students. Additionally, García-Muñoz et al. (2024) reported that high school teachers consider environmental education for sustainability “of supreme importance” in fostering students’ environmental values and attitudes. Adnyana et al. (2023) noted that environmental education integrates multiple disciplines and facilitates evidence-based decision-making. Project-based learning is also increasingly used to teach environmental topics, and empirical evidence shows that it has positive results (Hugerat, 2016; Genc, 2014). This underlines the role of project-based learning as a modern form of teaching that increases student autonomy, collaboration, communication, and reflection on the real world (Kokotsaki et al., 2016).

2 Aim and methods

This study aims to compare lower- and upper-secondary students’ perceptions of environmental education.

Based on the aims of the study, the following research questions were formulated:

RQ1: How do lower- and upper-secondary students differ in their perception of the importance of environmental education in school?

RQ2: What are the attitudes of lower- and upper-secondary students toward environmental project-based and internship-based learning?

RQ3: What sources of environmental knowledge do lower- and upper-secondary students report?

Quantitative research—a questionnaire survey—was conducted. The study participants are lower-secondary and upper-secondary students (equivalent to gymnasium in the Czech Republic) in a city located in the South Bohemian Region. A total of 236 completed questionnaires were collected. The response rate was high, nearly 100%, as data collection took place within the framework of formal instruction. Data collection was carried out at the end of 2024. Participants were recruited during Social Studies classes, as this subject provides the greatest coverage of environmental and sustainability-related topics within the curriculum. Students who were present during data collection were invited to participate, and participation was voluntary and anonymous. The questionnaire consisted of several interrelated sections: identification questions, formal environmental education, sources of environmental knowledge, and project-based learning along with other organizational forms. The questionnaire included predominantly categorical and Likert-type rating scale items, allowing for the application of appropriate statistical analyses.

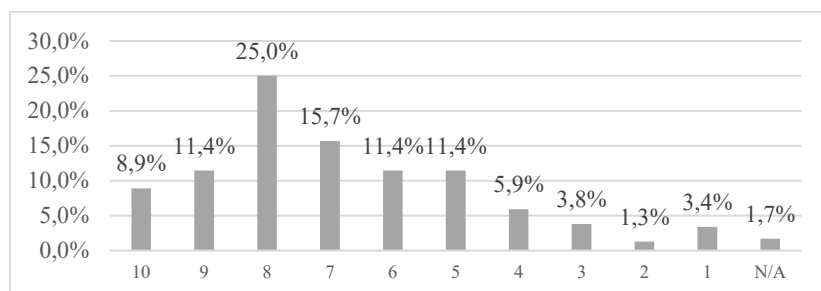
The gender distribution of the sample is 60.6% female, 31.8% male, and 7.6% did not specify. This distribution roughly corresponds to the actual gender distribution at the school under study. A total of 64.4% of the students surveyed live in the city, and 34.3% live in rural areas. Only 1.3% of the students did not specify this information in more detail. The number of lower-secondary students and upper-secondary students surveyed is not the same. A total of 68 lower-secondary students and 168 upper-secondary students participated in the study. A total of 80.9% of respondents reported having received instruction on environmental issues, climate change, or related topics during their studies. In contrast, 17.8% indicated that they had not, while 1.3% did not provide a response.

To examine the presence of statistically significant associations between categorical variables, the chi-square test of independence was employed. Welch's t-test was used for statistical analysis of differences between the means of two groups of respondents – lower-secondary students and upper-secondary students. The reason for this is that the samples are uneven, and it is assumed that the variance is also different. Welch's t-test is more robust in this case and is the standard recommended test.

3 Results

The first variable monitored was the importance students in both groups attached to teaching environmental topics at school. The most frequently selected value on a scale of 1-10, where 10 means extremely important, was 8, with a frequency of 25%. The second most frequently selected value was 7, i.e. 15.7%. The mean is equal 6.8 (Figure 1).

Figure 1 The importance of teaching environmental issues in schools



Source: Own elaboration; n = 236; 1 = not important at all, 10 = extremely important

Welch's t-test was used to determine statistically significant differences between the averages of both groups of students - lower-secondary students; upper-secondary students. Table 1 shows the results of the t-test, which confirm a statistically significant difference in the mean values between the two groups (p-value = 0.000). Lower-secondary students give higher values to the teaching of environmental topics (mean = 8.12) than upper-secondary students (mean = 6.27).

Table 1 Comparison of Lower- and Upper-Secondary Students' Ratings of the Importance of Environmental Topics (Welch's t-test)

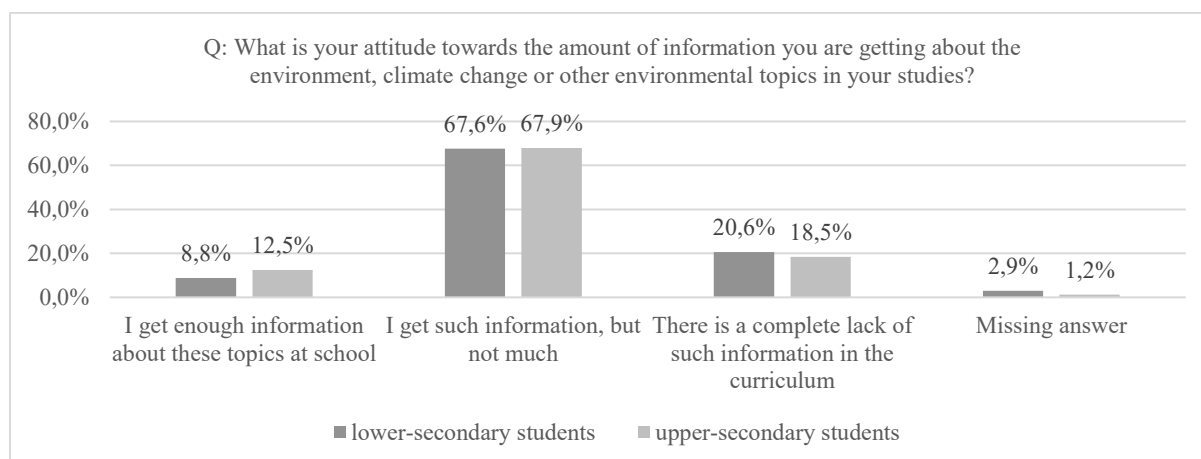
<i>t-test - independent samples (lower-secondary students; upper-secondary students)</i>					
	t	df	p-value	Mean difference	Std. error difference
The importance of teaching environmental topics	7.150	165.480	0.000	1.853	0.259

Source: Own elaboration; the mean difference was calculated as follows: lower-secondary students - upper-secondary students

Another variable under study is students' attitudes toward the amount of information they receive during their studies regarding the environment, climate change, and other environmental topics. It is obvious from Figure 2 that both lower-secondary and upper-secondary students most often report that they obtain such information, but not very much of it. In both cases, the frequency is nearly identical (lower-secondary students 67.6%; upper-secondary students 67.9%). For the response "I get enough information about these topics at school," the frequency is slightly higher among upper-secondary students 12.5% compared to 8.8% among lower-secondary students.

Whether there is a statistically significant difference between the two groups of students was also examined using a chi-square test based on contingency tables. The results show that there is no statistically significant difference in the amount of environmental information that the two selected groups of respondents receive at school ($\chi^2 = 1.563$; df = 3; p = 0.668).

Figure 2 Students' Perceived Adequacy of Environmental Information in Their Studies

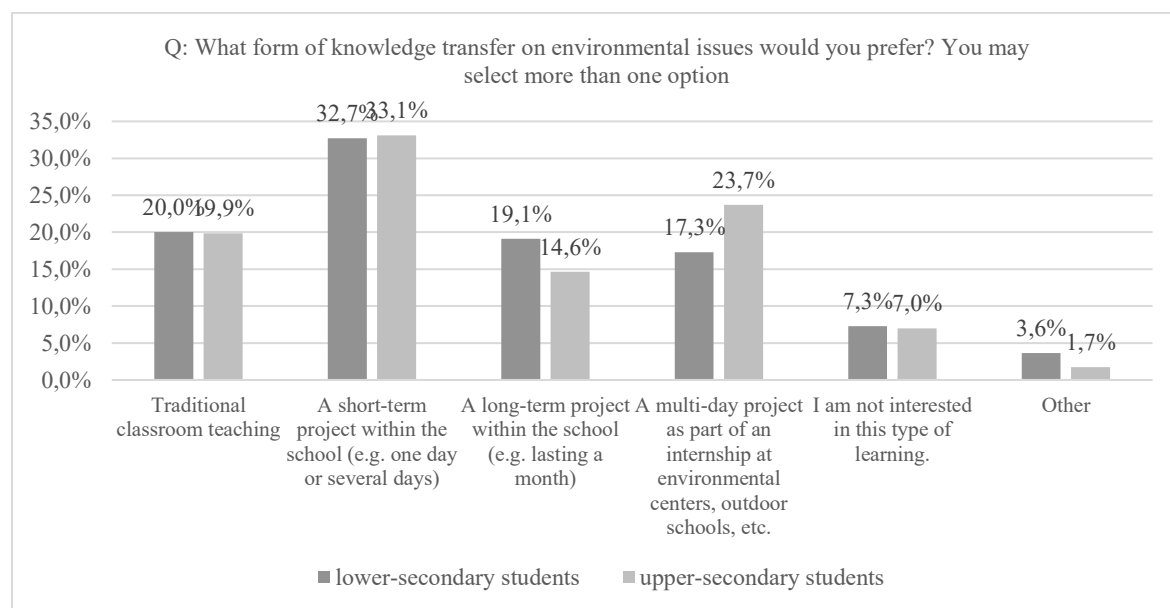


Source: Own elaboration; n = 68 (lower-secondary students), n = 168 (upper-secondary students)

In the next step, we focused on the ideal transfer of environmental knowledge to students. Students could choose from several options regarding how they would prefer information about the environment to be conveyed. Once again, the two groups of respondents are compared.

The frequency of responses indicates that traditional classroom instruction is not the most preferred method. It accounts for only 20% among lower-secondary students and 19.9% among upper-secondary students. The most preferred format is a short-term project within the school, which can be thought of as one or more days of project-based learning (lower-secondary students 32.7%; upper-secondary students 33.1%). Differences can be found, for example, in attitudes toward long-term projects within the school. Support for such projects is higher among lower-secondary students (19.1%) than among upper-secondary students (14.6%). Conversely, upper-secondary students are more inclined toward multi-day projects as part of an internship at environmental centres, outdoor schools, etc., with 23.7% compared to 17.3% among lower-secondary students (Figure 3).

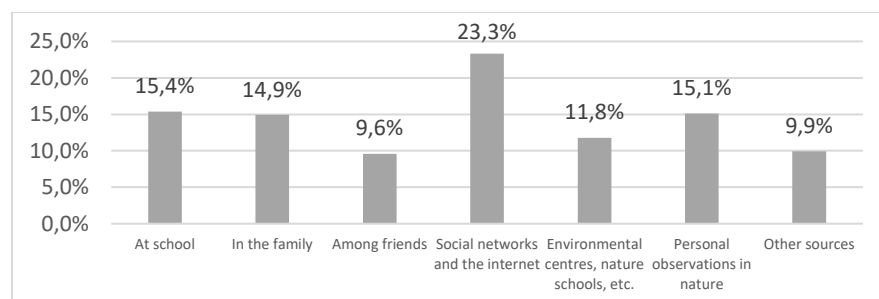
Figure 3 Preferred Forms of Environmental Knowledge Transfer (Multiple Responses Allowed)



Source: Own elaboration; n = 68 (lower-secondary students), n = 168 (upper-secondary students)

It is necessary to place the environmental knowledge gained through formal education—at school—within the context of the other environmental knowledge that students acquire from a variety of sources. Figure 4 shows that students obtain most of their environmental knowledge from social media and the internet, i.e., 23.3%. Similarly represented are the traditional sources of environmental knowledge, namely the family (14.9%) and school (15.4%). Personal observations in nature (14.1%) are also comparable. Environmental centres, nature schools, etc., which currently offer a wide range of project-based learning activities, are represented by only 11.8%. Students report that they gain the least environmental knowledge among friends (9.6%) and from other sources (9.9%).

Figure 4 Perceived Knowledge Gain from Environmental Information Sources



Source: Own elaboration; n = 236

Welch's t-test was used to identify statistically significant differences between the amount of information that the two groups of students obtain from different sources (Table 2). A statistically significant difference was found for the first source, "at school" (p-value = 0.005). Lower-secondary students (mean = 5.50) acquire more environmental knowledge from this source than upper-secondary students (mean = 4.61). The situation is similar for the "in the family" source, where a statistically significant difference was also found (p-value = 0.038). Lower-secondary students (mean = 5.34) acquire more knowledge from this source than upper-secondary students (mean = 4.56). For the other two sources where a statistically significant relationship was found, the opposite is true. For the "among friends" source (p-value = 0.001), upper-secondary students (mean = 3.30) acquire more environmental knowledge than lower-secondary students (mean = 2.38). The final source with a statistically significant difference in means is social media and the internet (p-value = 0.001). Upper-secondary students (mean = 7.75) acquire more environmental knowledge from this source than lower-secondary students (mean = 6.57).

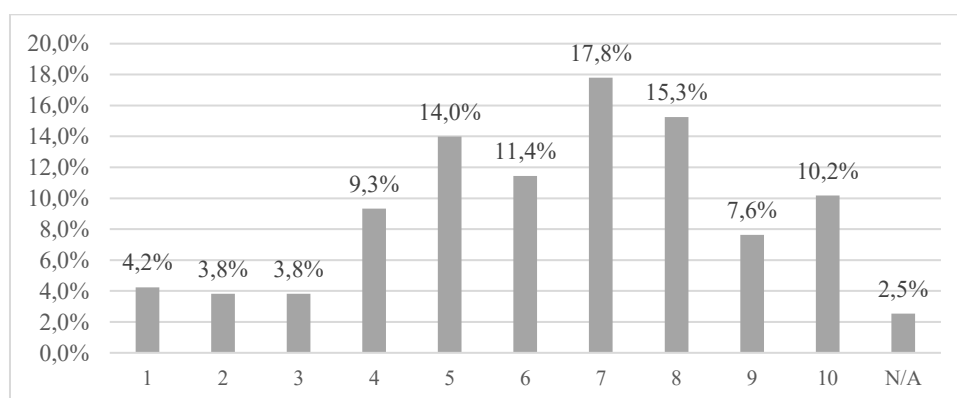
Table 2 Comparison of Lower- and Upper-Secondary Students' Perceived Knowledge Gain from Environmental Information Sources (Welch's t-test)

<i>t-test - independent samples (lower-secondary students; upper-secondary students)</i>					
<i>Sources of environmental knowledge according to students</i>	t	df	p-value	Mean difference	Std. error difference
At school	2.837	118.232	0.005	0.893	0.315
In the family	2.099	106.156	0.038	0.783	0.373
Among friends	-3.383	143.448	0.001	-0.921	0.272
Social networks and the internet	-3.297	98.659	0.001	-1.183	0.359
Environmental centres, nature schools, etc.	0.918	116.601	0.360	0.405	0.441
Personal observations in nature	-0.484	115.386	0.629	-0.195	0.402
Other sources	0.305	130.607	0.761	0.108	0.356

Source: Own elaboration; the mean difference was calculated as follows: lower-secondary students - upper-secondary students

Although sources of environmental knowledge such as environmental centres, nature schools, etc., were not among those from which students gained the most environmental knowledge, Figure 5 shows that students attach above-average importance to this option, as measured by their interest in this form of instruction. The most frequent value is 7 (17.8%), followed by 8 with a frequency of 15.3%.

Figure 5 Perceived Suitability of Internship-Based Environmental Learning (1–10 Scale)



Source: Own elaboration; n = 236; 10 = most suitable

Welch's t-test was again used to determine whether there was a difference in the mean between the two groups of students. In this case, no statistically significant difference in the mean was found, as the p-value was 0.458 (Table 3).

Table 3 Comparison of Lower- and Upper-Secondary Students' Perceived Suitability of Internship-Based Environmental Teaching (Welch's t-test)

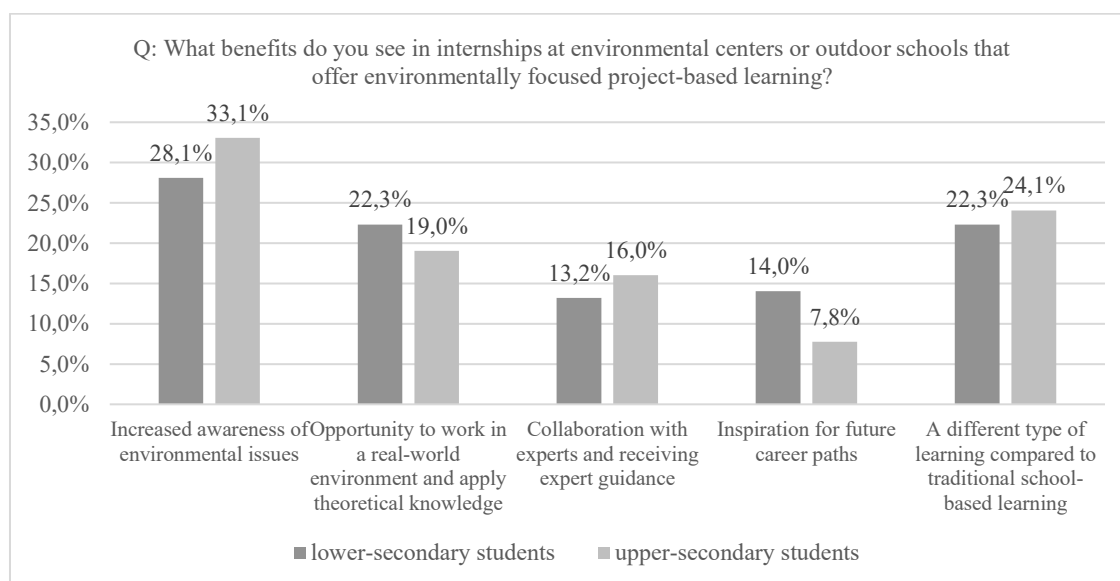
<i>t-test - independent samples (lower-secondary students; upper-secondary students)</i>					
	t	df	p-value	Mean difference	Std. error difference
If you were to teach environmental topics as part of an internship at environmental centres or outdoor schools, please rate on a scale from 1 to 10, where 10 = the most, how suitable this form of teaching would be for you?	0.745	143.909	0.458	0.241	0.324

Source: Own elaboration; the mean difference was calculated as follows: lower-secondary students - upper-secondary students

The final variable examined is the perceived benefits of internship-based environmental project-based learning. Figure 6 shows that the most frequently cited benefits in both groups are: increased awareness of environmental issues and a different type of learning compared to traditional school-based learning. However, certain differences were observed among the groups of students. Upper-secondary students more frequently cited the benefit "Increased awareness of environmental issues" (33.1% compared to 28.1%). The situation is similar for the benefits "A different type of learning compared to traditional school-based learning" (24.1% compared to 22.3%) and "Collaboration with experts and receiving expert guidance" (16.0% compared to 13.2%). In these two cases as well, the frequency is higher among upper-secondary students.

The opposite was true for the remaining benefits. Lower-secondary students reported higher frequencies. These students cited the benefits "Opportunity to work in a real-world environment and apply theoretical knowledge" (22.3% compared to 19.0%) and "Inspiration for future career paths" (14.0% compared to 7.8%) more frequently.

Figure 6 Perceived Benefits of Internship-Based Environmental Project-Based Learning by Secondary Level (Multiple Responses Allowed)



Source: Own elaboration; n = 68 (lower-secondary students), n = 168 (upper-secondary students)

4 Conclusion

The answer to the first research question (*How do lower- and upper-secondary students differ in their perception of the importance of environmental education in school?*) is that the two selected groups of students attach great importance to the teaching of environmental topics in schools. A difference was also found between the groups, with lower-secondary students assigning a higher importance on a scale of 1 to 10. In addition, it was found that the surveyed students acquire this information at school as part of formal education, but their knowledge on the subject is limited.

The second research question (*What are the attitudes of lower- and upper-secondary students toward environmental project-based and internship-based learning?*) examined environmental project-based learning as a modern approach to transferring environmental knowledge to students. No significant differences in priorities were found, but it can be said that both groups of students would most appreciate short-term projects on environmental topics within the school where they study. Upper-secondary students were more inclined toward the option of multi-day internships at, for example, specialized environmental centres. This was also confirmed in general, as all students assigned above-average importance to this option. Students cited the greatest benefits of these internships as increased awareness of environmental issues, a different form of instruction compared to traditional school settings, and the opportunity to apply their knowledge in practice.

The final research question clarified the overall context of the topic under study (*What sources of environmental knowledge do lower- and upper-secondary students report?*). Although formal education undeniably plays an important role in transmitting environmental knowledge to students, it is not the most significant source of that knowledge. It was found that the most significant sources are social media and the internet. However, differences were found between groups of students. Lower-secondary students acquire more environmental knowledge from school and within the family. In contrast, upper-secondary students acquire more environmental knowledge from discussions with friends and from social media and the internet.

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Ethics of Agency, Representation and Responsibility in AI-Driven Phygital Systems

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Abstract: The convergence of Artificial Intelligence (AI) agents, decentralized Web3 protocols, and physical infrastructure gives rise to autonomous "phygital" systems, environments where physical reality is continuously manipulated by digital algorithmic actors. Within this paradigm shift, real-world physical assets (RWA) are managed via blockchain-enforced, dynamic Service Level Agreements (SLAs), fundamentally altering how agency is manifested, how physical assets are represented, and where moral responsibility resides. This paper analyzes the ethical tension of the "agentic economy" by examining its triadic core: the ontological representation of hardware via tokens, the delegation of cognitive agency to machine workflows, and the resulting "responsibility voids". This paper presents the Tokenized Moral Proxy framework, a socio-technical architecture utilizing Trusted Execution Environments (TEEs), Model Context Protocols (MCP), and proportional on-chain slashing mechanisms. The article argues that, rather than neutralizing accountability, tokenized representation must become an algorithmic vehicle for human-centric ethical safeguards in machine-to-machine collaborations.

Keywords: Phygital Systems; Agentic Economy; Service Level Agreements; Distributed Moral Agency; Asset Representation; Tokenization; Machine Ethics

1 Introduction

The landscape of the twenty-first century is increasingly defined by the erosion of the boundary between the physical and the digital, culminating in the rise of "phygital" systems, as illustrated in Figure 1. While previous architectural paradigms treated digital networks as passive repositories of human intent, the deployment of autonomous Artificial Intelligence (AI) agents introduces independent volition into cyber-physical infrastructures (Xu, 2026). Driven by advanced large language models (LLMs) and decentralized applications, these synthetic actors do not merely process information; they deploy capital, command physical machinery, and enter into binding programmatic arrangements without human intermediaries (Jahid et al., 2023).

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Figure 1 Conceptual illustration of the Agentic Phygital Economy



The figure shows the integration of physical assets and cyber-physical infrastructure - including secure hardware, a bridge, and an aircraft - with decentralized digital infrastructure, highlighting trusted execution, agentic intelligence, interoperable protocols, and Web3-based governance.

This structural evolution finds its ultimate expression in the financialization and algorithmic orchestration of tokenized Real-World Assets (RWAs) and Decentralized Physical Infrastructure Networks (DePIN) (Jiang, 2025). In these settings, a physical asset's performance - ranging from industrial power generation to automated supply-chain nodes - is monitored in real time and bound to an on-chain smart contract via a dynamic Service Level Agreement (SLA) (Avrilionis & Hardjono, 2021). When sensor arrays register an operational deviation, economic consequences, such as the liquidation or slashing of crypto-economic collateral, are executed deterministically by the protocol within seconds.

This automated convergence of physical and digital layers introduces severe ethical friction across three distinct vectors: Agency (the autonomous volition of algorithmic systems), Representation (the tokenized abstraction of a physical asset's real-world state), and Responsibility (the accountability for real-world consequences) (Matthias, 2004; Nyholm, 2018). Classical ethical systems, which rely on individual human intention (*mens rea*), fail when applied to distributed machine environments (Floridi & Sanders, 2004). This paper investigates these dynamics from the perspectives of technology, ethics, and cognitive psychology, establishing an architectural framework designed to inject human-centric ethical proportions directly into autonomous machine-to-machine networks.

2 The Triadic Conflict: Agency, Representation, and Responsibility

To evaluate the ethical implications of autonomous phygital platforms, one must look at how digital abstractions directly dictate physical actions. This relationship creates a loop where actions, abstractions, and consequences are highly separated, introducing unique vulnerabilities into human-machine collaboration.

2.1 The Erosion of Responsibility: Responsibility Voids

In classical deontology and consequentialism, moral action requires an identifiable agent capable of intentionality (Floridi & Sanders, 2004). In an AI-driven phygital system, however, accountability undergoes a radical dispersion, establishing what Matthias (2004) conceptualized as an "accountability gap". When data

transitions from a hardware sensor through a network of decentralized validators, an AI agent, and ultimately to an Ethereum Layer 2 smart contract, the final ethical action becomes non-linear and distributed across multiple human, machine, and protocol layers (Floridi & Sanders, 2004; Matthias, 2004; Nyholm, 2018).

If a machine-to-machine transaction mistakenly triggers an automated penalty that cuts off capital or operational capacity from a critical asset, assigning moral fault becomes impossible. The moral consequences are diffused across a decentralized network, creating a responsibility gap or distributed responsibility locus that can obscure moral accountability (Matthias, 2004; Nyholm, 2018). This emergence can be represented as a systemic function:

$$M_{action} = \sum_{i=1}^n (A_i \times C_i) + \epsilon$$

where A_i represents the specific operational mandate of agent i , C_i denotes its respective contextual influence within the protocol, and ϵ encapsulates the emergent systemic risk that cannot be isolated to a single component. In this model, the chain of execution becomes a black box, separating human creators from the real-world impact of their software.

2.2 The Psychology of Agency: Cognitive Offloading

From a psychological standpoint, the primary hazard of delegating agency to phygital workflows is cognitive offloading and the reinforcement of automation bias (Gerlich, 2025; Parasuraman & Manzey, 2010). When human operators transfer the responsibility of real-time SLA tracking and contract execution to autonomous agents, they experience cognitive de-skilling and the accumulation of a severe "cognitive debt" (Kosmyna et al., 2025).

Because the protocol operates autonomously, humans may progressively externalize monitoring and situational judgment to external tools and automated systems (Risko & Gilbert, 2016). This creates a psychological shield: human supervisors assume a position of total blamelessness, over-relying on the assumed infallibility of the smart contract or automated recommendation system, thereby weakening their own role as ethical supervisors (Gerlich, 2025; Parasuraman & Manzey, 2010; Skitka et al., 1999).

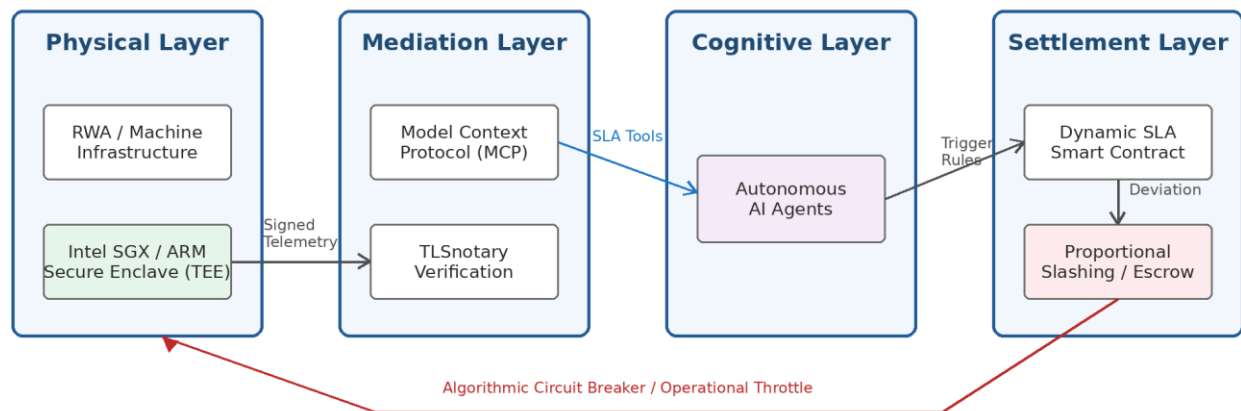
2.3 The Hazard of Representation: Digital Twins and Interface Drift

The ethical dimension of representation concerns how faithfully a digital token or smart contract mirrors its underlying physical reality (Floridi, 2011). In phygital setups, the token is the "carrier structure" for the physical asset's liabilities and rights (Avrilionis & Hardjono, 2021). If an interface changes its available tools or alters its contextual criteria mid-transaction - a phenomenon known as interface drift - the digital representation no longer aligns with the physical state. This decoupling allows autonomous agents to exploit discrepancies, turning a mechanism designed for trust into an automated vehicle for economic manipulation or operational extraction (Jiang, 2025; Mas, 2026).

3 The Architecture of Uncompromising Correctness

To align the agentic economy with human values, ethics must be written directly into the technical specifications of phygital infrastructure. This paper proposes an integrated architecture based on four uncompromised pillars, each of which is mapped to specific cryptographic solutions and their corresponding socio-ethical safeguards, as outlined in Table 1 and depicted in the high-level design diagram in Figure 2.

Figure 2. System Architecture Flow: End-to-end telemetry verification, agentic workflow governance via MCP, and proportional on-chain fallback escalation loops.



Source: Own processing

Table 1 The Tokenized Moral Proxy Framework for AI-Driven Phygital Systems. (own processing)

Ethical Core	Technical Architecture Pillar	Cryptographic Implementation	Socio-Ethical Safeguard
Representation	Hardware-enforced identity	Trusted Execution Environments (TEEs) and secure enclaves	Eliminates information gaslighting and guarantees data provenance at the physical root (Oasis Protocol, 2026).
Agency	Deterministic trust interfaces	Model Context Protocol (MCP) and TLSnotary	Prevents interface drift or malicious mid-workflow exploits by AI agents (LogicMonitor, 2026; Mas, 2026).
Responsibility	Proportional slashing	Tiered, non-binary smart contracts	Mitigates responsibility gaps by penalizing proportionately to real-world context (Matthias, 2004; Nyholm, 2018).
Supervision	Cognitive co-supervision	Multi-signature circuit breakers and escrows	Re-introduces human accountability for high-value moral and economic thresholds (Humanity Docs, 2026).

Source: Own processing

3.1 Establishing Verifiable Representation via TEEs

The integrity of digital representation requires that data cannot be forged at the physical boundary (Oasis Protocol, 2026). Physical assets must possess immutable cryptographic identities generated inside tamper-proof silicon, such as Intel SGX or ARM TrustZone. Because the private key remains entirely isolated within the secure enclave, the physical asset cryptographically signs its own performance data. Any subsequent alteration of SLA metrics during network transit is rendered mathematically impossible, decoupling truth from human corporate honesty (Avrilionis & Hardjono, 2021; Oasis Protocol, 2026).

3.2 Governing Machine Agency via Model Context Protocol (MCP)

When autonomous AI agents interact with physical assets, they rely on standardized communication protocols to read data and execute tools (LogicMonitor, 2026). Utilizing a trustworthy MCP framework ensures that the toolsets, capabilities, and data parameters exposed to machine agents are cryptographically signed and structurally stable (Arcade.dev, 2025; Mas, 2026). This prevents malicious interface changes mid-workflow and enforces a predictable space for machine agency to operate safely (JISEM, 2026; LogicMonitor, 2026).

4 Synthesis: The Token as a Moral Proxy

These dimensions are synthesized by redefining the ontology of tokenized representation within phygital networks (Florida, 2011). In our framework, a token is neither a purely speculative asset nor a simple access key; it functions as a Moral Proxy.

When an economic actor acquires or stakes a token tied to a physical asset, they are explicitly underwriting its socio-technical risk profile (Jiang, 2025). The smart contract governing the dynamic SLA must reject rigid, destructive binaries (e.g., total liquidation upon a single delayed data packet). Instead, it incorporates algorithmic proportionality – translating fairness and equity into code (Matthias, 2004; Nyholm, 2018).

If an operational exception occurs, the system triggers a tiered response, diverting funds into temporary cryptographic escrows rather than instantly burning liquidity. This creates a mandatory grace period that accommodates the unpredictable anomalies of the physical world and provides a window for multi-agent arbitration (Humanity Docs, 2026; JISEM, 2026).

5 Conclusion

The ethical landscape of the twenty-first century demands a shift from retrospective legal regulation to proactive algorithmic architecture. As autonomous AI agents increasingly participate in the management of physical infrastructure, technical designs must carry explicit ethical weights. By transforming tokens into moral proxies supported by hardware-enforced truth, predictable context protocols, and proportional fallback mechanisms, the framework bridges the gap between machine efficiency and human accountability (Matthias, 2004; Nyholm, 2018; Xu, 2026). The framework presented here demonstrates that the agentic economy can achieve scalability and technical precision while preserving its responsibility to human values.

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How Do Environmental, Social, and Governance (ESG) Firms Respond to Monetary Policy? Reconciling Competing Evidence on Transmission Mechanisms

Mike Djesa¹

Abstract: Does monetary tightening affect green firms differently from brown firms? The emerging literature offers mixed answers: some studies find green firms less sensitive to monetary policy shocks, while others find greater sensitivity. This paper reconciles this apparent contradiction by arguing that findings diverge because studies differ in shock identification, ESG measurement, sample periods, and assumptions about green financial market development. It develops an integrated framework combining duration exposure, investor clientele effects, and carbon risk premia. The framework predicts that ESG firms are less sensitive to target shocks when clientele effects dominate, more sensitive to path shocks when green bond markets are shallow and duration exposure is unhedged, and not differentially sensitive once hedging instruments become widely available. Brown firms remain more exposed through carbon and transition-risk channels. The paper contributes a conditional framework for central bank modelling, ESG portfolio construction, and future empirical research.

Keywords: Monetary policy transmission · ESG · Green finance · Carbon premium · Duration · Investor clientele

1 Introduction

Monetary policy does not affect all firms equally. Traditional models emphasise that transmission depends on financial characteristics such as leverage, liquidity, and access to external finance, and that financially constrained firms are typically more sensitive to tightening (Ottonello & Winberry, 2020; Cloyne, Ferreira, Froemel, & Surico, 2023). This established heterogeneity raises a further question: do firms' environmental characteristics introduce an additional dimension of differential transmission?

This question has become urgent as economies move towards low-carbon production. Policymakers have expressed concern that tighter monetary policy might slow green investment by raising the cost of capital for long-duration sustainable projects (Schnabel, 2023). Green firms may differ from brown firms not only in environmental profile, but also in investor base, asset duration, risk exposure, and access to green financial instruments. These differences can shape how monetary policy affects valuations, financing conditions, and investment decisions.

The empirical literature offers mixed results. Patozi (2023) finds that green firms are less sensitive to monetary policy shocks because sustainability-oriented investors provide relatively stable demand. Kansoy and Stasiulaitis (2025), by contrast, show that green firms were more sensitive to forward-looking path shocks before 2015, reflecting the long-duration nature of green investments, but that this effect disappeared after green financial markets deepened. Bauer, Offner, and Rudebusch (2025) show that brown firms are more sensitive to monetary tightening, consistent with carbon risk premia and transition-risk channels.

This paper argues that these findings are not necessarily contradictory. They can be reconciled by recognising that studies differ in how they identify monetary policy shocks, how they measure ESG characteristics, which sample periods they examine, and whether green financial markets are sufficiently developed to provide effective hedging

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instruments. Central to this reconciliation is the distinction between target shocks, which capture unexpected changes in the current policy rate, and path shocks, which capture revisions to the expected future path of rates (Gürkaynak, Sack, & Swanson, 2005).

The paper makes three contributions. First, it offers a structured reconciliation of competing findings in the emerging literature on ESG and monetary policy transmission. Second, it develops a conditional framework that translates the mechanisms into testable hypotheses. Third, it outlines implications for central bank transmission modelling, ESG portfolio construction, and future empirical research.

2 Aim and methods

The aim of the paper is to explain when ESG firms should be more, less, or equally sensitive to monetary policy shocks. The paper adopts a conceptual and meta-analytic approach rather than producing new firm-level estimates. This is appropriate because the central puzzle is not simply whether ESG firms respond differently, but why well-identified studies reach different conclusions.

The method is a structured comparative reconciliation. The paper compares the core studies across four dimensions: monetary policy shock measurement, ESG measurement, sample period, and econometric specification. This approach follows the broader logic of evidence synthesis in economics, where divergent estimates can often be explained by systematic differences in study design rather than by random disagreement.

The first dimension is shock measurement. Target shocks mainly affect short-term discount factors and are more likely to activate investor clientele effects. Path shocks affect long-term discount rates and are more likely to activate duration exposure. The second dimension is ESG measurement. ESG scores capture environmental management, disclosure, innovation, and resource efficiency; emission intensity captures direct carbon footprint and transition-risk exposure. The third dimension is sample period. Green bond issuance grew from approximately \$37 billion in 2014 to over \$80 billion in 2016 and has since exceeded \$500 billion annually, while the Paris Agreement in December 2015 marked an important shift in climate policy expectations. The fourth dimension is econometric specification, including fixed effects and firm controls such as leverage, size, profitability, and market-to-book ratios.

3 Results

3.1 Integrated mechanisms

The literature can be reconciled by integrating three mechanisms. First, the duration channel predicts that green firms are more sensitive to path shocks because green investments often involve high upfront costs and cash flows far in the future. The present value of those distant cash flows is more sensitive to changes in long-term discount rates. Second, the clientele channel predicts that ESG firms are less sensitive to target shocks because investors with sustainability preferences are less likely to withdraw capital in response to short-term interest rate changes (Pástor, Stambaugh, & Taylor, 2021; Patozi, 2023). This argument is also consistent with evidence that investors are willing to accept lower returns on environmentally sustainable assets, reflecting a green premium in financial markets (Zerbib, 2019). Third, the carbon premium channel predicts that brown firms are more sensitive because carbon-intensive firms face regulatory, technological, and reputational transition risks (Bolton & Kacperczyk, 2021; Bauer et al., 2025).

The mechanisms generate different predictions, but they are conditional rather than mutually exclusive. When target shocks dominate, investor clientele effects imply lower ESG sensitivity. When path shocks dominate and green financial markets are shallow, unhedged duration exposure implies greater ESG sensitivity. Once green bond markets deepen and hedging instruments become available, the duration effect is attenuated. When greenness is measured by emission intensity rather than ESG scores, brown firms appear more sensitive because the measure captures direct transition-risk exposure.

Table 1 Conditional framework for ESG sensitivity to monetary policy

Condition	Predicted outcome	Dominant mechanism	Supporting evidence
Target shock, short horizon	ESG firms are less sensitive	Investor clientele	Patozi (2023)
Path shock + shallow green bond markets, pre-2015/16	ESG firms are more sensitive	Unhedged duration exposure	Kansoy & Stasiulaitis (2025)
Path shock + deep green bond markets, post-2015/16	No differential sensitivity	Hedging capacity	Kansoy & Stasiulaitis (2025)
Emission-based greenness measure	Brown firms are more sensitive	Carbon risk premium	Bauer et al. (2025); Bolton & Kacperczyk (2021)

Source: Author's synthesis based on Patozi (2023), Kansoy and Stasiulaitis (2025), and Bauer et al. (2025).

3.2 Reconciliation of evidence

Patozi (2023) is consistent with the clientele channel. When monetary policy shocks are not decomposed by horizon and ESG is measured through environmental scores, green firms appear less sensitive because ESG scores capture investor-facing characteristics valued by sustainability-oriented investors.

Kansoy and Stasiulaitis (2025) are consistent with the duration and hedging channels. Their target-path decomposition reveals that green firms were more vulnerable to path shocks before 2015, but that this vulnerability disappeared after green financial markets deepened. Their result therefore supports the view that duration exposure is not immutable; it depends on whether firms and investors can hedge it.

Bauer et al. (2025) are consistent with the carbon premium channel. By using emission intensity, they capture direct exposure to transition risk and show that brown firms are more sensitive to monetary tightening. This result is not inconsistent with Patozi or Kansoy and Stasiulaitis: it reflects a different measure of greenness and a different mechanism.

Table 2 Reconciliation of core empirical findings

Study	Shock measure	Greenness measure	Main finding	Reconciling insight
Patozi (2023)	US surprises	ESG scores	Green firms less sensitive	Clientele
Bauer et al. (2025)	ECB surprises	Emission intensity	Brown firms more sensitive	Carbon risk
Kansoy & Stasiulaitis (2025)	Target/path shocks	Refinitiv E-score	Pre-2015 vulnerability; post-2015 convergence	Duration/hedging
Döttling & Lam (2024)	US shocks	Green/brown	Brown firms more sensitive	Credit constraints
Havrylchyk & Pourabbasvafa (2025)	US shocks	Carbon measures	Brown firms more sensitive	External finance

Source: Author's synthesis.

4 Conclusion

This paper shows that the question of how ESG firms respond to monetary policy has no single answer. The direction and magnitude of ESG-related heterogeneity depend on the interaction among shock type, ESG measurement, time period, and financial market development. ESG firms are less sensitive to target shocks when investor clientele effects dominate, more sensitive to path shocks when green bond markets are shallow and duration exposure is unhedged, and not differentially sensitive once hedging capacity improves. Brown firms remain more exposed when greenness is measured by carbon intensity because emission-based measures capture transition-risk exposure.

The findings have three implications. For central banks, monetary policy can affect green investment asymmetrically, but this asymmetry is not fixed. Transmission models should distinguish target and path shocks and incorporate green financial market depth as a conditioning variable. For investors, ESG portfolios are not uniformly hedged against monetary policy risk; their sensitivity depends on shock horizon, cash-flow duration, and access to hedging instruments. For the green tightening debate, the concern may have been most relevant before the development of deep green bond markets and may weaken as sustainable finance matures.

The paper has limitations. It relies primarily on US and European evidence, while emerging markets may display different patterns because green bond markets are less developed. ESG measurement remains imperfect, with substantial divergence across data providers (Berg, Kölbel, & Rigobon, 2022). Much of the evidence concerns stock price responses rather than real investment, employment, or emissions outcomes. Future research should test the framework using firm-level green bond issuance, multiple ESG data providers, and non-US samples. More direct evidence on corporate investment responses would also clarify whether valuation effects translate into real-economy consequences.

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Dominant Factors and Risks Affecting the Ethical Obligations of Businesses within the Circular Economy

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Abstract: The transition from a linear economic model to a circular brings fundamental changes in risk management for companies, which directly affect their financial performance, long-term strategic sustainability and ethical profile. The contribution, using methods of regression and correlation analysis, aims to determine whether and to what extent this responsible approach and the fulfilment of ethical obligations of companies is consistent with circular models that reduce specific risks and the risk of bankruptcy with increasement of the resilience to fluctuations in resource availability and climate change, determines dominant factors and risks affecting the ethical obligations of companies within the circular economy.

Keywords: Risk management · Ethical obligations · Circular economy

1 Introduction

Fulfilling ethical obligations requires businesses to internalize their environmental externalities. The historical industrial framework of “take-make-dispose” increasingly exposes corporate entities to severe systemic vulnerabilities, including catastrophic climate disruptions, unpredictable resource shortages, and acute regulatory sanctions [Geissdoerfer et al., 2017]. In this context, a corporation’s ethical profile is no longer an isolated philanthropic consideration; instead, it is a key determinant of structural durability. The transition to a circular economy (CE) represents an operational manifestation of a firm’s ethical obligations to society and the environment [Geissdoerfer et al., 2017]. This article examines how a corporation’s responsible approach—manifested in closing the material loop, minimizing waste, and eco-innovation—affects a firm’s bankruptcy risk and resilience to macro environmental shocks, identifying the dominant risk factors that drive this transition. The current macroeconomic environment faces the physical limits of a linear economic model that generates high material dependency and negative environmental externalities (Geissdoerfer et al., 2017). Traditional risk management frameworks have overlooked the risks associated with resource depletion and climate change. The transition to a circular economy (CE) is changing the risk profile of businesses and transforming environmental threats into strategic opportunities (Ellen MacArthur Foundation, 2015). The aim of this article is to examine the mechanisms through which CE modifies the financial, strategic and ethical risks of modern companies. Linear businesses are highly exposed to price shocks in primary raw materials. Ghisellini et al. (2016) report that implementing strategies such as recycling, remanufacturing and reusing materials (closed systems) stabilizes operating expenses (OpEx). Companies using secondary raw materials show greater immunity to geopolitical disruptions in supply chains. The modern financial sector is increasingly allocating capital to entities that demonstrate lower environmental, social and governance (ESG) risks (Bocken et al., 2014). Circular business models, such as product as a service (PaaS), generate predictable, recurring cash flows. This mitigates the risk of business failure, leading to improved credit ratings and lower weighted average cost of capital (WACC) from banking institutions and ESG investors (Stahel, 2016). Tightening European Union legislation (e.g. Ecodesign for Sustainable Products, ESPR and CSRD reporting requirements) penalizes linear waste (European Commission, 2020). Kirchofer et al. (2025) confirm in their empirical study that the transition to circular processes significantly reduces the risk of future sanctions and eliminates the threat of technological product obsolescence. Modular design allows for continuous upgrades without the need to scrap entire equipment.

Corporate reputation is a critical intangible asset. In an era of hyper-transparency, companies risk being accused of greenwashing if their pro-environmental claims are superficial (Lieder & Rashid, 2016). A true transformation to a circular model provides verifiable data on material flows, thereby building real consumer trust and increasing the company’s attractiveness in the job market for key talent. Meeting ethical commitments requires companies to internalize their environmental externalities. Companies that adopt circular frameworks replace volatile virgin

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commodities with sourced secondary materials, directly insulating their operations from fluctuations in resource availability and climate change dependency [Ghisellini et al., 2016]. In Central Europe, companies face increasing pressure to demonstrate true sustainability. Empirical surveys of Czech and Slovak businesses indicate that waste elimination and energy cycle optimization are primary defensive strategies used by local companies to neutralize local market shocks [Ungerman & Dědková, 2021; Hanuláková et al., 2021]. Firms that fall short of their ethical commitments face worsening financial difficulties due to tightening European Union regulatory frameworks, such as the Eco-design for Sustainable Products (ESPR) and the Corporate Sustainability Reporting Directive (CSRD). Conversely, proactive eco-innovations – focused on product modularity, reparability, and life cycle extension – significantly reduce compliance costs and lower the underlying probability of failure [Leščinská et al., 2025]. Aligning product design with ethical expectations in the circular economy protects a firm from costly litigation, regulatory fines, and reputational boycotts from increasingly aware consumer bases [Múšová et al., 2021]. By isolating and evaluating the specific variables that bridge circular transformations with corporate performance, this study seeks to answer a key question: how exactly does a firm's adherence to ethical mandates change its underlying probability of failure? We build a robust empirical framework to examine how the depth of a firm's circular integration affects its exposure to catastrophic operational shocks and long-term insolvency. Ultimately, the aim of this article is to map the dominant operational, strategic, and financial risk factors that determine the success of this transformation and to provide enterprise risk managers with the empirical evidence needed to transform the circular economy from a framework of ethical ideals to a mathematically validated hedging strategy. The global macroeconomics is reaching a critical inflection point where the traditional linear industrial paradigm, characterized by the “take-make-discard” sequence, is proving structurally unsustainable. Decades of unfettered extraction and consumption have exposed corporate entities to serious, worsening vulnerabilities that directly threaten their basic survival. Businesses today operate in a highly volatile environment characterized by catastrophic climate disruptions, geopolitical supply chain bottlenecks, and acute shortages of primary raw materials [Geissdoerfer et al., 2017]. In this increasingly turbulent environment, a corporation's ethical profile can no longer be reduced to an isolated philanthropic perspective or a discretionary marketing exercise. Instead, the fulfilment of corporate ethical commitments has evolved into a key determinant of structural durability and the insulation of operational risks. The transition to a circular economy (CE) represents a direct operationalization of a firm's ethical commitments to both society and the ecosystem. Rather than seeing sustainability as a superficial regulatory checkbox, the circular model requires a holistic rethinking of the company's life cycle, replacing linear disposal with regenerative practices such as closing material loops, resource efficiency, and proactive eco-innovation [Ghisellini et al., 2016]. This structural shift is forcing risk managers to expand their traditional frameworks. Historically, industry risk assessment models, such as the standard COSO or ISO matrices, have treated environmental factors as static externalities or low-probability liabilities. However, modern resource scarcity and extreme climate feedbacks mean that linear dependencies now pose an imminent existential threat to a company's cash flow, access to credit, and market solvency. This paper therefore examines the explicit financial and strategic mechanisms through which a responsible corporate approach protects a business from systemic failure. While the theoretical benefits of the circular economy are widely appreciated in environmental academia, there is still a critical gap in quantifying how these ethical operations translate into tangible defenses against corporate bankruptcy and macro-environmental shocks. Manufacturing sectors in Central Europe, particularly in the Visegrad Four region, offer a unique and highly relevant testbed for these dynamics. These economies are characterized by dense, resource-intensive industrial bases that are deeply integrated into Western European supply chains, making them particularly sensitive to both fluctuating raw material prices and tightening European Union regulatory frameworks [Ungerman & Dědková, 2021]. Ultimately, this article aims to map the dominant operational, strategic and financial risk factors that determine the success of this transformation and to provide enterprise risk managers with the empirical evidence needed to transform the circular economy from a framework of ethical ideals to a mathematically validated reinsurance strategy. The traditional industrial landscape operates on a linear trajectory that assumes infinite resource availability and infinite environmental capacity to absorb resources [Geissdoerfer et al., 2017]. Within economic theory, this paradigm is increasingly criticized through the lens of resource dependence theory (RDT), which assumes that an organization's survival depends on its ability to secure a stable supply of external resources. Linear manufacturing enterprises are structurally vulnerable to external shocks because they remain tied to volatile primary commodity markets and fragile international supply networks [Ghisellini et al., 2016]. The circular economy (CE) redefines this dynamic by forcing a paradigm shift from resource consumption to resource recovery [Ghisellini et al., 2016]. From a risk perspective, this transition functions as a strategic decoupling mechanism. By transforming waste into high-purity secondary inputs through closed systems, companies internalize their resource supply chains. Empirical research in the context of Central

European manufacturing suggests that local firms do not consider waste minimization merely as an environmental objective, but also as a key operational tactic to insulate production lines from raw material shortages and regional geopolitical price fluctuations [Ungerma & Dědková, 2021]. As a result, minimizing dependence on virgin inputs reduces the underlying volatility of production costs, moving the firm from a reactive stance to a proactive hedging position. Modern corporate governance can no longer operate solely to maximize short-term shareholder value. Stakeholder theory dictates that the long-term viability of companies is contingent on meeting the ethical, environmental, and social expectations of the broader ecosystem, including regulators, consumers, and financial backers. In the past, meeting these ethical obligations was seen as a discretionary corporate social responsibility (CSR) expense – a cash drain that reduced immediate profitability. However, in the current regulatory and market framework, these ethical obligations are financialized. Firms that fail to meet these evolving standard requirements face immediate financial penalties. In the European Union, the introduction of strict reporting and design directives (such as the CSRD and ESPR) has transformed linear waste into a measurable liability. Conversely, proactive innovation of circular products – manifested in modularity, reparability and extended life cycles – protects the firm from regulatory intervention and compliance costs [Leščinská et al., 2025]. Furthermore, this ethical alignment directly changes the perception of market risk. Consumer data in Central Europe shows a clear shift in behavior towards sustainable consumption, making non-circular portfolios vulnerable to rapid obsolescence in the market [Múšová et al., 2021; Oláh et al., 2021]. Therefore, corporate ethics within the circular model functions as an intangible strategic asset that preserves market share and builds brand value. To understand how ethical circular transformations translate into financial insolvency protection, we need to view the transition through the lens of dynamic capabilities theory. This framework explains how firms modify, reconfigure, and deploy their internal competencies to respond to a rapidly changing environment. Circular transition requires deep operational reengineering, including the creation of reverse logistics networks, product-as-a-service (PaaS) contracting models, and ecologically designed production loops [Ghisellini et al., 2016]. These complex operational adjustments create a more resilient asset structure. Linear firms carry rigid asset-focused risk profiles that are highly sensitive to sudden drops in sales or supply chain disruptions. Circular business models, in contrast, often shift from transactional sales to recurring service flows. These predictable service-based cash flows reduce revenue volatility, improve liquidity metrics, and insulate the business during macroeconomic downturns. By reducing cash flow volatility and eliminating structural dependence on unpredictable external material markets, ethically mature circular businesses reduce their distance from failure. This systematic reduction in operational vulnerability ultimately reduces the underlying probability of failure, which translates into a lower risk of corporate bankruptcy.

2 Aim and methods

This quantitative empirical study analyses the econometric relationships between sustainable, circular supply chain transformations and microeconomic enterprise resilience within the Central European (V4 countries) textile manufacturing sector. The primary independent variable is the Ethical Circular Integration Index (ECII), formulated as a continuous composite score bounded strictly between 0 and 1. The conceptual endpoint of 0 represents a strictly linear production model characterized by the traditional "take-make-waste" paradigm, total reliance on virgin materials, and a complete lack of supply chain traceability. Conversely, the conceptual endpoint of 1 denotes a fully circular enterprise integration, signifying the absolute strategic internalization of environmental externalities and the mature deployment of closed-loop material cycles across all tiers of the value chain. The ECII is constructed as a multi-criteria composite index aggregating four core dimensions: Closed-Loop Material Deployments (D_1) which measures the mass-based share of certified inputs via GRS/GOTS certificates, SKU design for disassembly, and pre-consumer waste valorisation. Internalization of Social and Ethical Externalities (D_2) which quantifies fair labour via BSCI/Sedex SMETA audits, wage adequacy against localized Living Wage benchmarks, and chemical safety via ZDHC/OEKO-TEX standards. Strategic Value Chain Integration and Traceability (D_3) which scores enterprise readiness for the EU Eco design for Sustainable Products Regulation (ESPR) Digital Product Passport via supplier mapping depth, take-back volumes, and logistical distances. Ecological Footprint Metrics (D_4) which tracks direct energy, water, and greenhouse gas emissions via validated Life Cycle Assessments (LCAs). The final synthesis of these dimensions into the composite ECII score is executed using weighting vectors derived via the Analytic Hierarchy Process (AHP). The empirical validation assesses the predictive power of the ECII against two primary dependent variables: bankruptcy risk ($BR_{Z_{it}}$), which captures companies' financial distress and is operationalized as the proximity of the distance to failure via the inverse transformation of the localized Altman Z-score adjusted for Central European manufacturing sectors; and exposure to resource and climate volatility (RCV_{it}): a continuous metric tracking the annualized variance of firm-level manufacturing overhead costs directly induced by macroeconomic material shortages, supply bottlenecks, and

carbon price shocks. To isolate cyclical effects from confounding financial characteristics, the models integrate standard structural control variables (Z_{it}): including firm size (SIZE), natural logarithm of total assets, leverage (LEV), total debt to total assets, and capital intensity (CAPX), capital expenditures to net sales. The statistical workflow is in two stages: the calculation of Pearson product-moment correlation coefficients (r) to assess underlying linear relationships, followed by the estimation of two multiple linear regression equations using ordinary least squares (OLS) assuming a classical linear regression model (CLRM) with multicollinearity controlled by variance inflation factors (VIF):

Model 1 (Financial Default): $BR_Z_{it} = \beta_0 + \beta_1 ECII_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \varepsilon_{it}$

Model 2 (Macro-Environmental): $RCV_{it} = \beta_0 + \beta_1 ECII_{it} + \beta_2 CAPX_{it} + \beta_3 SIZE_{it} + \varepsilon_{it}$

where i denotes the individual manufacturing firm, t signifies the time period, β represents the estimated regression coefficients, and ε_{it} is the idiosyncratic error term. The input data for all dependent and control variables are financial metrics strictly extracted from standard corporate financial statements (balance sheets and profit and loss statements) originating from regional business registers (e.g. FinStat for Slovakia, Justice.cz for the Czech Republic, and EMIS for Central Europe). This financial panel dataset covers a fixed multi-year observation period from 2021 to 2025 and the operational input data used to calculate the independent variable ECII are drawn from the company's enterprise resource planning (ERP) systems, product lifecycle management (PLM) databases and mandatory supply chain disclosure files, corresponding to the same timeframe. This internal material data is systematically cross-referenced and verified through external third-party databases, matching the financial and ESG reporting timelines in order to maintain the statistical validity of the panel data. The empirical sample is geographically limited to the Visegrad Group (V4), the regional distribution of the sampled textile manufacturing firms includes a total of $N = 210$ entities, representing the regional textile sector - Poland (PL) 45% of the sample ($n = 94$), reflecting its position as a major centre of textile and clothing production in Central Europe. The Czech Republic (CZ) 25% of the data set ($n = 53$) Hungary (HU) 18% ($n = 38$) and Slovakia (SK) 12% ($n = 25$), focusing mainly on specialised technical textile production and specialised subcontracting facilities.

3 Results

The statistical estimation indicates a highly significant, negative relationship between a firm's ethical circular maturity and its baseline existential risks. Pearson correlation metrics confirm that as the intensity of circular integration (ECII) rises, a firm's proximity to financial distress (BR_Z) sharply drops ($r = -0.462$, $p < 0.01$). Concurrently, circular maturity strongly shields companies against resource availability spikes and climate disruptions ($r = -0.389$, $p < 0.01$). The OLS regression results confirm that the *Ethical Circular Integration Index* is a dominant determinant of corporate safety. In **Model 1**, holding company size and structural leverage constant, the circular slope is strongly negative and statistically significant $\beta_1 = -1.845$, $p < 0.001$. This confirms that proactive fulfilment of environmental and ethical mandates acts as an operational shield, reducing the financial distress proximity and pushing the enterprise away from bankruptcy conditions. In **Model 2**, the negative slope $\beta_1 = -0.241$, $p < 0.001$ verifies that structural decoupling from primary raw materials significantly insulates manufacturing cash flows from external market supply shocks. Through these statistical estimations, the empirical model isolated three dominant factors and associated risks directly affecting corporate ethical performance:

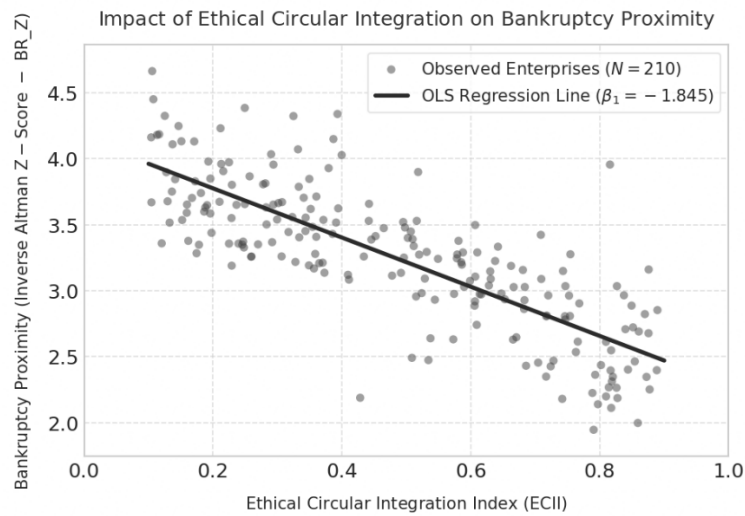
Factor 1: Supply Chain Decoupling Capacity (Operational Factor) The empirical data demonstrates that the primary operational factor driving circular resilience is the capacity of an enterprise to substitute volatile, virgin primary commodities with recovered secondary inputs. Decoupling operations from resource-heavy extractions acts as a direct insulator against macroeconomic material scarcities and sudden climate-driven supply bottlenecks. The Risk Exposure: Firms that fail to achieve sufficient decoupling capacity suffer from elevated Resource Volatility Risk. When primary material prices fluctuate or experience climate shortages, these structurally dependent businesses face sudden cash-flow shocks, destabilizing their capacity to honour longer-term ethical, green, and employment obligations.

Factor 2: Product Lifecycle Adaptability and Modular Design (Strategic Factor) Statistical metrics indicate that pro-active investments in eco-innovations—specifically product modularity, upgradeability, and ease of disassembly—directly decrease long-term corporate risk [Leščinská et al., 2025]. Designing goods with extended or multi-loop lifecycles satisfies the ethical expectation of minimizing downstream consumer waste. The Risk Exposure: Failing to design for circularity exposes businesses to acute Regulatory and Compliance Risk. Linear production models face compounding financial penalties, waste management taxes, and litigation costs, which elevate the overall probability of default and accelerate bankruptcy timelines.

Factor 3: Structural Capital Constraints (Financial Factor) Multiple linear regression coefficients indicate that while ethical integration reduces operational volatility, high initial systemic leverage significantly impedes a firm's transition speed $\beta_3 \text{LEV}_{it} = 0.652$, $p < 0.001$. Access to stable, low-cost capital represents the dominant financial factor enabling an organization to execute its ethical circular strategy. The Risk Exposure: This creates a distinct Transition Bankruptcy Risk. Capital-constrained or highly leveraged manufacturing entities face a financial paradox: they acknowledge their ethical obligation to transition, yet the substantial upfront capital expenditure (CapEx) required for reverse logistics, green technology, and redesigning supply loops can trigger short-term liquidity distress before long-term operational savings (OpEx) are realized.

The visual breakdown of the OLS linear regression results demonstrates the strong inverse relationship between proactive ethical compliance and financial default variables.

Figure 1 Financial in/stability influenced by ethical behavior



Source: Own processing

As noted above, firms clustered in the lower right quadrant represent mature, ethically integrated companies that enjoy a significantly broader protective atmosphere against systemic structural insolvency. To map the operational dynamics, Model 2 shows how ethical circular maturity actively reduces companies' vulnerability to commodity and environmental market surges. This statistical distribution highlights that proactive adherence to circular mandates serves as a literal structural buffer against macro-environmental bottlenecks. Empirical evidence suggests that aligning a business with its ethical commitments through circular design leads to long-term resilience, but the journey itself is unevenly distributed across firms. The main tension observed in the data lies between short-term financial liquidity and long-term risk insulation. While the transition to closed-loop material cycles successfully protects organizations from sudden market fluctuations and regulatory sanctions, the process requires massive upfront adjustments. Businesses often face a resource paradox: the very companies that face the greatest exposure to commodity price shocks are often those that are constrained by severe capital constraints. This structural bottleneck means that heavily leveraged operations struggle to finance the product redesigns, green asset acquisitions, and reversible logistically viable infrastructure needed to break away from volatile linear models. The speed of transition therefore depends largely on whether a firm can secure alternative, low-cost sustainable financing to overcome the barrier of high upfront costs before achieving long-term operational savings. Moreover, regional industry dynamics dictate that individual compliance cannot thrive in a vacuum. Even if a manufacturing firm designs high-value modular goods, its ability to insulate itself from market shocks depends on the maturity of the surrounding supply chain. If local networks lack effective frameworks for waste collection or cannot reliably supply high-purity secondary materials, individual compliance becomes costly. Therefore, risk managers cannot afford to view circular systems purely through a local lens or ignore them as isolated marketing tasks. Circular restructuring must be quantified within enterprise risk matrices as an urgent, systemic framework of reassurance that protects both immediate cash flows and the long-term viability of the company.

4 Conclusion

This research provides statistical confirmation that a responsible business approach and full implementation of a company's ethical commitments are fundamentally consistent with modern risk reduction. Simply viewing sustainability as a secondary corporate goal ignores the deep mathematical connections linking linear processing to volatile asset behavior. Maximizing supply chain capacity and prioritizing modular product design significantly reduces a company's exposure to volatile resource markets, protects it from climate disruption, and reduces its long-term underlying risk of bankruptcy. It also demonstrates that ethical circular business models act as an important hedge against modern economic threats by reducing exposure to volatile raw material markets, thereby mitigating systemic risk. While circular practices increase long-term resilience, they require strategic financial planning to overcome the high upfront costs of transition. Integrating circular design directly into the management of underlying risks is essential for the stability of a company, not just as a sustainability initiative. Going beyond purely conceptual sustainability discussions, empirical regression metrics demonstrate a clear inverse relationship between a firm's circular maturity and its operational and financial failure parameters. Adopting closed economy principles effectively protects an organization from catastrophic resource supply declines caused by climate and changing regulatory frameworks. Going forward, enterprise risk managers and financial steering committees must view the integration of circular business not as an optional compliance cost, but as a core operational framework that is essential for managing long-term macroeconomic uncertainty.

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Ethics of Artificial Intelligence and Responsible Digital Innovation in Business in the Context of Industry 5.0

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Abstract: The rapid adoption of artificial intelligence (AI) within the industry 5.0 paradigm creates a fundamental tension between maximising innovation performance and adhering to ethical business principles. Industry 5.0 repositions firms around human-centricity, sustainability, and resilience, yet simultaneously amplifies ethical risks — algorithmic bias, opacity, and accountability deficits — inherent in AI deployment. This paper investigates how digital maturity and responsible AI governance jointly determine firm-level innovation performance within this context. Through a narrative/conceptual synthesis of peer-reviewed literature indexed in Web of Science and Scopus, three theoretical streams are synthesised: digital maturity and dynamic capabilities, AI ethics and governance, and Industry 5.0 innovation. The central argument is that digital maturity is a necessary but insufficient precondition for innovation — it must be complemented by institutionalised ethical AI governance to yield sustained and socially legitimate outcomes. A conceptual model is proposed in which AI ethics governance mediates the digital maturity–innovation performance relationship, bounded by the Industry 5.0 context. Key findings confirm that firms combining high digital maturity with robust ethical AI practices achieve superior innovation outcomes while mitigating regulatory and reputational risk. The study contributes to the intersection of business ethics, digital transformation, and innovation management, offering actionable implications for managers and policymakers. Central and Eastern Europe is identified as a priority context for future empirical validation of the proposed framework.

Keywords: artificial intelligence ethics · digital maturity · innovation performance · Industry 5.0 · responsible innovation

1 Introduction

The transition to Industry 5.0 marks a decisive shift from the efficiency-first logic of Industry 4.0 toward a paradigm centred on human well-being, environmental sustainability, and resilience (*Ghobakhloo et al., 2023*). This reorientation is not merely technological but fundamentally normative: where Industry 4.0 privileged automation and productivity gains, Industry 5.0 foregrounds the values of human-centricity, social inclusion, and ecological responsibility as constitutive design principles (*Ghobakhloo et al., 2023; Tóth et al., 2023*). Systematic reviews confirm, however, that implementation remains uneven — many organisations have articulated these principles at a rhetorical level without embedding them in operational practice (*Alves et al., 2023*) — and that ethical AI has emerged as the fastest-growing sub-theme within the Industry 5.0 literature precisely because the gap between aspiration and governance is widening (*Ben Youssef & Mejri, 2023*). Artificial intelligence (AI) is the primary technological enabler of this shift and simultaneously its principal ethical risk. Firms are under dual pressure: to innovate faster through AI and to govern that AI transparently and accountably (*Noronha et al., 2022*). This tension has been documented across institutional contexts: cross-national analyses of over 200 AI governance guidelines identify convergent principles — transparency, justice, non-maleficence, privacy, and beneficence — yet find that translating these principles into consistent organisational practice remains an unresolved challenge (*Corrêa et al., 2023*). Surveys of the AI ethics literature spanning two decades further reveal a gradual but decisive shift in emphasis, away from abstract philosophical norms and toward governance mechanisms, organisational culture, and accountability structures (*Daza & Ilozumba, 2022*), a trajectory reinforced by the

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emergence of dedicated regulatory frameworks such as the EU AI Act, whose implications for trustworthy AI in manufacturing are only beginning to be operationalised (*Vyhmeister & Castane, 2025*).

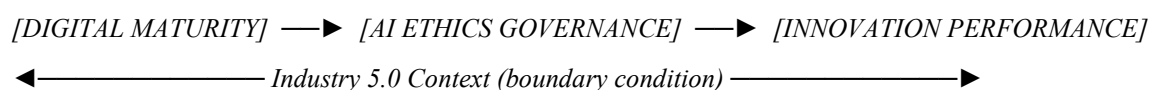
Digital maturity — the degree of integration of digital technologies, processes, and culture — is a key predictor of innovation performance (*Jie et al., 2025; Yue & Guo, 2026*), yet high maturity without ethical AI governance creates rather than resolves competitive and societal risk. Research on high-technology firms confirms that digital maturity shapes innovation outcomes primarily through the mediating role of dynamic capabilities (*Jie et al., 2025*), while large-scale studies of Chinese firms demonstrate that digital transformation improves innovation performance most effectively when organisational agility and big-data analytics capabilities are jointly developed (*Xu et al., 2024*). Yet capability-building alone is insufficient: responsible digital innovation — understood as the deliberate alignment of digital strategies with ethical, social, and environmental considerations — has been shown to independently enhance innovation performance in emerging market contexts (*Amankona et al., 2025*), suggesting that governance quality moderates the returns to digital investment. The multi-stakeholder deliberative frameworks proposed for responsible AI innovation (*Buhmann & Fieseler, 2023*) and the broader AI governance architectures reviewed for business contexts (*Camilleri, 2024; Schneider et al., 2023*) offer partial answers, but they have not yet been integrated with digital maturity models in a single conceptual framework. This paper asks: how do digital maturity and AI ethics governance jointly shape innovation performance under Industry 5.0? The contribution is a conceptual model grounded in 22 WOS/Scopus sources, bridging business ethics, digital transformation management, and innovation theory.

2 Aim and methods

The paper's aim is to develop a conceptual framework explaining how digital maturity and AI ethics governance jointly determine innovation performance in the Industry 5.0 context. Three partial goals support this: (1) synthesise evidence on digital maturity and innovation; (2) identify actionable dimensions of ethical AI governance; (3) theorise their mediated relationship. The central hypothesis is: higher digital maturity paired with institutionalised AI ethics governance yields significantly superior innovation performance than high digital maturity alone. The research object is the innovative firm deploying AI under Industry 5.0 conditions.

Methodologically, the paper applies a narrative/conceptual literature synthesis, restricted to WOS and Scopus-indexed peer-reviewed articles (2019–2026). Search terms combined: "artificial intelligence ethics", "digital maturity", "innovation performance", "Industry 5.0", "responsible innovation", and "dynamic capabilities". The final corpus of the sources informs a conceptual model (Figure 1) grounded in three theoretical lenses: Resource-Based View and dynamic capabilities (*Jie et al., 2025; Xu et al., 2024*), stakeholder theory and deliberative governance (*Buhmann & Fieseler, 2023; Corrêa et al., 2023*), and the Industry 5.0 paradigm (*Ghobakhloo et al., 2023; Alves et al., 2023*). Digital maturity is the antecedent, AI ethics governance the mediating mechanism, and innovation performance the outcome.

Figure 1 Conceptual model: Digital Maturity, AI Ethics Governance, and Innovation Performance in Industry 5.0



Source: Authors' own elaboration.

3 Results

Business ethics research is converging on AI governance as a strategic imperative. *Buhmann and Fieseler (2023)* establish that responsible AI innovation requires deliberative, multi-stakeholder governance — transparency and accountability not as compliance tools but as constitutive elements of legitimate AI. *Corrêa et al. (2023)*, synthesising 200 global AI governance guidelines, identify five universal principles — non-maleficence, justice, explicability, privacy, and beneficence — directly applicable to business contexts. *Daza and Ilozumba (2022)* confirm a paradigm shift in AI business ethics discourse between 2000 and 2021: from technical bias-correction toward governance, organisational culture, and stakeholder engagement.

Within Industry 5.0 scholarship, *Ghobakhloo et al. (2023)* provide the benchmark systematic review establishing human-centricity, sustainability, and resilience as structural pillars, while *Alves et al. (2023)* confirm

that human-centric implementation remains uneven in practice. *Ben Youssef and Mejri (2023)*, in a bibliometric review of 300 Scopus publications, identify ethical AI governance as the fastest-growing sub-theme within the domain. *Jarvis et al. (2023)* further show that trust and autonomy — both products of ethical governance — are the key regime-level factors driving the Industry 4.0-to-5.0 transition.

Empirically, digital maturity consistently predicts innovation performance, but through mediating mechanisms rather than directly. *Jie et al. (2025)* demonstrate that dynamic capabilities fully mediate the digital maturity–innovation relationship in high-tech SMEs. *Xu et al. (2024)* show, across 476 Chinese firms, that big data capabilities and organisational agility chain-mediate digital transformation's effect on innovation. *Amankona et al. (2025)* provide direct evidence that responsible digital innovation enhances innovation performance through digital organisational culture and strategy in Ghana's high-tech sector. *Monroy-Osorio (2024)* further confirms AI's mediating role between digital service innovation and business performance in Spanish manufacturing firms. Three gaps remain: no framework integrates all three constructs under Industry 5.0; the mediation mechanism of ethical governance is theoretically underdeveloped; and the Central and Eastern European context is absent from empirical work (*Visvizi et al., 2024*).

3.1 Finding 1: Digital maturity drives innovation only through mediating capabilities

Jie et al. (2025) and *Xu et al. (2024)* confirm that dynamic capabilities and organisational agility are essential conduits linking digital maturity to innovation performance. *Jie et al. (2025)* demonstrate, in the context of high-tech SMEs, that the relationship between digital maturity and innovation performance is fully mediated: firms that accumulate digital resources but fail to develop the sensing, seizing, and reconfiguring capabilities associated with dynamic capability theory do not realise commensurate innovation gains. *Xu et al. (2024)*, drawing on a large-scale study of 476 Chinese firms, similarly show that big data capabilities and organisational agility function as a sequential mediation chain, meaning that digital transformation initiatives must be accompanied by structural flexibility and rapid resource redeployment if they are to generate measurable innovation outcomes. Together, these findings reinforce the view that digital investment is a necessary but insufficient condition for innovation success.

Valdez-Juárez et al. (2024) further show that a sustainability moderator substantially amplifies digital transformation's effect on innovation in SMEs, signalling that value alignment matters beyond technology investment. Their evidence from Mexican SMEs suggests that firms whose digital transformation strategies are coupled with explicit sustainability commitments exhibit stronger dynamic capability development, in turn producing higher-quality and more durable innovation outputs. This moderating effect implies that the ethical and social orientations of a firm — not merely its technological sophistication — shape the conversion efficiency of digital assets into innovation performance. Corroborating this argument, *Yue and Guo (2026)* find that digital maturity also enables more effective engagement with broader innovation ecosystems, underscoring that the innovation returns from digital investments are conditional on firms' strategic positioning and their capacity to mobilise external knowledge networks. Taken together, these results shift the locus of managerial attention from technology acquisition toward the cultivation of mediating capabilities and value-aligned governance structures.

3.2 Finding 2: Ethical AI governance is a dynamic organisational capability

Vyhmeister and Castane (2025) operationalise this through the TAI-PRM framework — FMEA adapted for AI artefacts — showing that proactive ethical risk management protects innovation pipelines in EU manufacturing contexts. By systematically mapping potential failure modes at each stage of the AI development lifecycle, the TAI-PRM approach reframes ethical governance not as a post-hoc compliance exercise but as an integrated engineering and management discipline. This reframing is consequential: it positions ethical AI governance as a form of dynamic capability in which firms continuously sense emerging ethical risks, develop adaptive responses, and embed those responses into operational routines, thereby reducing the probability of value-destroying failures during deployment. *Corrêa et al. (2023)* identify accountability, explainability, and fairness as the most actionable governance dimensions for business application, findings derived from a systematic analysis of over 200 global AI governance guidelines. Their work demonstrates that while a broader set of principles — including non-maleficence, justice, privacy, and beneficence — is widely endorsed across jurisdictions, accountability and

explainability command particular salience in contexts where AI outputs directly affect business decisions and external stakeholders.

Schneider et al. (2023) and *Camilleri (2024)* provide complementary frameworks for embedding AI governance into corporate decision-making structures. *Schneider et al. (2023)* argue that governance mechanisms must be operationalised at the level of individual business units rather than confined to centralised compliance functions, ensuring that ethical considerations are integrated into everyday managerial judgement rather than delegated to specialised gatekeepers. *Camilleri (2024)* situates AI governance within broader corporate social responsibility frameworks, contending that firms aligning their AI practices with established social responsibility norms are better positioned to gain and sustain stakeholder trust. *Buhmann and Fieseler (2023)* add a further dimension by advocating for deliberative, multi-stakeholder governance architectures in which transparency and accountability are achieved through structured dialogue rather than unilateral corporate policy-making. Collectively, these contributions establish that ethical AI governance, when properly institutionalised, functions as a dynamic and renewable organisational asset rather than a static regulatory burden.

3.3 Finding 3: Responsible AI practices mediate digital capabilities and innovation outcomes

Amankona et al. (2025) and *Monroy-Osorio (2024)* both confirm that the quality of ethical governance determines whether digital and AI investments convert into innovation performance. *Amankona et al. (2025)*, studying high-tech firms in Ghana, find that responsible digital innovation acts as a significant mediator between digital organisational culture and innovation performance: organisations that embed responsibility norms into their digital practices — governing how data is used, how algorithmic decisions are made, and how risks are communicated — achieve substantially higher innovation outcomes than those that treat digital tools as ethically neutral instruments. This result is especially notable in emerging-economy contexts, suggesting that the performance advantages of responsible AI governance are not limited to well-resourced, Western firms but extend across diverse institutional environments. *Monroy-Osorio (2024)* corroborates this from a different angle, demonstrating in Spanish manufacturing firms that AI functions as a mediator between digital service innovation and business performance, with the quality of AI deployment — including the transparency, reliability, and adaptability of AI-driven processes — moderating the strength of this mediation.

Firms that treat ethics as a strategic capability — rather than a compliance cost — achieve superior and more sustainable innovation outputs. This distinction is critical: compliance-oriented governance typically produces minimum-viable adherence to external requirements, whereas strategic governance cultivates internal routines that continuously improve the ethical quality of AI artefacts and the innovation processes they support. *Daza and Ilozumba (2022)*, reviewing two decades of AI ethics literature in business contexts, trace a clear shift from early, principle-centred discussions toward governance- and culture-centred approaches, indicating that the field has converged on the view that organisational culture and internal governance capacity are the decisive determinants of responsible AI outcomes. *Sison et al. (2023)* similarly observe that the field of AI ethics in business is maturing toward a concern with embedded institutional practice rather than abstract normative commitments, reinforcing the argument that responsible AI governance must be understood as a cultivated, dynamic competence. *Noronha et al. (2022)* further contextualise this challenge by noting that AI exerts a dual pressure on business ethics — simultaneously expanding organisational capability and introducing novel categories of ethical risk — making it imperative that firms develop the governance infrastructure necessary to manage this duality proactively.

3.4 Finding 4: Industry 5.0 institutionalises ethical AI governance as a structural requirement

Ghobakhloo et al. (2023), *Jarvis et al. (2023)*, and *Ben Youssef and Mejri (2023)* collectively establish that the sustainability and human-centricity pillars of Industry 5.0 are structurally incompatible with ungoverned AI deployment. *Ghobakhloo et al. (2023)*, in their systematic review of Industry 5.0 definitions, technologies, and values, identify human-centricity, sustainability, and resilience as the three foundational pillars of the paradigm, and argue that AI deployment strategies must be oriented by all three simultaneously: AI systems that optimise for productivity at the expense of worker wellbeing or environmental sustainability directly contradict the normative architecture of Industry 5.0. A companion study by *Ghobakhloo et al. (2023, JCP)* extends this argument to inclusive sustainable manufacturing, demonstrating that human-centric AI design is not merely an ethical aspiration but a structural precondition for realising the full productivity and sustainability potential of advanced

manufacturing systems. *Jarvis et al. (2023)* examine the transition from Industry 4.0 to Industry 5.0 through the lens of sociotechnical regime theory, identifying trust and autonomy as regime-level factors that must be actively governed: as AI systems acquire greater decision-making autonomy, the governance mechanisms that regulate that autonomy become load-bearing elements of the industrial system rather than optional supplements.

Ben Youssef and Mejri (2023), drawing on a bibliometric review of 300 Scopus papers, confirm that ethical AI has emerged as the fastest-growing sub-theme within Industry 5.0 research, signalling a broad scholarly consensus that AI governance is central rather than peripheral to the paradigm's realisation. *Tóth et al. (2023)* and *Agote-Garrido et al. (2024)* further show how human-AI collaboration architectures operationalise this requirement at the firm level. *Tóth et al. (2023)* propose a structured human-AI collaboration architecture in which role boundaries, decision rights, and accountability chains are explicitly defined, ensuring that human oversight is preserved even as AI systems assume greater operational responsibility. *Agote-Garrido et al. (2024)* demonstrate, in the context of sustainable manufacturing, how the integration of Industry 4.0 digital technologies with Industry 5.0 human-centric values requires governance mechanisms that can reconcile efficiency-oriented AI optimisation with worker autonomy and environmental stewardship. *Alves et al. (2023)*, in their systematic review of the human-centric approach in Industry 5.0, further document the breadth of this governance challenge, identifying a range of organisational, technological, and ethical conditions that must be met for human-AI collaboration to deliver on the paradigm's promises. *Visvizi et al. (2024)* complement this body of evidence by situating Industry 5.0 within a broader Society 5.0 framework, arguing that the governance of AI in industrial settings cannot be decoupled from societal-level policy architectures, and that firms operating within Industry 5.0 must therefore align their internal governance practices with multilevel regulatory and normative expectations. Taken together, these findings establish ethical AI governance not as an optional enhancement but as a structural and irreducible requirement of Industry 5.0 participation.

4 Conclusion

The proposed model advances the literature by integrating three previously separate streams into a unified explanatory framework bounded by the Industry 5.0 context. Positioning AI ethics governance as a dynamic capability — rather than an external constraint — is the key theoretical contribution, consistent with RBV logic (*Jie et al., 2025; Xu et al., 2024*) and with the deliberative governance tradition in business ethics (*Buhmann & Fieseler, 2023*). For managers, the model implies that digital infrastructure investments must be paired with governance infrastructure — ethics boards, algorithmic transparency mechanisms, and impact assessment protocols. Firms neglecting this pairing will encounter ceiling effects: short-term innovation gains offset by reputational, regulatory, and stakeholder-trust costs (*Noronha et al., 2022; Daza & Ilozumba, 2022*).

The model's primary limitation is its conceptual nature. Empirical validation via SEM across industry sectors and geographic contexts is required. Central and Eastern Europe — where digital maturity is heterogeneous and formal AI governance is nascent — represents a high-priority validation site (*Ben Youssef & Mejri, 2023*). Future research should also examine service-sector and public-sector boundary conditions, and test whether the mediation pathway differs by firm size or AI maturity stage (*Visvizi et al., 2024*).

This paper examined how digital maturity and AI ethics governance jointly shape innovation performance in the Industry 5.0 context. Through a narrative/conceptual synthesis of WOS/Scopus sources, four findings were established: digital maturity drives innovation only through mediating capabilities; ethical AI governance is itself a dynamic capability; responsible AI practices mediate the maturity–performance relationship; and Industry 5.0 structurally requires ethical AI governance as a core competence. The proposed conceptual model reframes business ethics from a constraint on innovation to an enabling condition for sustainable, legitimate, and high-performing digital innovation. For policymakers, the findings support incentive structures — procurement criteria, certifications, and funding schemes — that explicitly reward responsible AI governance as a component of Industry 5.0 transition strategies

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The Use of Artificial Intelligence in Marketing Practices in Ukraine

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Abstract: This study examines the role of artificial intelligence in Ukrainian businesses, particularly its impact on marketing effectiveness and competitiveness. It outlines current approaches to using AI tools, identifies key areas of their integration into marketing practice, and summarizes their forecasts regarding further development and use of artificial intelligence in the marketing sector. Based on interviews with specialists, a comparative analysis of practical experience in implementing AI tools was conducted. Common challenges and differences in integration approaches were identified. Special attention is given to barriers in the Ukrainian context, including insufficient processing in Ukrainian, technical instability, and the limited relevance and practical value of generated content.

Keywords: Artificial Intelligence · Marketing · Ukraine · Expert reviews · Thematic analysis

1 Introduction

Artificial intelligence has significantly transformed marketing practices worldwide, ranging from content generation and data analysis to customer segmentation and personalization (Huang & Rust, 2021). An increasing number of companies are adopting AI technologies to improve efficiency, competitiveness, and overall performance (Davenport, Guha, Grewal, & Bressgott, 2020).

Ukraine represents a particularly interesting case for examining AI adoption. The country is currently adapting to several simultaneous challenges, including accelerated digitalization, resource constraints, and the conditions of a wartime economy. These circumstances create both a strong demand for technological innovation and significant barriers to its implementation. Although Ukrainian companies are actively exploring the potential of artificial intelligence, there is still limited empirical research documenting how marketing professionals in Ukraine actually use AI-based tools, what challenges they encounter, and how they perceive the future role of AI in their field.

The aim of this study is to address this gap by examining the perspectives of two Ukrainian professionals: an academic involved in educating future marketing specialists and a marketing practitioner working in a manufacturing company where AI technologies are already being applied.

The study seeks to answer the following research question: “How do Ukrainian marketing professionals perceive the role, challenges, and future prospects of artificial intelligence in their professional practice?”. To address this question, two semi-structured interviews with experts from Ukraine were conducted and analysed using thematic analysis.

2 Aim and methods

2.1 Research aim

The aim of this study is to explore perceptions of the implementation of artificial intelligence technologies in marketing activities in Ukraine and to explore how marketing professionals perceive the influence of artificial intelligence on marketing practices, communication, education, and professional competencies.

The study focuses on the role of AI in contemporary marketing, the benefits and limitations of its use, barriers to its adoption in Ukrainian companies, and its influence on marketing education and professional practice.

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2.2 Data collection

The study adhered to fundamental ethical principles. Participation was voluntary, and all respondents were informed about the purpose of the research and the intended use of the collected data prior to the interviews. To ensure confidentiality, no personal information is disclosed in this paper. All collected materials were used exclusively for research purposes.

To achieve the research objective, two semi-structured interviews were conducted with professionals representing both the academic and practical perspectives on marketing. Participants were selected using purposive sampling based on their professional experience with artificial intelligence in marketing and their ability to provide informed insights into AI implementation in the Ukrainian context. The selection criteria included active involvement in marketing practice or marketing education, practical experience with the application of AI tools in marketing-related activities, and familiarity with the opportunities and challenges associated with AI adoption. One participant is a university lecturer specialising in marketing and marketing education, while the second participant is a marketing specialist employed in a Ukrainian manufacturing company where AI tools are actively used in marketing activities. Both participants possess direct professional experience relevant to the research topic and were therefore considered appropriate expert informants. Given the exploratory nature of this qualitative study, the purpose of the interviews was to obtain in-depth expert insights rather than statistically generalisable findings.

Data collection took place in May 2026. The interviews were conducted in Ukrainian, audio-recorded, and subsequently transcribed verbatim. In addition, field notes were taken during the interviews to provide contextual clarification of selected statements.

The data were analysed using thematic analysis (Braun & Clarke, 2006). This method enables the systematic identification of recurring ideas and patterns within qualitative data. The interview transcripts were analysed using thematic analysis following the approach proposed by Braun and Clarke (2006). After familiarisation with the data, the transcripts were coded to identify recurring ideas and patterns. These codes were subsequently grouped into broader themes corresponding to the research objectives. The resulting themes formed the basis for the presentation and interpretation of the findings. Based on the coding process, key themes were identified that reflected respondents' perceptions of the use of artificial intelligence in marketing.

3 Results

The thematic analysis of the interviews identified four main themes: the perception of artificial intelligence as a supportive tool, barriers to its use, expectations regarding the future development of the technology, and ethical considerations related to its implementation.

3.1 Artificial Intelligence as a Supportive Tool Rather Than a Replacement for Professionals

Both respondents viewed artificial intelligence as a tool that assists with specific tasks rather than as a technology capable of fully replacing human professionals. The participants noted that AI can accelerate workflows, analyse data, and provide recommendations; however, the final outcome still depends on the expertise and judgement of the user.

Respondent 2, a marketing practitioner working in the manufacturing sector, emphasised the current limitations of AI in the workplace: "At this stage, it does not replace a single position in our production process" (Respondent 2, personal interview, May 20, 2026, author's translation).

Respondent 1 also highlighted the importance of human oversight and critical evaluation of AI-generated outputs: "Not all of us are able to critically rethink and evaluate the information. Either we learn how to do this, or the technology will simply be used inefficiently" (Respondent 1, personal interview, May 10, 2026, author's translation).

These findings indicate that the participants perceive AI as a means of increasing efficiency rather than as a substitute for professional knowledge, experience, and creativity. This finding is consistent with the research of Huang and Rust (2021), who argue that artificial intelligence in marketing is more commonly used to support decision-making and automate specific processes than to fully replace human specialists.

3.2 Barriers to the Use of Artificial Intelligence

The second theme concerned the limitations that users encounter when working with artificial intelligence. The most frequently mentioned issues included language-related challenges of AI models, the need for content editing, and the significant differences between free and paid versions of AI services.

Respondent 2 noted that the quality of responses often depends on the language used in the prompt: “It still performs better in English. We explained various terms to it, such as *zakrepka* and *polotno*. It does not understand these terms.” (Respondent 2, personal interview, May 20, 2026, author’s translation).

In addition, the interview participants emphasized the need to revise and refine materials generated by artificial intelligence: “Artificial intelligence is useless without human involvement.”, “My main message is clear: we use it, but we think independently.” (Respondent 1, personal interview, May 10, 2026, author’s translation).

A distinction between free and paid tools was also highlighted: “Even if we take ChatGPT as an example, something simple—when we use the same prompt in the free and paid versions, the quality of the answers is completely different. Therefore, I believe that cost is one of the barriers.” (Respondent 1, personal interview, May 10, 2026, author’s translation).

Both respondents also emphasized the importance of properly formulating prompts and critically evaluating the generated results, suggesting that AI-related competencies are among the key factors for the successful use of the technology.

Thus, the primary barriers are associated not only with the technical limitations of the tools themselves but also with the level of user preparedness. Similar conclusions were presented by Dwivedi et al. (2023), who emphasized the importance of developing AI literacy and critical evaluation skills when working with AI-generated outputs.

3.3 Future Development of Artificial Intelligence

The third theme concerns respondents’ expectations regarding the future development of artificial intelligence and its integration into professional practice. Both participants viewed AI not as a temporary trend but as a technology that will gradually become a standard tool in marketing, business, and education.

Respondent 1 compared artificial intelligence to other digital tools that have become an integral part of everyday work processes over time: “We all use computers. We use Excel for calculations, Word for writing texts, and CRM systems in our daily work. Artificial intelligence will be used in the same way” (Respondent 1, personal interview, May 10, 2026, author’s translation).

According to the respondent, the widespread adoption of AI has the potential to improve organizational efficiency and enhance interactions with customers. At the same time, she emphasized that these benefits can only be achieved through the proper use of the technology and adequate user training: “It is just another tool that requires experience and knowledge in order to be integrated and used effectively in professional practice” (Respondent 1, personal interview, May 10, 2026, author’s translation).

The respondents also identified changes in education as an important aspect of the future development of AI. In the expert’s view, the ability to work with artificial intelligence tools is gradually becoming an essential component of marketing education: “Marketing without artificial intelligence will fall behind. Those who do not use it will be left behind” (Respondent 1, personal interview, May 10, 2026, author’s translation).

Both respondents noted that the future expansion of artificial intelligence will depend not only on technological progress but also on professionals’ willingness to learn new tools and use them responsibly. Therefore, the participants expect AI to become increasingly integrated into everyday professional practice and regard it as one of the key elements shaping the future of marketing.

3.4 Ethical Considerations and Public Perceptions of Artificial Intelligence

The fourth theme concerns ethical issues related to the use of artificial intelligence and public attitudes towards the technology. During the interviews, respondents discussed data privacy, responsibility for AI-generated outputs, and the level of public awareness of the risks associated with AI.

Both participants emphasized that the use of artificial intelligence requires ongoing human oversight. Despite AI’s ability to generate texts, analyse data, and provide recommendations, responsibility for the quality and

accuracy of the final output remains with the user. According to the respondents, it is the responsibility of individuals to verify information and make final decisions based on it.

Data privacy was also identified as an important aspect of AI use. Respondent 2 noted that she deliberately limits the amount of information shared with artificial intelligence systems: “I do not provide it with any information that I am concerned about. My communication with it is structured in such a way that it cannot obtain anything sensitive from me. I only discuss matters that are necessary for my work” (Respondent 2, personal interview, May 20, 2026, author’s translation).

At the same time, the respondent pointed out that issues related to data protection and AI ethics are not yet widely discussed among the general public. In her view, many people do not consider these risks because they do not use artificial intelligence in their everyday lives: “People who do not use it simply do not need it” (Respondent 2, personal interview, May 20, 2026, author’s translation).

The respondents did not view ethical concerns as a major barrier to the further adoption of artificial intelligence. Instead, they emphasized the importance of responsible use of the technology, the development of digital literacy, and the cultivation of skills necessary for the critical evaluation of AI-generated outputs.

These findings are consistent with the conclusions of Jobin, Ienca, and Vayena (2019), who identify transparency, accountability, and data protection as key themes in contemporary discussions of AI ethics. In both interviews, ethical risks were not perceived as a reason to reject the technology but rather as factors requiring conscious and responsible management.

4 Conclusion

The conducted study identified several common patterns in marketing professionals' perceptions of artificial intelligence. Despite differences in the respondents' professional experience, their assessments of the role and future prospects of AI were largely similar.

The first key theme concerned the perception of artificial intelligence as a support tool rather than a replacement for human workers. Both experts emphasized that AI can improve work efficiency, accelerate routine tasks, and facilitate access to information. However, the final outcome still depends on the specialist's knowledge, experience, and critical thinking skills.

The second theme was related to the existing limitations of the technology. Among the most significant barriers, respondents identified differences in the quality of results when working in Ukrainian and English, the need to review and edit AI-generated content, and the cost of paid tools. Furthermore, both interview participants noted that the effectiveness of AI use directly depends on the user's level of expertise and ability to formulate effective prompts.

The interviews also indicated that the growing use of artificial intelligence is influencing the competencies required from marketing professionals. Both respondents emphasized the importance of developing skills related to prompt formulation, critical evaluation of AI-generated outputs, and the effective integration of AI tools into professional workflows. In addition, AI was perceived as a technology that can support communication-related activities, including content creation and customer interaction, provided that the generated outputs are reviewed and adapted by human specialists.

The third theme concerned expectations regarding the future development of artificial intelligence. The respondents agreed that the current high level of interest in the technology is likely to decrease over time. However, this will not diminish its importance. On the contrary, artificial intelligence is expected to become a standard professional tool and will be increasingly integrated into marketing, education, and business processes.

The experts also paid particular attention to issues of ethics and data privacy. Although both respondents acknowledged the existence of certain risks, they did not view them as serious obstacles to the further adoption of the technology. Instead, they emphasized the importance of responsible AI use and maintaining human oversight. These observations are consistent with global trends; as noted by Jobin, Ienca, and Vayena (2019), the key ethical principles associated with AI include transparency, accountability, and respect for privacy, which further confirms the relevance of a responsible approach within the Ukrainian context.

In conclusion, the main finding of this study is that professionals view artificial intelligence not as a direct replacement for human labor but as a tool whose effectiveness is determined by the competence of its user. Despite

the existing limitations, both experts expect the continued expansion of AI technologies and their transformation into an integral part of everyday professional practice. These findings are consistent with contemporary research that views artificial intelligence as a means of enhancing human professional capabilities rather than replacing them (Davenport et al., 2020; Huang & Rust, 2021).

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Data Integration Ethics in Sustainable Development: Reconciling Macroeconomic Growth with Environmental Stewardship through Information Management

Chinyere Chidera Okechukwu¹, Petra Marešová²

Abstract: This study aims to examine how ethically governed information management reconciles macroeconomic growth with environmental sustainability. Utilizing a method involving a modified Cobb-Douglas production function and fixed effects panel regression on 20-year European data, the main result indicates environmental elasticity is the strongest predictor ($\gamma=0.338$, $p<0.001$), indicating sustainability enhances growth. The study contributes the Ethical Data Sustainability framework, bridging economic performance and institutional governance. It concludes that macroeconomic policies must embed ethical data principles to resolve the growth-stewardship tension, transitioning toward a data-driven economy that serves both present prosperity and future generations by prioritizing robust long-term ecological health.

Keywords: Ethical data governance, Environmental sustainability, Modified Cobb-Douglas, Panel regression, Information management

JEL classification: Q56, O47, C23

1 Introduction

The relationship between macroeconomic growth and environmental sustainability constitutes a pressing ethical challenge. Economic development has historically been associated with increased resource consumption and carbon emissions, creating tensions between present prosperity and the wellbeing of future generations (Stern & Stiglitz, 2023; IPCC, 2022). Data has emerged as a new factor of production with the potential to reshape how economies balance growth with environmental stewardship (Feroz et al., 2021; Pantović et al., 2024). Advances in big data analytics further underscore the role of information systems in sustainable policy design (Wencan & Wei, 2024). The integration of data-driven frameworks holds promise for achieving the Sustainable Development Goals while maintaining economic performance (Popkova et al., 2022), yet the ethical dimensions remain underexplored (Koskinen et al., 2023; Floridi, 2023; Stahl, 2021). The EU AI Act (European Commission, 2024) represents a regulatory milestone, but sustainability mandates in data governance remain fragmented.

Existing literature addresses data-driven decision making (Pantović et al., 2024), digital transformation and environmental sustainability (Feroz et al., 2021), and data economy governance (Koskinen et al., 2023) as separate streams. However, a critical gap persists at their intersection: no framework explicitly integrates ethical governance principles into data-driven sustainability within macroeconomic growth models. Production functions typically omit environmental input as a productive factor, and TFP specifications rarely incorporate governance quality alongside innovation capacity.

2 Aim and methods

The aim of this study is to address this gap by developing and empirically testing an integrated framework that links ethical data governance to macroeconomic performance and environmental outcomes. Specifically, the study constructs a modified Cobb-Douglas production function with an explicit environmental variable and a composite TFP index operationalizing both data-driven innovation and ethical governance quality. Three research questions

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guide the inquiry: RQ1: How does ethically governed information management influence sustainable economic development? RQ2: What role does data integration play in reducing the trade-offs between economic growth and environmental preservation? RQ3: How can macroeconomic policies incorporate data-driven sustainability frameworks grounded in ethical principles? The paper contributes a novel Ethical Data Sustainability (EDS) framework, a modified Cobb-Douglas production function estimated on 20-year panel data, and comparative evidence from five European economies.

The theoretical foundation integrates four perspectives. Endogenous growth theory posits that data and information management represent knowledge capital accelerating innovation (Chang et al., 2024). The non-rival nature of data introduces ethical questions about equitable access (Cong et al., 2021; Yang et al., 2024). The Environmental Kuznets Curve (EKC) hypothesis suggests digital technologies compress the EKC timeline through environmental monitoring (Gan et al., 2021; Muratoğlu et al., 2024). Figure 2 illustrates how ethical data governance accelerates the transition from environmental degradation to improvement, with each country positioned along the curve. Digitalization reduces carbon footprints when supported by governance structures (Škare et al., 2024). Circular economy theory advocates systemic resource efficiency (Liu et al., 2022; Chauhan et al., 2022; Akarsu, 2024), though data infrastructure raises concerns about data ownership (Koskinen et al., 2023). Building on the Solow model extended by Barbier and Burgess (2023), we propose a modified Cobb-Douglas production function (Figure 1):

$$Y = A \cdot K^{\alpha} \cdot L^{\beta} \cdot E^{\gamma} \quad (1)$$

where Y = total output, GDP per capita

A = total factor productivity (TFP) encompassing data-driven innovations and ethical governance quality

K = capital input,

L = labour input,

E = environmental input (energy efficiency, renewable resource utilization, environmental quality)

α, β, γ = the respective output elasticities

The sum $\alpha + \beta + \gamma$ indicates returns to scale, while the environmental elasticity γ measures the sensitivity of output to environmental quality. Critically, the TFP parameter A captures the productivity enhancing effects of ethical data governance, including improved information transparency and reduced decision-making asymmetries.

Based on this framework, four hypotheses are proposed:

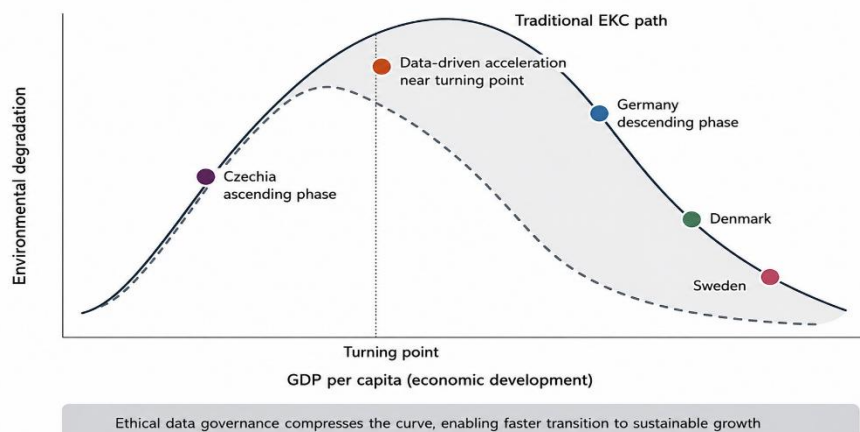
H1: Environmental input has a positive and significant effect on GDP per capita ($\gamma > 0, p < 0.05$), indicating that sustainability enhances rather than constrains growth.

H2: Labour input has the largest conventional elasticity ($\beta > \alpha$), consistent with endogenous growth theory.

H3: Composite TFP is the strongest bivariate correlate of GDP, but its fixed effects coefficient is absorbed by country-level institutional structures.

H4: Countries with higher composite TFP exhibit simultaneously higher GDP growth and lower GHG emission trends over 2005 to 2024.

Figure 2 Environmental Kuznets Curve with data-driven acceleration and country positioning



Source: Processed by the authors based on Grossman & Krueger (1995), Gan et al. (2021).

The study employs a fixed effects panel regression on secondary data from Eurostat and the OECD covering 2005 to 2024 for Czechia, Denmark, Germany, Spain, and Sweden (N=100). These countries represent diverse economic structures, varying digital maturity, and distinct sustainability trajectories. The dependent variable is $\ln(\text{GDP per capita})$ in current euros. Independent variables are $\ln(\text{GFCF as \% of GDP})$ for capital, $\ln(\text{employment rate})$ for labour, and $\ln(\text{renewable energy share})$ for environmental input. Data sources: Eurostat [nama_10_pc], [sdg_13_10], [nrg_ind_ren], [nama_10_an6], [lfsi_emp_a], [rd_e_gerd_tot], World Bank Worldwide Governance Indicators, and OECD Data Explorer (2025).

The TFP parameter A is operationalized as a composite index capturing data-driven innovation and ethical governance quality, constructed from four equally weighted components, each min-max normalized to a 0 to 1 scale: (1) R&D expenditure (% GDP); (2) internet usage (% population); (3) ICT specialists (% employment); and (4) government effectiveness (World Bank WGI). This composite directly operationalizes the EDS framework's claim that TFP is jointly determined by technological innovation and governance quality. Table 1 presents descriptive indicators, Table 2 presents the composite scores, and Figure 3 visualizes the component structure across countries.

Table 1 Descriptive Country Indicators (2024)

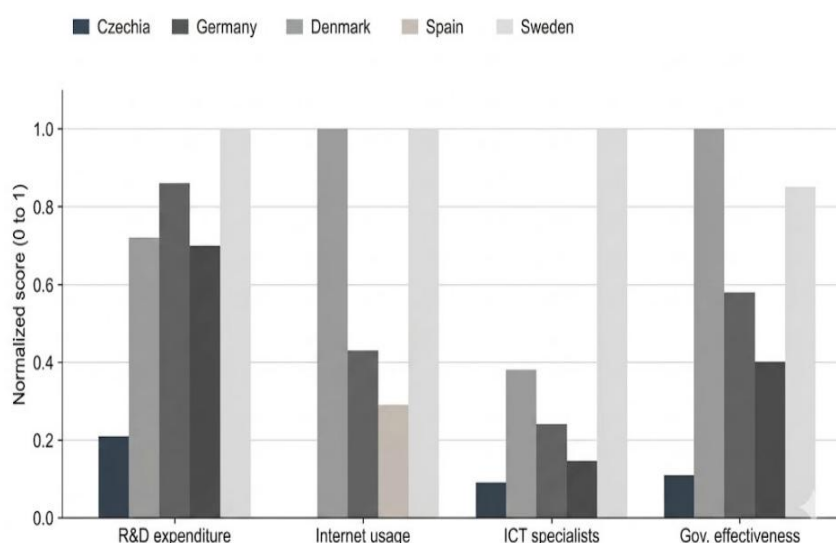
Indicator	Czechia	Denmark	Germany	Spain	Sweden
GDP/capita (€)	29,330	58,500	46,800	30,200	56,000
GHG (t/capita)	10.5	6.8	8.5	6.0	4.0
Renewable (%)	19.0	44.0	23.0	24.0	68.0
GFCF (% GDP)	27.2	23.2	21.3	20.5	25.5
Employment (%)	76.0	78.2	77.2	65.5	79.2
R&D (% GDP)	1.90	2.90	3.18	1.50	3.45

Source: Eurostat and OECD, 2024.

Table 2 Composite TFP Index (A), 2024 (min-max normalized, 0 to 1)

Component	Czechia	Denmark	Germany	Spain	Sweden
R&D (norm.)	0.21	0.72	0.86	0.00	1.00
Internet (norm.)	0.00	1.00	0.43	0.29	1.00
ICT specialists (norm.)	0.09	0.38	0.24	0.00	1.00
Gov. effectiveness (norm.)	0.11	1.00	0.58	0.00	0.85
Composite A (0 to 1)	0.10	0.77	0.53	0.07	0.96
Rank	4th	2nd	3rd	5th	1st

Source: Eurostat, World Bank WGI. Equal weighted average of four normalized components.

Figure 3 Components of the Composite TFP Index (A) by Country, 2024 (normalized 0 to 1 scale)

Source: Eurostat, World Bank WGI. Processed by the authors

The log linearized specification is: $\ln(Y) = c + \alpha \cdot \ln(K) + \beta \cdot \ln(L) + \gamma \cdot \ln(E) + \delta \cdot \ln(A) + \text{country FE} + \varepsilon$. Country fixed effects control for time invariant heterogeneity. Supplementary analyses include Pearson correlation matrices and country-level linear trend regressions.

3 Results

Table 3 presents the fixed effects panel regression results. The model explains 97.7% of the variation in GDP per capita ($R^2=0.977$, $F=477.69$, $p<0.001$), with all production factor elasticities significant at $p<0.01$.

Table 3 Fixed Effects Panel Regression (2005 to 2024, N=100)

Variable	Coeff.	Std. Err.	t stat.	p value	Sig.
Constant	3.571	0.905	3.95	<0.001	***
α (Capital: $\ln$ GFCF)	0.375	0.123	3.06	0.003	***
β (Labour: $\ln$ Empl.)	0.984	0.275	3.58	<0.001	***
γ (Environment: $\ln$ Renew.)	0.338	0.038	8.96	<0.001	***
δ (TFP: $\ln$ Composite A)	0.062	0.045	1.37	0.174	
R^2 / Adj. R^2	0.977	0.975			
F statistic	477.69	($p<0.001$)			

Source: Processed by the authors..

Regarding H1, the environmental elasticity $\gamma=0.338$ ($t=8.96$, $p<0.001$) is positive and strongly significant (Table 3), confirming that a 1% increase in renewable energy share is associated with a 0.34% increase in GDP per capita. This directly answers RQ2: data integration significantly reduces the growth sustainability tradeoff. Sweden (68.0% renewable, Table 1) and Denmark (44.0%) simultaneously achieve the highest GDP per capita and lowest emissions. H1 is supported.

Regarding H2, the labour elasticity $\beta=0.984$ exceeds the capital elasticity $\alpha=0.375$, with both significant at $p<0.01$ (Table 3), consistent with endogenous growth theory (Chang et al., 2024). H2 is supported.

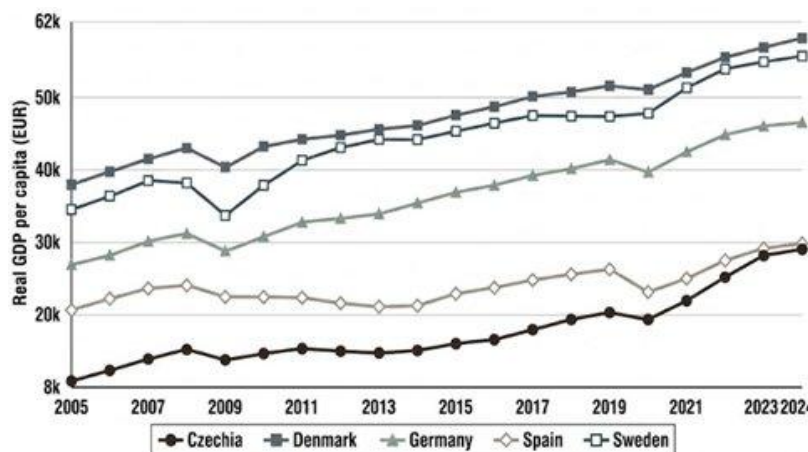
Regarding H3, the composite TFP index correlates at $r=0.911$ with GDP (Table 4), the strongest bivariate association. However, its individual coefficient ($\delta=0.062$, $p=0.174$) is absorbed by country fixed effects that capture persistent governance differences. The country dummies (DK=0.683, DE=0.716, ES=0.481, SE=0.346, all $p<0.001$) jointly represent the governance channel. This answers RQ1: ethically governed information management influences sustainable development through the persistent institutional quality of governance systems. H3 is supported.

Table 4 Pearson Correlation Matrix (N=100)

	GDP/cap	GHG/cap	Renew.	TFP(A)	Empl.	GFCF
GDP/cap	1.000					
GHG/cap	-0.552	1.000				
Renewable	0.731	-0.793	1.000			
TFP (A)	0.911	-0.484	0.775	1.000		
Employment	0.726	-0.099	0.540	0.833	1.000	
GFCF	-0.307	0.195	0.055	-0.274	0.098	1.000

Source: Eurostat, OECD, World Bank WGI, 2005 to 2024.

Figure 4 Real GDP per capita trajectories (2005 to 2024)

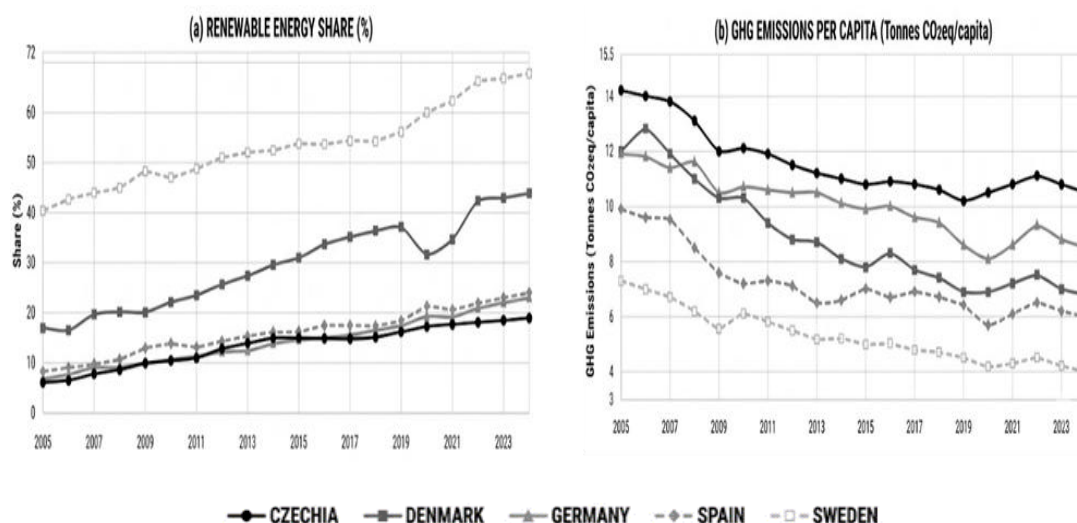


Source: Eurostat [nama_10_pc]. Processed by the authors.

Regarding H4, Figure 4 shows Sweden ($A=0.96$) achieves the fastest GDP growth (+1,082 EUR/yr) alongside the steepest emission decline, while Denmark ($A=0.77$) leads renewable expansion (+1.44 pp/yr) and decarbonization (-0.30 t/yr). Czechia ($A=0.10$) and Spain ($A=0.07$) show the slowest GDP growth (+776 and +340 EUR/yr). Figure 5 visualizes the renewable energy expansion and emission decline across all five countries, directly illustrating the inverse relationship captured by the correlation $r=-0.793$ (Table 4). Spain's case highlights the ethical tension at the core of the EDS framework: low emissions (6.0 t/capita, Table 1) coexist with the lowest employment (65.5%), demonstrating that sustainability outcomes must be evaluated alongside distributional consequences (Dai et al.,

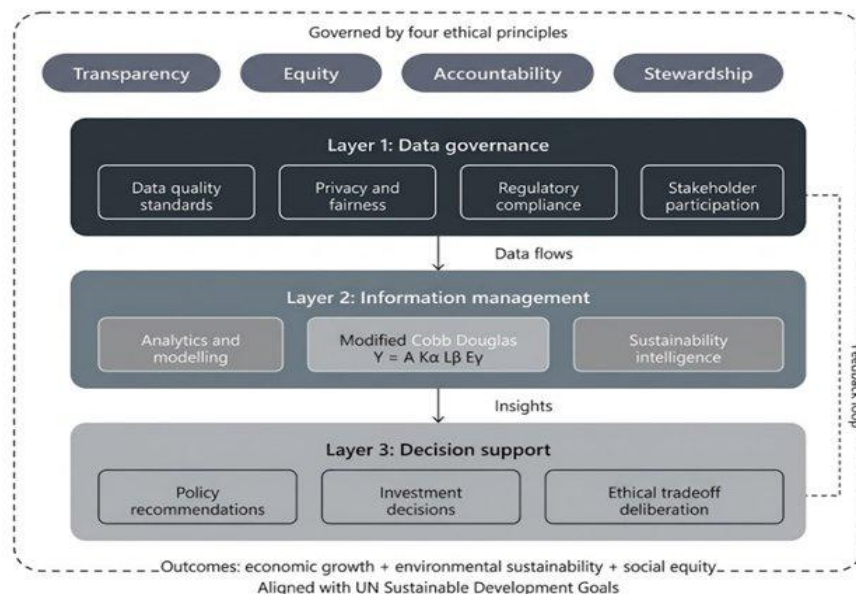
2024; Yi et al., 2022). As shown in Figure 2, Spain is near the EKC turning point, while Sweden and Denmark have progressed well into the descending phase. H4 is supported.

Figure 5(a) Renewable Energy Share (%) and (b) GHG Emissions (t/capita), 2005 to 2024



Source: Eurostat [nrg_ind_ren], [sdg_13_10]. Processed by the authors.

Figure 6 Ethical Data Sustainability (EDS) Framework: three layers and four ethical principles



Source: Processed by the authors.

Figure 6 presents the EDS framework that organizes the empirical findings. The data governance layer (Layer 1) encompasses the institutional structures captured by the composite TFP index (Table 2) and the country fixed effects (Table 3). The information management layer (Layer 2) incorporates the modified Cobb-Douglas function, where the elasticities α , β , γ quantify how inputs translate into output. The decision support layer (Layer 3) translates insights into policy. The feedback loop ensures continuous alignment between governance structures and sustainability outcomes. This architecture directly answers RQ3: macroeconomic policies can incorporate data-driven sustainability frameworks by embedding the four ethical principles (transparency, equity,

accountability, stewardship) across all three layers, using the composite TFP as a governance benchmark and the environmental elasticity as an evidence-based target.

4 Conclusion

The results support all four hypotheses and provide direct answers to the three research questions. The environmental elasticity of 0.338 (H1) answers RQ2 with quantitative evidence that a 1% increase in renewable energy share yields a 0.34% GDP increase. The composite TFP's $r=0.911$ correlation with GDP yet insignificance in the fixed effects model (H3) answers RQ1 by revealing that ethical governance operates through persistent institutional structures. The EDS framework (Figure 6) answers RQ3 by providing a three layer architecture through which policymakers can embed ethical principles into sustainability strategies.

This study makes three contributions to the literature gap identified in Section 1. First, the EDS framework (Figure 6) is the first to explicitly integrate ethical governance principles into a macroeconomic production function context, bridging the separate literatures on data economy governance (Koskinen et al., 2023), digital sustainability (Feroz et al., 2021), and growth theory (Chang et al., 2024). Second, the composite TFP index (Table 2, Figure 3) operationalizes data-driven innovation and governance quality as a single measurable construct, addressing the methodological gap of R&D only TFP proxies. Third, the 20 year panel estimation (Table 3, Figures 4 and 5) provides the first comparative evidence linking composite governance scores to simultaneous GDP growth and decarbonization trajectories, filling the empirical gap identified by Pantović et al. (2024) and Popkova et al. (2022).

The sum $\alpha + \beta + \gamma = 1.697$ indicates increasing returns to scale. The strong negative correlation between GHG and renewable energy ($r=-0.793$, Table 4) confirms clean energy as the primary decarbonization mechanism. Germany's recycling leadership (69.2%) demonstrates how digital technologies applied to circular economy systems yield measurable gains (Liu et al., 2022; Akarsu, 2024). Policy implications: the strong environmental elasticity justifies renewable energy investment as both environmental and economic policy. Governments should establish data ethics commissions with sustainability mandates. Investment in data literacy for less digitally mature economies (Czechia $A=0.10$, Spain $A=0.07$) is essential to prevent sustainability data divides. The principal limitation is reliance on aggregate country-level data; future research should employ instrumental variable approaches, agent based modelling, and micro level panel data.

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From Black Box to Glass Box: Business Ethics and Gender Fairness in AI-Automated Corporate Digital Communication

Chinyere Chidera Okechukwu¹, Hana Mohelská²

Abstract: This research aims to examine how enterprise AI systems structurally reproduce gender bias in corporate reporting across diverse regional contexts. Utilizing a methodology centered on the content analysis of twenty corporate reports from the USA, Europe, and Africa via WEAT-based bias scoring, the main results reveal that Western firms record significantly higher bias ($M=3.87$) than African counterparts ($M=1.20$; $t=9.07$, $p<0.001$), indicating systemic algorithmic impression management. The study contributes “Enterprise System Blind Spot” and “Africa Exclusion” frameworks, positioning Ubuntu governance as ethical resistance. It concludes that stakeholders must implement human-in-the-loop reviews to transition from black boxes toward transparent accountable glass boxes

Keywords: Algorithmic Accountability, Gender Bias, Enterprise-AI Systems, Corporate Reporting, Ubuntu Governance

JEI classification: M14, O33, D63

1 Introduction

Corporate communication is being reshaped as artificial intelligence becomes embedded in enterprise systems, automating the production of sustainability disclosures and executive narratives through platforms such as SAP, Oracle, and Salesforce (Caliskan et al., 2017; Souto-Romero et al., 2024). While this shift promises efficiency, it raises questions of algorithmic accountability: AI systems trained on decades of male-dominated, Western-centric corporate texts risk reproducing historical biases. Operating behind corporate firewalls, these systems generate documents that shape regulation, investment, and legitimacy, yet remain invisible to bias researchers (Masiero, et al., 2024). Masculine-coded language marginalizes female leadership and distorts corporate social responsibility narratives (Newstead et al., 2023; Pimentel & Palomino, 2025). These risks are compounded by the deployment of Western-trained AI across African firms, threatening Ubuntu-based governance and reinforcing algorithmic colonialism (Osinubi et al., 2026; Broodryk, 2006; Metz, 2011).

AI systems amplify gender stereotypes across domains: 86% of AI-generated cardiologists are male (Currie et al., 2024), 76% of AI professional visuals feature men versus 8% women (Gorska & Jemielniak, 2023), and LLMs performatively amplify non-inclusive scripts (Gross, 2023). Within enterprises, bias is driven by training data reflecting decades of male-dominated leadership (Guilbeault & Delecourt, 2025; Parthasarathy & Padmapriya, 2023). Corporate reporting amplifies these dynamics through AI-driven impression management risking standardization and greenwashing (Merkl-Davies & Brennan, 2007; Sneideriene, et al. (2025)). Western regulatory frameworks dominate, marginalizing African contexts despite rapid ERP adoption and Ubuntu philosophy (Broodryk, 2006; Metz, 2011; Ngeetane-Vika & Pule, 2025). While scholarship documents AI bias in consumer-facing applications (Gorska & Jemielniak, 2023; Achtari et al., 2024), a critical gap persists in understanding enterprise AI bias in corporate reporting. Enterprise platforms such as SAP S/4HANA and Salesforce Einstein function as black boxes (Settibathini, 2025). Moreover, African contexts and Ubuntu governance are systematically excluded from AI ethics scholarship.

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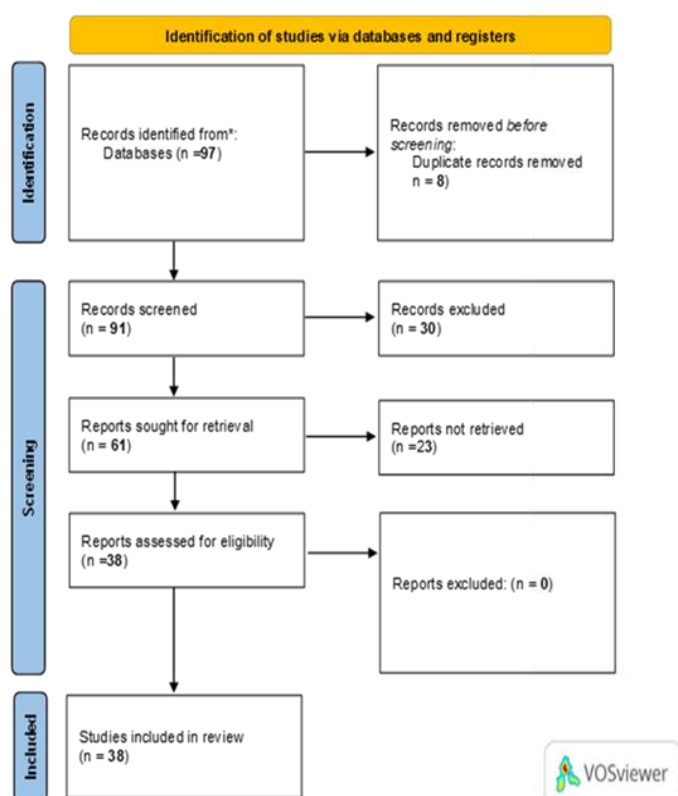
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2 Aim and methods

This study addresses these gaps by: (1) providing the first cross-regional comparison of gender bias in AI-mediated corporate reporting across 20 firms; (2) introducing the Enterprise System Blind Spot and the Africa Exclusion as novel theoretical concepts; and (3) demonstrating Ubuntu governance as an ethical counterweight to algorithmic bias. Two research questions guide the inquiry: RQ1: How do AI-driven enterprise systems function as algorithmic impression managers that reproduce gendered patterns across regions? RQ2: What role does Ubuntu governance play in mitigating embedded gender bias in AI-generated corporate reporting?

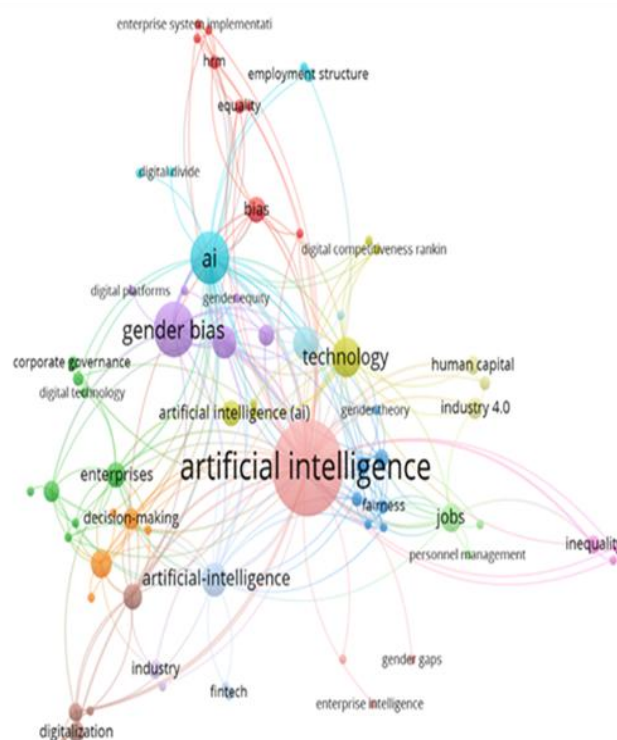
The framework combines Impression Management theory (Schopmans & Cupac, 2021) with a postcolonial technology perspective (Barry & Stephenson, 2025; Bouko et al., 2025). The PRISMA flow diagram summarizes the systematic literature selection process. A structured search targeting digital inequality, enterprise systems, gender, and artificial intelligence identified 97 English-language records (2015 to 2025). After removing duplicates and screening titles and abstracts, 61 articles remained for full-text assessment. Of these, 38 studies met all eligibility criteria and were included in the final analysis. This transparent filtering process ensures the reliability and relevance of the evidence base. (Figure 1) See Appendix for detailed findings.

Figure 1: PRISMA Flow Diagram of Systematic Literature Selection



Source: Processed by the authors

Figure 2: VOSviewer bibliometric



A comparative cross-regional content analysis was applied to a purposive sample of twenty corporate reports (FY2025), stratified by region: USA Tech (n = 7: Salesforce, Oracle, Microsoft, IBM, ServiceNow, Pfizer, Amazon), Europe ERP (n = 8: SAP, Siemens, Deutsche Telekom, Atlassian, Novo Nordisk, Unilever, Nestlé, Accenture), and Africa (n = 5: Aspen Pharmacare, MTN Group, Naspers/Prosus, Standard Bank, Vodacom). A Simplified Bias Scoring System (1 to 5) grounded in WEAT principles (Garg et al., 2018) was applied: high bias (4 to 5) indicates masculine-coded, agentic narratives; low bias (1 to 2) indicates communal, female-coded narratives; neutral (3) indicates balanced representation. DEI sections were extracted, coded for the top five gender-associated terms, contextually analysed, and scored. The analysis interprets findings through technological determinism and cultural institutionalism. The coding followed a structured protocol with predefined keyword categories grounded in established gendered language research (Caliskan et al., 2017), applied consistently across all 20 reports to ensure procedural reliability.

3 Results

Table 1 presents regional summary statistics. Western firms ($n = 15$) record a mean bias of 3.87, a 3.22-fold amplification over African firms ($M = 1.20$).

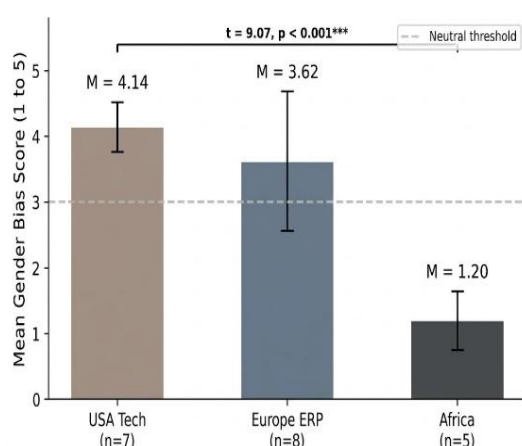
Welch's t-test: $t(17) = 9.07$, $p < 0.001$. One-way ANOVA: $F(2,17) = 24.67$, $p < 0.001$.

Table 1: Regional Summary of Gender Bias Scores (FY2025)

Region	n	Mean	SD	Dominant Narrative	Representative Terms
USA Tech	7	4.14	0.38	Technical Masculinity	CEO, Platform, Lead, AI
Europe ERP	8	3.63	1.06	Technocratic Efficiency	Engineering, Innovation
Africa	5	1.20	0.45	Communal Stewardship	Community, Women, Care
Western (comb.)	15	3.87	0.83		

Source: Processed by the authors

Figure 3: Regional Gender Bias Scores in AI-Enterprise Systems



Source: processed by the authors

In response to **RQ1**, enterprise AI systems function as algorithmic impression managers by generating narratives that systematically privilege masculine-coded language. Salesforce (score 5) exhibited the highest bias. SAP and Siemens (both 4) strongly emphasize engineering and technical leadership, associating CTO roles with male-dominated teams (Settibathini, 2025; Caliskan et al., 2017). Amazon (4) frames AI deployment through chief-architect and executive agency, confirming the Enterprise System Blind Spot: platforms carry distinct fingerprints of gender bias.

The SLR corroborates this: Qiu et al. (2026) identify an algorithmic hierarchy where women are marginalized in operational roles, while Borwein et al. (2024) show women perceive workplace automation as less fair than men. In response to **RQ2**, African firms demonstrate that algorithmic bias is not inevitable. Aspen Pharmacare and MTN Group (both 1.0) frame women as active agents of community transformation, reflecting Ubuntu-based relationality (Broodryk, 2006; Mangaliso, 2001). Nwafor (2024) documents a disconnect between African AI gender goals and implementation, yet the present findings show that when African firms author their own narratives, they produce markedly more inclusive outcomes. Omotubora (2024) extends this: AI fintech improves women's inclusion only when aligned with local needs. Unilever (Europe, score 1) is a significant outlier confirming that cultural orientation can override platform bias. Ubuntu governance thus functions as a cultural shield, preserving inclusive narratives and positioning the Global South as a source of governance innovation (Ngcetane-Vika & Pule, 2025).

Figure 4: Company-Level Gender Bias Scores in AI-Generated Corporate Reports

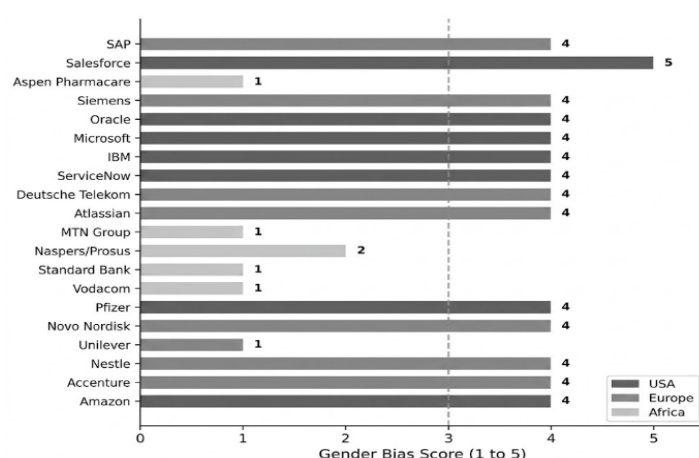


Table 2: Company-Level Gender Bias Scores, FY2025 Reporting Cycle

SN	Company	Region	Sample DEI Text	Key Terms	Score	Note
1	SAP	Europe	CTO leads AI innovation across engineering teams	CTO, AI, engineering	4	high bias (masculine-coded)
2	Salesforce	USA	CEO launched new AI platform for enterprises	CEO, AI	5	high bias (masculine-coded)
3	Aspen Pharma.	Africa	Women lead 48% of community health programs	women, community	1	low bias (communal)
4	Siemens	Europe	Technical leadership drives digital industries	technical, leadership	4	high bias (masculine-coded)
5	Oracle	USA	AI developers power executive cloud strategy	AI, developers, exec.	4	high bias (masculine-coded)
6	Microsoft	USA	Chief engineers accelerated Azure AI rollout	engineers, AI	4	high bias (masculine-coded)
7	IBM	USA	Executive AI council oversees Watson deployment	executive, AI	4	high bias (masculine-coded)
8	ServiceNow	USA	CTO platform serves enterprise leaders globally	CTO, enterprise	4	high bias (masculine-coded)
9	Dt. Telekom	Europe	Engineering excellence powers digital leadership	engineering, leadership	4	high bias (masculine-coded)
10	Atlassian	Europe	Developers drive DevOps leadership innovation	developers, leadership	4	high bias (masculine-coded)
11	MTN Group	Africa	Women empowered through digital community hubs	women, community	1	low bias (communal)
12	Naspers	Africa	Diversity initiatives serve emerging markets	diversity	2	low bias (communal)
13	Standard Bank	Africa	Inclusive banking for women entrepreneurs	women, inclusive	1	low bias (communal)
14	Vodacom	Africa	Female leadership in community connectivity	female, community	1	low bias (communal)
15	Pfizer	USA	Chief scientists lead AI drug discovery	chief, scientists, AI	4	high bias (masculine-coded)
16	Novo Nordisk	Europe	Executive diabetes innovation leadership team	executive, leadership	4	high bias (masculine-coded)
17	Unilever	Europe	Sustainable living plan empowers women globally	women, empowers	1	low bias (communal)
18	Nestlé	Europe	Technical nutrition research leadership center	technical, leadership	4	high bias (masculine-coded)
19	Accenture	Europe	AI consulting leadership serves Fortune 500	AI, leadership	4	high bias (masculine-coded)
20	Amazon	USA	AWS chief architects drive enterprise AI deployment	chief, architects, AI, enterprise	4	high bias (masculine-coded)

Source: processed by the authors

The VOSviewer bibliometric (Fig 2) map positions artificial intelligence as the central concept, directly linked to gender bias, technology, and fairness, confirming that AI systems are a primary site where inequality is produced. Enterprise-related nodes such as "enterprise system implementation" and "corporate governance" appear at the network periphery, validating the Enterprise System Blind Spot: enterprise AI bias remains weakly connected to the core gender bias conversation. Notably, "inequality" is marginal and terms such as "Ubuntu" and "Africa" are absent entirely, providing bibliometric evidence for the Africa Exclusion. The map confirms that this study fills a documented structural gap by integrating enterprise reporting, gender bias, and indigenous governance perspectives into a unified analytical framework.

4 Conclusion

The findings carry three implications for algorithmic accountability. First, high Western bias scores demonstrate encoded discrimination: bias structurally embedded in digital outputs rather than arising from individual intent (Schopmans & Cupac, 2021; Guilbeault & Delecourt, 2025). Second, the privileging of technical language constitutes epistemic injustice, as enterprise AI marginalizes communal narratives (Pimentel & Palomino, 2025; Barry & Stephenson, 2025; Metz, 2011). Third, Ubuntu-grounded reporting demonstrates that organizational culture can function as an ethical filter, and simplified content analysis provides a practical glass-box alternative (Garg et al., 2018; Harvey et al., 2025). Addressing these deficits requires coordinated interventions: organizations must embed human-in-the-loop review into AI-generated ESG outputs (Settibathini, 2025); the EU AI Act must extend to corporate reporting with mandatory AI disclosure statements (European Commission, 2024; OECD, 2024); system developers must diversify training datasets (Aker et al., 2022); and academia must elevate Ubuntu within AI ethics research (Broodryk, 2006; Nwafor, 2024; Omotubora, 2024). This study provides empirical evidence that digital inequality is structurally embedded into corporate communication through AI-enterprise systems. The 3.22-fold bias amplification ($t = 9.07$, $p < 0.001$, $d = 3.49$) demonstrates that enterprise AI platforms function as algorithmic impression managers (RQ1), while Ubuntu governance provides effective ethical resistance (RQ2). Limitations include the sample of twenty reports and the surface-level linguistic approach. Future research should extend the sample, incorporate NLP for automated analysis, and conduct longitudinal tracking. The Recommendations lies in moving from the algorithm's black box to the glass box of human culture and ethical responsibility. Organizations must embed human-in-the-loop review processes into all AI-generated

ESG outputs, supported by simplified content analysis tools enabling early detection of gendered language before publication (Settibathini, 2025).

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APPENDIX: Summary of the SLR

SN	Article Title	Authors & Date	Summary of Key Insights and Findings
1	Impact of entrepreneurial orientation... on financial reporting quality among women artisans	Yadav, US; et al. (Oct 2025)	This study finds that digital technology partially mediates the relationship between AI accounting tools and the quality of financial reporting for female artisans.
2	New Trends in Digital Marketing... on X.com About Metaverse and AI	Blanco-Ruiz, M; et al. (Oct 2024)	Research reveals that the most "liked" content on social media regarding the metaverse often features AI characters that sexualize and objectify women.
3	Towards Inclusive Machine Translation: AI, LGBTQIA+ Terminology, and Gender Bias	Fresno, EH; Antón, MTO (2025)	Analysis of tools like DeepL and ChatGPT shows a persistent bias toward the male gender and concludes that GenAI has not significantly improved translation inclusivity.
4	Gender Mainstreaming into African AI Policies: Egypt, Rwanda and Mauritius	Nwafor, IE (2024)	The study identifies a significant disconnect between gender equality goals and the current implementation of AI strategies in leading African nations.
5	Generative AI Images for Instruction: A Content Analysis	Campbell, LO; et al. (Sept 2025)	A visual audit of AI-generated STEM visuals revealed that 21.3% contained gender bias and 18.9% contained racial bias.
6	AI and algorithmic bias? Field tests on social network with teens	Cecere, G; et al. (Apr 2024)	Field tests indicate that gender-oriented messaging in ads can reduce algorithmic bias but often lowers the overall visibility of the advertisement.
7	Gender Bias in Text-to-Image Generative AI When Representing Cardiologists	Currie, G; et al. (Oct 2024)	When using DALL-E 3, 86% of cardiologists were depicted as male, reinforcing existing workforce disparities through visual communication.
8	Algorithmic bias in anthropomorphic AI: Practice of women media artists	Antonopoulou, C (Oct 2023)	Argues that the underrepresentation of women in AI design leads to feminized assistants that encode gender stereotypes and normative femininity.
9	Gender and AI: Challenges and Imminent Possibilities	Souto-Romero, M; et al. (2024)	The study defines explainability and STEM education as critical future challenges to ensure the responsible and ethical development of AI for women.
10	Raising awareness of sex and gender bias in AI and health	Buslón, N; et al. (Sept 2023)	Highlights the necessity of integrating sex and gender perspectives into public policies to prevent AI from amplifying historical biomedical biases.
11	Gender bias in generative AI text-to-image depiction of medical students	Currie, G; et al. (Nov 2024)	AI-generated images of medical students favor white males, failing to reflect the actual diversity of the Australian medical student body.
12	Female perspectives on algorithmic bias: implications for AI researchers	Fraille-Rojas, B; et al. (Nov 2025)	Female social media users call for intersectional AI systems and are likely to fund entrepreneurial solutions to counter algorithmic injustice.
13	Engines of Patriarchy: Ethical AI in Times of Illiberal Backlash Politics	Schopmans, H; Cupac, J (2021)	Explores how illiberal political actors use veto threats to remove "gender equality" language from international AI standard documents.
14	AI Literacy and Gender Bias: Comparative Perspectives from UK and Indonesia	Tunjungbiru, AD; et al. (Sept 2025)	Findings show UK respondents have more confidence in leadership inclusivity, while Indonesians report more targeted initiatives for women in tech.
15	Nursing students' perceptions of gender and race in AI healthcare imagery	Molu, B (Dec 2025)	Nursing students associate doctors with men and nurses with women in AI visuals, reflecting persistent internal gender schemas despite claiming objectivity.
16	AI algorithms and gendered labor: narratives of female employees in China	Qiu, ZY; et al. (Jan 2026)	Identifies an "algorithm value-driven hierarchy" where women are marginalized in operational roles while men dominate technical AI development.
17	Perpetuation of Gender Bias in Visual Representation of Professions in DALLE and Bing	Sandoval-Martin, T; et al. (May 2024)	Research shows continued objectification and sexualization of women in professional depictions and reinforced stereotypes in children's imagery.
18	The Gendered, Epistemic Injustices of Generative AI	Barry, I; Stephenson, E (Jan 2025)	Applies feminist epistemology to show how gender data gaps lead to hermeneutical injustice, marginalizing women's experiences within AI knowledge.
19	Evaluating AI chatbots for gender-based violence support	Urquijo, BS; et al. (July 2025)	All evaluated models lacked intersectional sensitivity for supporting survivors, though ChatGPT provided the most empathetic responses.
20	Smiling women pitching down: representational and presentational gender biases	Sun, LH; et al. (Jan 2024)	An audit of 15,300 images found that AI underrepresents women in male jobs and more frequently shows them with submissive poses.
21	Understanding and Mitigating Gender Bias in Information Retrieval Systems	Seyedsalehi, S; et al. (2025)	This monograph examines the origins of bias in IR systems and provides data-driven strategies for debiasing neural embeddings.
22	AI for women's financial inclusion: product design in Nigeria	Omotubora, A (2024)	AI-powered fintech can improve inclusion only if services are aligned with the specific needs of underserved women through proactive policy.
23	What ChatGPT Tells Us about Gender: Performativity and Gender Biases	Gross, N (Aug 2023)	Argues that LLMs performatively amplify non-inclusive gender scripts, though they can also be prompted to "undo gender".
24	Gender stereotypes in AI-generated images	Garcia-Ull, FJ; et al. (Sept 2023)	Findings indicate that AI increases human stereotyping; 59.4% of AI images were strongly stereotypical compared to 35% in human-led research.
25	How neoliberalism shapes feminism in AI-Generated visuals	Bouko, C; et al. (Dec 2025)	Generative AI reproduces "neoliberal feminism" by aestheticizing protest and rebranding feminism as a politically sanitized commodity.

26	Dancing With a Loving Chatbot: Power Dynamics Between Women and Their AI Partners	Pan, SY; Mou, Y (June 2025)	Urban Chinese women use AI partners to challenge norms but face risks of harassment and bias channeled from the online world.
27	AI, Stock Photography, and Image Banks: Gender Biases and Stereotypes	Freixa, P; et al. (May 2025)	AI platforms show a closer gender balance than traditional banks but heavily favor younger, Eurocentric aesthetics and ignore disabilities.
28	The gender gap in attitudes toward workplace technological change	Borwein, S; et al. (Apr 2024)	Women perceive automation as less fair than men, which is partially explained by lower self-reported social status and technological knowledge.
29	Race and Gender Bias in Narrative Letters of Recommendation for Plastic Surgery	Yi, VN; et al. (Feb 2025)	AI analysis of professional letters shows female writers emphasize social and emotional qualities more frequently than male writers.
30	How AI can perpetuate - Or help mitigate - Gender bias in leadership	Newstead, T; et al. (Oct-Nov 2023)	AI content can perpetuate leadership-related gender biases, necessitating practical management strategies to ensure corporate equity.
31	Gender Bias in AI's Perception of Cardiovascular Risk	Achtari, M; et al. (Oct 2024)	GPT-4's risk assessment is influenced by psychiatric comorbidities differently for men versus women, indicating biased clinical reasoning.
32	The invisible women: uncovering gender bias in AI-generated images of professionals	Gorska, AM; Jemielniak, D (Nov 2023)	Men were identified in 76% of AI visuals for professions like law and medicine, while women appeared in only 8%.
33	Talking science: Women scientists' engagement in spoken science communication online	Pérez-Llantada, C; et al. (Nov 2025)	Quantitative female researchers show the lowest engagement in online science communication; AI tools for outreach remain underused.
34	Gender and the invisibility of care on Wikipedia	Ford, H; et al. (July 2023)	Wikipedia is less likely to grant pages to women in caring professions compared to sports or politics, marginalizing "feminine" labor in AI training data.
35	Tackling gender disparity and achieving optimal distinctiveness in crowdfunding	Chandna, V; Axelton, Z (May-Jun 2025)	Crowdfunding platforms can empower women by using gender-blind campaigns and dedicated network expansion support.
36	Are women at greater risk after major surgery?	Zindani, S; et al. (Feb 2026)	Analysis shows female patients have higher odds of 30-day mortality and a higher "failure to rescue" rate following surgical complications.
37	Factors causing work related stress... for working women in India	Chandrasekaran, S; et al. (May 2025)	Negative performance feedback is a primary stressor; AI-driven solutions are recommended to help women manage mental well-being.
38	Racial, skin tone, and sex disparities in automated proctoring software	Yoder-Himes, DR; et al. (Sept 2022)	Algorithms used in proctoring are significantly more likely to flag women with the darkest skin tones for "suspicious" behavior.

Ethical Dimensions of Environmental Sustainability Monitoring: Integrating Time Series Forecasting, ESG Principles, and Knowledge Management for Water Use Efficiency in Nigeria and South Africa

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Abstract: This study aims to investigate the ethical dimensions of sustainability monitoring by evaluating water use efficiency in Nigeria and South Africa. Utilizing a method involving ARIMA and ETS time series forecasting (2000–2022) integrated with ESG and knowledge management theory, the main results reveal a significant divergence ($t=4.52$, $p<0.001$); Nigeria projects 42.76% coverage by 2030 while South Africa stagnates at 16.53%. The study contributes a novel four-layer Ethical SDG Monitoring Architecture to global scholarship. It concludes that embedding forecasts within stakeholder-inclusive governance frameworks is essential for transitioning from technocratic opacity toward environmental justice and truly accountable sustainability monitoring practices.

Keywords: Environmental Ethics, ESG, Knowledge Management, Water Use Efficiency, SDG, ARIMA, Ethical AI, Sustainability Monitoring

JEL classification: Q25, C22, M14

1 Introduction

Water scarcity and inefficient water use are binding constraints on sustainable development in Sub Saharan Africa, where climate change, population growth, and rapid urbanization intensify demand and vulnerability (African Development Bank, 2024; World Bank, 2024). Sustainable Development Goal 6 calls for the availability and sustainable management of water and sanitation for all, with target 6.4 emphasizing higher water use efficiency (UN Water, 2022; United Nations, 2024). However, the measurement and projection of progress toward such targets is not ethically neutral. Decisions about which indicators to monitor, which forecasting methods to deploy, and how uncertainty is communicated to policymakers carry ethical implications for intergenerational equity, distributive justice, and the right to water as a human right (Chopra et al., 2024; Floridi et al., 2018). Environmental ethics demands that sustainability monitoring move beyond technocratic measurement toward frameworks embedding values of transparency, accountability, and stakeholder inclusiveness (Vinuesa et al., 2020; Kulkov, 2024).

The Environmental, Social, and Governance (ESG) framework links environmental stewardship to social responsibility and institutional accountability (Chopra et al., 2024; Baratta et al., 2023). Knowledge management (KM) provides the organisational architecture for this integration. Nonaka and Takeuchi's (1995) SECI model describes how tacit knowledge held by domain experts combines with explicit monitoring data to create organisational knowledge (Dalkir, 2017). In the SDG 6.4.1 context, raw time series data must be transformed through statistical modelling into forecasts, which are then embedded within institutional decision frameworks to guide policy. The ethical dimension arises at each stage: data collection must be inclusive, models must be transparent, and knowledge dissemination must reach marginalized stakeholders equitably (Kulkov, 2024). Time series models such as ARIMA and ETS represent algorithmic decision support tools whose outputs influence resource allocation, infrastructure investment, and policy prioritization (Agaj et al., 2024; Box & Jenkins, 1970).

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This study responds to that demand by integrating time series forecasting with ESG principles and knowledge management theory

2 Aim and methods

This study addresses: (i) environmental ethics and sustainability through analysis of water access trajectories; (ii) ethics in the context of digitalization and AI through critical reflection on algorithmic forecasting in policy; and (iii) business ethics and social responsibility through the ESG and KM integration framework. Two research questions guide the inquiry: RQ1: Do Nigeria and South Africa exhibit statistically distinct water use efficiency trajectories that raise ethical concerns about divergent sustainability outcomes? RQ2: How can ESG principles and KM theory be integrated with time series forecasting to support ethically grounded SDG monitoring?

The study formulates two testable hypotheses.

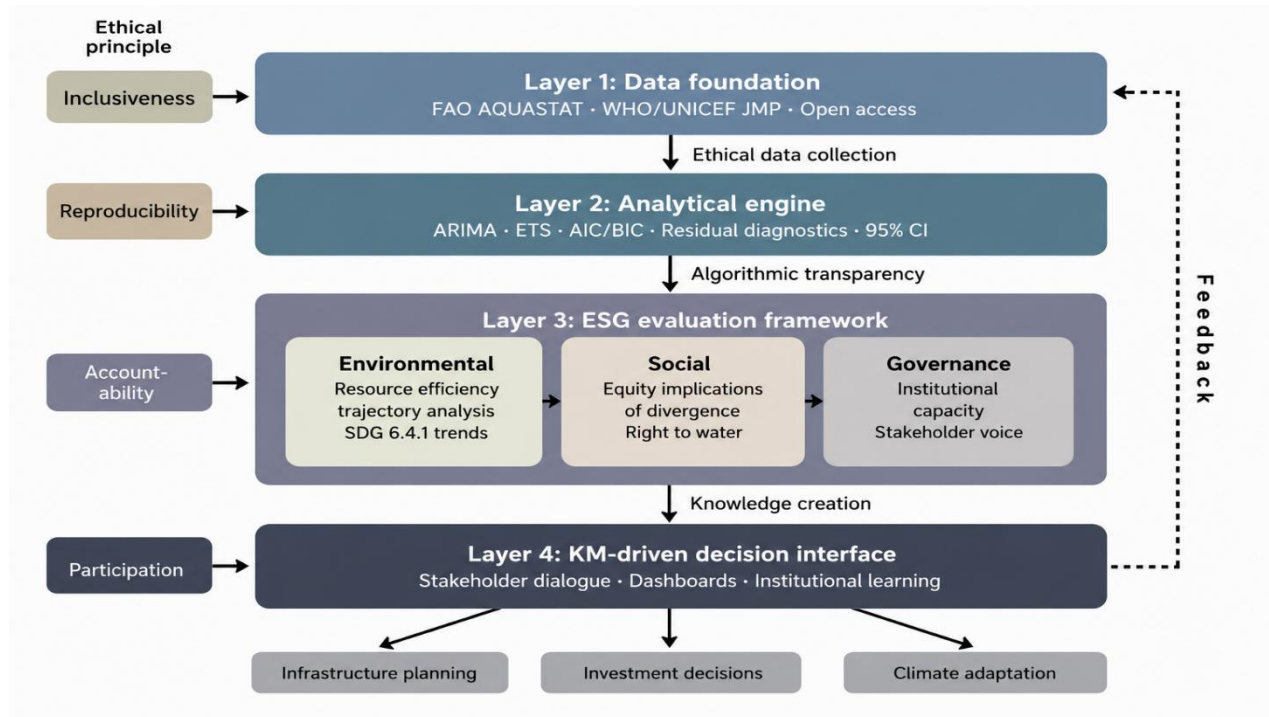
H1: Mean water use efficiency (SDG 6.4.1) in Nigeria differs significantly from that in South Africa over 2000 to 2022.

H2: Nigeria exhibits a significant positive time trend in water use efficiency, while South Africa does not.

H3: ARIMA and ETS models provide statistically adequate forecasts of SDG 6.4.1 for both countries to 2030 with quantified uncertainty.

Annual SDG 6.4.1 data for Nigeria and South Africa (2000 to 2022) were sourced from the FAO AQUASTAT database and corroborated with WHO/UNICEF Joint Monitoring Programme reports, yielding 23 observations per country on the proportion of the population using safely managed drinking water services (FAO, 2025; UN Water, 2024; WHO/UNICEF JMP, 2024). All data are publicly accessible, ensuring reproducibility and democratic scrutiny. The methodology integrates three analytical layers. The first layer comprises descriptive and inferential statistics, including Welch's two sample t test for inter country comparison and country specific linear regression to assess time trends (Welch, 1947). The second layer involves ARIMA and ETS time series modelling following the Box Jenkins approach (Box & Jenkins, 1970), with model selection based on AIC and BIC, residual diagnostics (ACF, Durbin Watson, QQ plots), and forecast generation to 2030 with 95% prediction intervals. The third layer applies an ESG evaluation framework mapping statistical outputs onto Environmental (resource efficiency trajectory), Social (equity implications), and Governance (institutional capacity) dimensions, mediated by KM principles of data transparency and participatory knowledge creation (Nonaka & Takeuchi, 1995; Dalkir, 2017).

Figure 1 Four-layer framework: Data Foundation, Analytical Engine, ESG Evaluation, KM Driven Decision Interface.



Source: Processed by the authors

For Nigeria, the series was made stationary by first differencing ($d = 1$), and an ARIMA (1,1,1) model was selected, with ETS (A, A, N) as the exponential smoothing alternative. For South Africa, the undifferenced series was already stationary ($d = 0$), and ARIMA (2,0,1) was selected, with ETS (M, A, N) preferred for its capacity to capture proportional error patterns. Residual diagnostics confirmed adequacy for both countries: ACF values within 95% bounds, Durbin Watson statistics approaching 2 for the time series specifications, and QQ plots indicating approximate normality.

The ARIMA(p,d,q) model is specified as:

$$Y_t = c + \phi_1 Y'_{t-1} + \dots + \phi_p Y'_{t-p} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \dots + \theta_q \varepsilon_{t-q} \quad (1)$$

Where:

Y_t = water use efficiency (%) at time t ;

Y'_t = the differenced series;

c = the intercept;

$\phi_1 \dots \phi_p$ = autoregressive coefficients on p lagged values;

$\theta_1 \dots \theta_q$ = moving average coefficients on q lagged errors;

d = the differencing order for stationarity; and

ε_t = the white noise error term with mean zero and constant variance (Box and Jenkins, 1970).

Nigeria is specified as ARIMA (1,1,1) and South Africa as ARIMA (2,0,1), selected via AIC/BIC with residuals validated through ACF, Durbin Watson, and QQ diagnostics (Agaj et al., 2024).

3 Results

Table 1 presents descriptive statistics and trend analysis. Nigeria (2000 to 2022) has a mean water efficiency of 23.95% (SD 7.09; range 12.71 to 32.38), while South Africa's mean is 17.15% (SD 1.36; range 15.56 to 19.40). Nigeria's higher mean and larger variance indicate both stronger progress and greater year to year change; South Africa's narrow range reflects long term stagnation around a low plateau.

Table 1 Descriptive Statistics and Trend Analysis (SDG 6.4.1, 2000 to 2022)

Statistic	Nigeria	South Africa	Interpretation
Mean (%)	23.95	17.15	Nigeria 6.8 pp higher
Std. Dev.	7.09	1.36	Nigeria: high variability
Range	12.71 to 32.38	15.56 to 19.40	Nigeria: dynamic; SA: flat
R ² (trend)	0.937***	0.018 (ns)	94% vs 2% explained
Slope (pp/yr)	+1.01	−0.03	Growth vs stagnation
DW statistic	0.32	0.23	Autocorrelation present

Source: FAO AQUASTAT / WHO UNICEF JMP (2024). *** $p < 0.001$; ns = not significant.

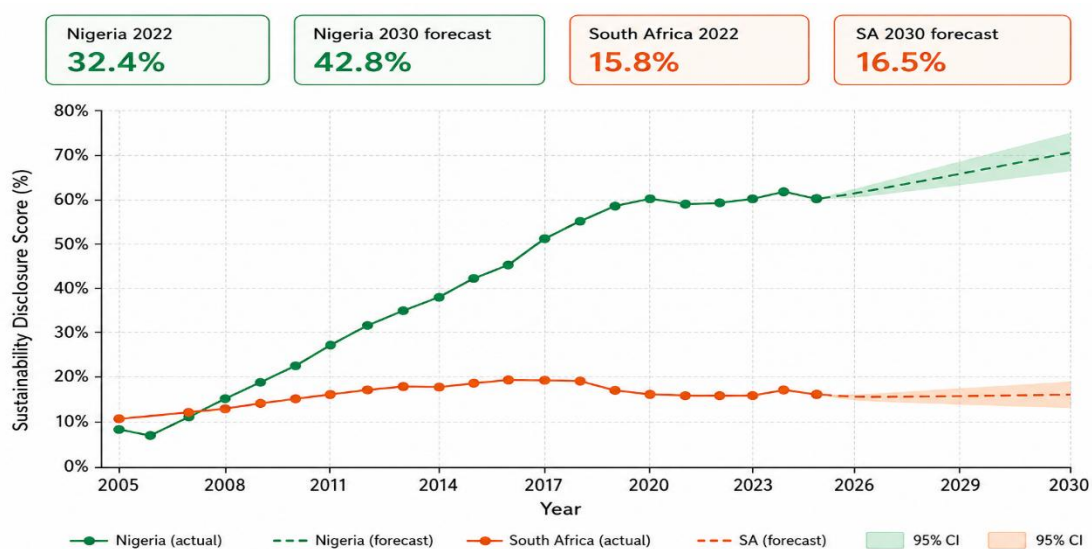
Table 2 ARIMA and ETS Forecast Summary to 2030

Metric	Nigeria	South Africa	Ethical Implication
2022 Actual	32.38%	15.81%	Divergent baselines
2030 Forecast	42.76%	16.53%	Widening inequality
95% CI	39.03 to 46.49%	13.41 to 19.64%	SA: risk of further decline
MSE / MAD	3.0 / 1.4	1.7 / 1.2	Model accuracy acceptable
Model	ARIMA (1,1,1)	ARIMA (2,0,1)	Transparent specification

Source: Author's ARIMA and ETS models. FAO data (2000 to 2022).

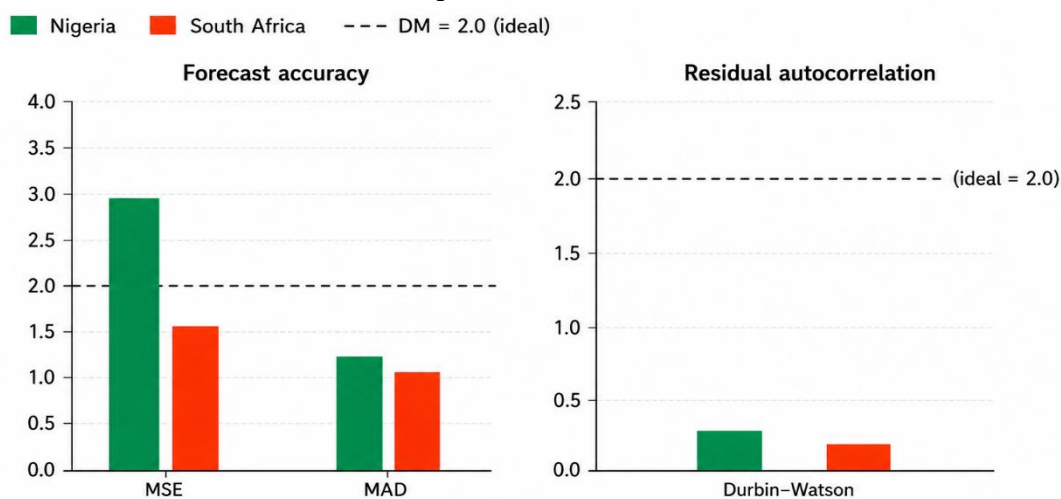
In response to **RQ1**, Welch's t test confirms the mean difference is statistically significant: $t(24) = 4.52$, $p < 0.001$, with a 95% confidence interval of approximately 3.9 to 9.8 percentage points. For Nigeria, regression of water use efficiency on year yields $R^2 = 0.937$ ($F(1,21) = 312.2$, $p < 0.001$), with a slope of approximately 1.01 percentage points per year, reflecting cumulative investments and policy attention. For South Africa, $R^2 = 0.018$ ($F(1,21) = 0.38$, $p = 0.54$), with no significant trend detected. The near zero explanatory power points to systemic governance challenges, including aging infrastructure and climate induced shocks (World Bank, 2024; South African DWS, 2024). Durbin Watson statistics of 0.32 (Nigeria) and 0.23 (South Africa) confirm strong positive autocorrelation, validating the use of ARIMA and ETS models over simple OLS (Power, 1993).

Figure 2 Time series with 95% prediction intervals for Nigeria and South Africa



Source: Processed by the authors

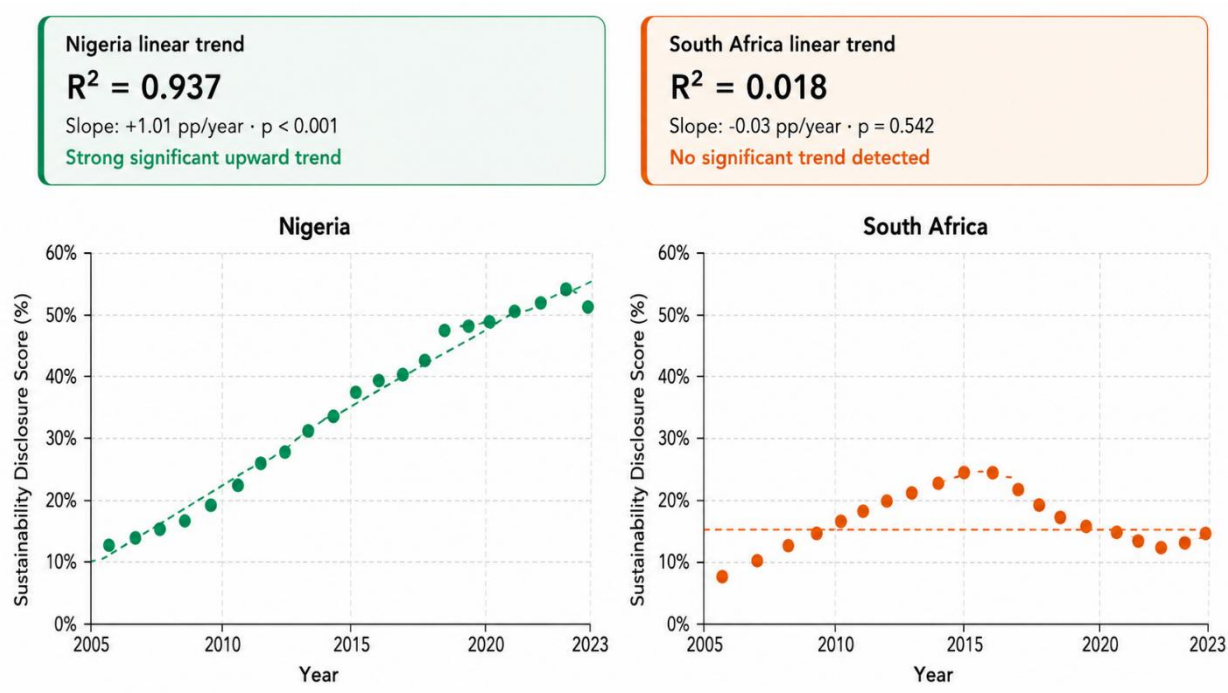
Figure 3 MSE, MAD, and Durbin Watson for Nigeria and South Africa



Low Durbin-Watson values confirm strong positive autocorrelation in OLS residuals, validating the use of ARIMA-EST over simple regression.

Source: Processed by the authors

Figure 4 Scatter plots with trend lines for Nigeria ($R^2 = 0.937$) and South Africa ($R^2 = 0.018$)

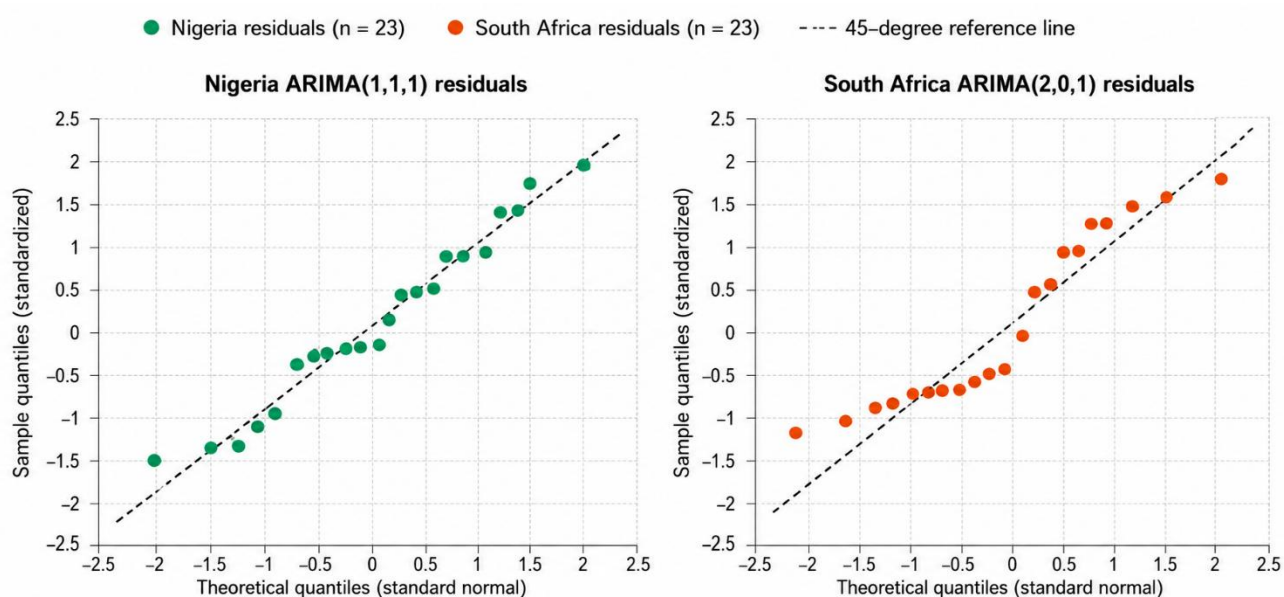


Source: Processed by the authors

QQ plots (Figure 5) provide visual evidence for the residual normality claim that supports H3, complementing the numerical diagnostics (MSE, MAD, DW) already presented in Table 1,2.

Points near the 45-degree reference line indicate approximate normality, validating forecast interval coverage (Box and Jenkins, 1970; Power, 1993)."

Figure 5 Normal QQ plots of standardized residuals



Source: Processed by the authors

These forecasts reveal ethically significant divergent futures. Nigeria's trajectory suggests a plausible path to markedly higher water use efficiency if current governance commitments are sustained. Even the lower bound of

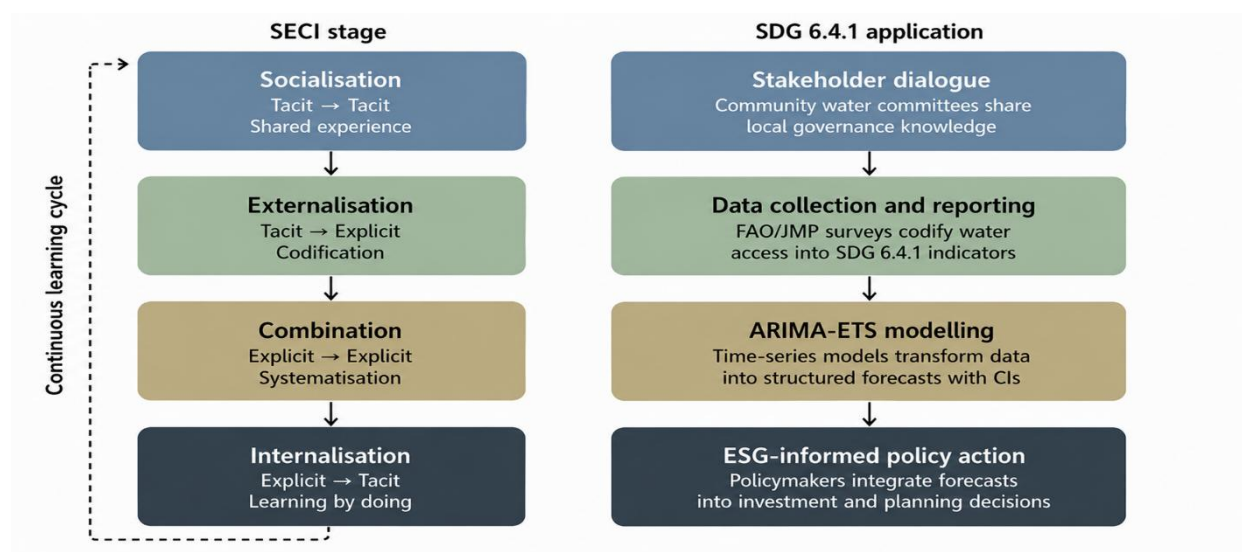
the 95% CI implies considerable improvement over 2022. South Africa's near flat trajectory, with a lower confidence bound indicating potential further deterioration, represents a governance failure with direct implications for intergenerational equity and the human right to water (Sachs et al., 2025; UNESCO, 2024).

4 Conclusion

In response to RQ2, the study proposes a four-layer Ethical SDG Monitoring Architecture integrating ESG principles with KM theory. Layer 1 (Data Foundation) ensures ethical data collection through open access, standardised sources with transparent metadata (FAO, 2025; UN Water, 2024). Layer 2 (Analytical Engine) applies validated ARIMA and ETS models with full disclosure of specifications and limitations, adhering to algorithmic transparency (Eker et al., 2018). Layer 3 (ESG Evaluation) maps model outputs onto Environmental (resource efficiency trajectories), Social (equity implications of forecast divergence), and Governance (institutional capacity for accountable decision making) dimensions. Layer 4 (KM Driven Decision Interface) transforms ESG evaluated forecasts into actionable knowledge through stakeholder dialogue, real time dashboards, and institutional learning loops (Nonaka & Takeuchi, 1995; Dalkir, 2017). This architecture addresses the conference theme of ethical challenges by providing a practical framework for ensuring that the increasing digitalization of sustainability governance serves justice and intergenerational equity rather than technocratic opacity.

The findings carry three implications. First, the contrasting trajectories demonstrate that higher national income does not guarantee improving water use efficiency, challenging narratives that frame environmental sustainability as accessible only to richer nations. South Africa's stagnation despite upper middle-income status highlights the critical role of governance quality and institutional maintenance (World Bank, 2024; South African DWS, 2024). Second, ARIMA and ETS models deployed with full diagnostic transparency offer an ethical advantage over black box machine learning approaches: each parameter carries statistical meaning and each forecast can be traced to specific autoregressive and smoothing components, supporting democratic scrutiny of policy recommendations (Chenery et al., 2024; Power, 1993). Third, the ESG and KM integration provides a replicable framework for translating quantitative forecasts into stakeholder inclusive governance, connecting forecasting outputs to green finance, performance-based bonds, and infrastructure planning (Vinuesa et al., 2020; Chopra et al., 2024). Limitations include the short time series ($n = 23$ per country), the univariate specification omitting drivers such as rainfall and GDP, and the absence of structural break testing. Future research should extend the sample, incorporate multivariate models with climate and governance variables, and validate the ESG and KM framework through implementation case studies (Kulkov, 2024; Zhou et al., 2022).

Figure 6 Nonaka and Takeuchi's SECI model mapped to SDG monitoring stages



Source: Processed by the authors

This study demonstrates that environmental sustainability monitoring, when embedded within an ethically grounded ESG and KM framework, transcends technocratic measurement to become a tool for environmental

justice and accountable governance. As digitalization increasingly shapes sustainability governance, ensuring that algorithmic tools serve democratic values and equitable outcomes is a fundamental ethical imperative.

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Environmental Taxes in OECD Countries

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Abstract: Environmental taxes are an important environmental policy tool for regulating the behaviour of economic entities and at the same time generate public revenue. Approaches to environmental taxation vary significantly between countries. The aim of the article is to identify differences between OECD countries in environmental taxation. The results indicate that energy taxes account for the dominant part of environmental tax revenues, on average over 70%. Transport taxes are the second most important. Here, on average, they account for around 20%. Taxes on pollution and the use of natural resources account for a negligible part of tax revenues. Differences between countries are influenced by economic development, energy mix and environmental policy.

Keywords: OECD · European Union · Ecological fees · Energy taxes · Transport taxes · Pollution taxes

1 Introduction

Environmental policy, as stated by Dvořáková-Líšková & Cudlínová (2015), has become an independent area of public policy, the aim of which is to protect natural resources, minimize the negative impacts of human activity and promote sustainable development. An important instrument of this policy are taxes imposed in the field of the environment, which influence the behaviour of economic agents and at the same time generate public revenues, which are called environmental taxes here. Their main objective is to internalise the negative externalities³ associated with the use of natural resources and the production of pollution, through price mechanisms. On the topic of negative externalities and related market failures in more detail Corporate Finance Institute These taxes are intended to correct market failures by increasing the price of activities leading to environmental damage and bringing private costs closer to those of society (CFI, 2025).

In recent decades, the importance of these instruments has been growing, especially in connection with the emphasis on sustainable development and climate policy. As stated by the OECD (2010), the growing importance of these instruments can be seen mainly in the countries of the European Union and the OECD. Approaches to environmental taxation vary significantly from one country to another, both in terms of the overall level of taxation and the structure of individual types of taxes. These differences reflect not only the economic level of individual countries, but also their institutional set-up, energy mix and environmental policy priorities. An international comparison of environmental taxes thus makes it possible to identify common trends and specific national approaches.

Special attention is paid to the countries of the Organisation for Economic Co-operation and Development (OECD), which provide comparable and methodologically uniform data on environmental taxation. The analysis of these data allows for a comprehensive view of the position of individual countries in the field of environmental taxes and the identification of groups of countries with similar characteristics.

This study focuses on the analysis and comparison of the structure and level of environmental taxes in the Czech Republic and in selected OECD countries. On the basis of selected indicators, the position of the Czech Republic in international comparison is evaluated, while a multivariate statistical method is applied to identify groups of countries with similar characteristics.

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³ Externalities arise when the costs associated with a certain economic activity are borne not by its originator, but by society as a whole. Environmental pollution is a typical example where the polluter does not pay the full social costs associated with its activities. (CFI, 2025)

2 Aim and methods

The aim of the article is to identify differences between selected OECD countries in the area of taxation focused on the burden on the environment and the consumption of energy products. The analysis of environmental taxation is based on data from the OECD – Environmentally Related Tax Revenue database, which provides internationally comparable data on environmental taxes. For the purposes of the analysis, data from 32 OECD countries for 2021 were used, representing the latest available comprehensive set of data for the monitored countries. Prior to the analysis, the data was standardized to eliminate the influence of different scales of individual variables and ensure their comparability. Cluster analysis as a method of multivariate statistics is used to identify groups of countries with similar characteristics of environmental taxation. The evaluation of the level and structure of environmental taxes within the clustering process is based on the following indicators:

- the share of environmental taxes in gross domestic product,
- the share of environmental taxes in total tax revenues,
- the structure of environmental taxes expressed as the share of energy, transport and pollution taxes in total environmental tax revenues. These groups are energy taxes⁴, transport taxes⁵, pollution taxes⁶ and taxes on the use of natural resources⁷. The division of environmental taxes into four groups allows for a unified analytical framework across OECD member states and provides a structured view of the most common areas in which taxes perform an environmental function. This systematic breakdown provides the basis for a more accurate assessment of the environmental effects of tax instruments and for an international comparison of tax structures.

Hierarchical cluster analysis is applied in the thesis using Ward's method, which minimizes the increase in intra-cluster variability during the gradual joining of objects, as stated by e.g. Řezanková et al. (2007) and Everitt (2011). Euclidean distance is used as a measure of similarity. Basic descriptive statistics are used to characterize individual clusters, namely arithmetic mean, standard deviation and coefficient of variation. The explanatory factors for the evaluation of the results of the cluster analysis are the indicator of environmental taxes per capita in absolute terms and the indicator of the standard of living (GDP per capita in USD in PPP, Current prices). These indicators prove whether the values of the ratio indicators correspond to the actual burden on the population of a given state and whether the burden is caused by a higher standard of living of the population. In other cases, it can be assumed that higher values of ratio indicators have a different cause. These other causes may be different approaches of states to environmental policy, differences in the amount of gross domestic product or different shares of other taxes in the tax mix of a given state, etc.

3 Results

3.1 Indicators for cluster analysis

Three ratio indicators were used for cluster analysis, which are briefly presented below.

Share of environmental taxes in GDP

The share of environmental taxes in gross domestic product is a basic indicator of the intensity of environmental taxation in individual OECD countries.

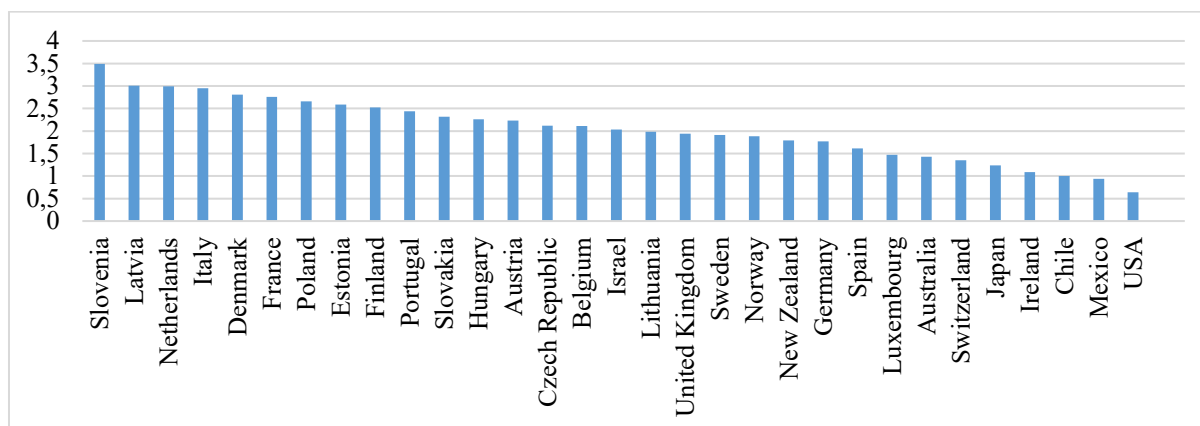
⁴ Taxes and fees on various energy products, e.g. tax on electricity, natural gas and some other gases, tax on solid fuels, tax on mineral oils.

⁵ Taxes and charges on transport, such as road tax, emission fee or environmental tax when registering a vehicle with higher exhaust emissions.

⁶ Taxes and fees on wastewater discharge, air pollution, landfilling, emission permits, etc.

⁷ Taxes and fees for the extraction of groundwater resources, minerals, etc.

Figure 1 Share of environmental taxes in GDP in OECD countries (%)

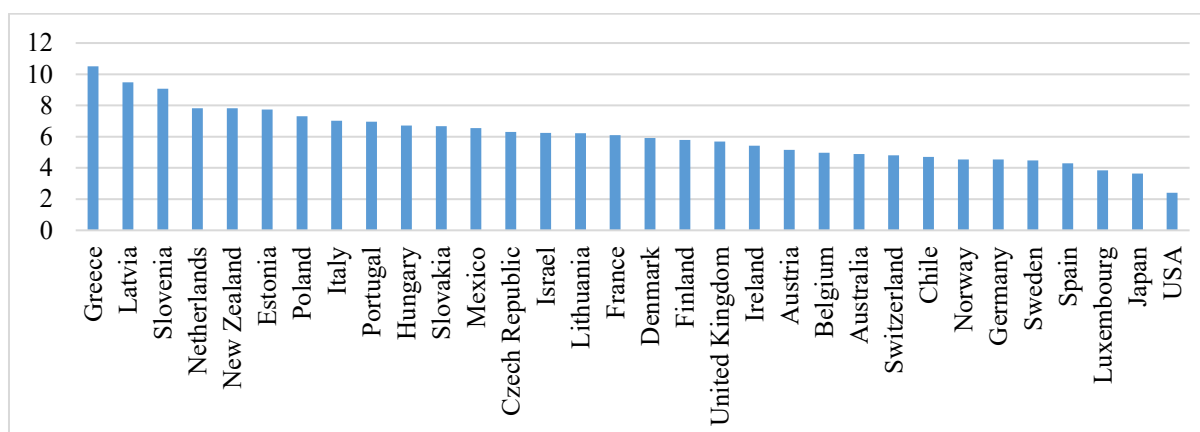


Source: (OECD Data Explorer, 2026), own processing

Share of environmental taxes in total tax revenues

The share of environmental taxes in total tax revenues provides a complementary insight into the importance of these taxes within national fiscal systems. Country values reflect different approaches to the use of environmental taxes as a fiscal and environmental policy tool.

Figure 2 Share of environmental taxes in total tax revenues in OECD countries (%)



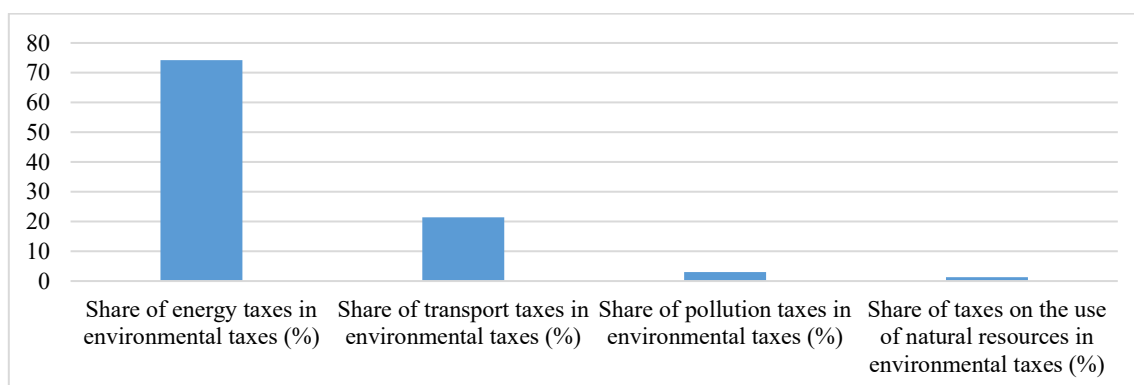
Source: (OECD Data Explorer, 2026), own processing

Structure of environmental taxes

The structure of environmental taxes in the monitored countries shows a significant dominance of energy taxes. The indicator represents the percentage share of selected tax groups from the total revenue of environmental taxes in a particular country. These groups are: energy taxes, transport taxes, pollution taxes and taxes on the use of natural resources.

The following Figure 3 shows that the taxation of energy products is a key instrument of environmental policy in most OECD countries. The second most important component is transport taxes. Their importance reflects the fact that transport is a significant source of negative externalities, especially greenhouse gas emissions and local pollution. On the other hand, taxes on pollution and taxes on the use of natural resources show a relatively low representation in the countries under review. Their role is thus rather complementary and compared to energy and transport taxes, they have limited fiscal importance. The dominance of energy taxes can be explained mainly by their administrative simplicity, stable tax base and direct link to fossil fuel consumption, which is closely linked to environmental impacts. By contrast, pollution taxes are often more targeted, but their collection is more administratively demanding and their yield is lower.

Figure 3 Average structure of environmental taxes as a percentage of total environmental tax revenue (%)



Source: (OECD Data Explorer, 2026), own processing

3.2 Cluster Analysis

To identify groups of countries with similar characteristics of environmental taxation, a hierarchical cluster analysis was applied. The result of this analysis is a dendrogram, which graphically illustrates the process of gradual merger of individual states based on the similarity of the monitored indicators. The distance between the individual objects expresses the degree of their difference, while a smaller distance means a higher similarity in the field of environmental taxation.

Based on the hierarchical cluster analysis, the analysed 32 countries were divided into five groups as follows:

1. *Lowest level of environmental taxes: **Australia, Chile, Ireland, Japan, Switzerland, USA***

The first cluster includes countries with a low level of environmental taxation. Environmental taxes play a rather marginal role in the tax system, and their fiscal importance is limited. The structure of environmental taxes here is mainly based on energy and transport taxes, while pollution taxes and taxes on the use of natural resources have a negligible share.

2. *Highest level of environmental taxation: **Latvia, Greece, Slovenia***

The second cluster consists of countries with a high level of environmental taxation. Environmental taxes represent an important component of public revenues. These countries are particularly characterised by a high share of energy taxes, which make up the dominant part of their environmental tax revenues. Environmental taxation fulfils not only a fiscal but also a regulatory function here and is actively used as an instrument of environmental policy.

3. *Average level of environmental taxation, better balanced tax structure: **Denmark, Israel, Netherlands, Austria***

The third cluster represents a group of countries with an average level of environmental taxation and a relatively balanced structure of environmental taxes. Unlike other groups, transport taxes also play a significant role here, in addition to energy taxes, which indicates a wider range of environmental policy instruments used. This cluster can be characterized as a transitional type between countries with low and high environmental tax intensity.

4. *Higher share of pollution taxes: **France, Hungary, New Zealand***

The fourth cluster is characterized by a higher share of taxes on pollution. This distinguishes it from other groups. Although the overall level of environmental taxation remains at a medium level, the structure of these taxes is specific precisely because of the greater representation of targeted instruments targeting specific environmental externalities. This approach may indicate an emphasis on more selective and targeted forms of regulation.

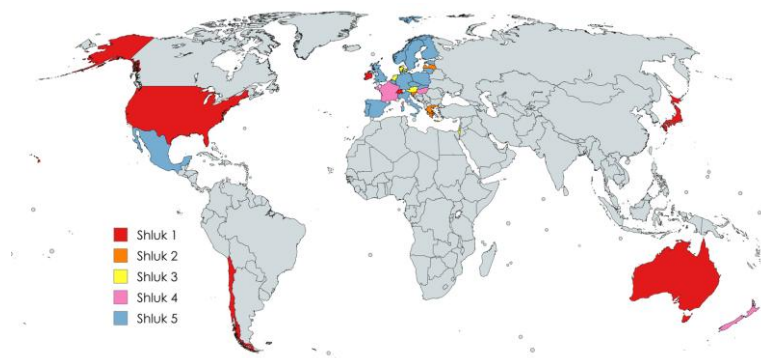
5. *Average level of environmental taxation without significant specifics: **Austria, Belgium, Czech Republic, Estonia, Finland, Italy, Lithuania, Luxembourg, Mexico, Germany, Norway, Poland, Portugal, Slovakia, Spain, Sweden and the United Kingdom***

The fifth cluster includes the largest group of countries with average values of monitored indicators. This group is characterized by the dominance of energy taxes and relatively low variability between individual countries. Environmental taxation here corresponds to the usual model applied in most OECD countries, with no significant deviations in level or structure.

Within the analysed OECD countries, the Czech Republic can be classified as a group of countries with an average level of environmental taxation. It can thus be stated that the Czech system of environmental taxation does not show any significant specificity, but rather corresponds to the standard setting typical for most of the analysed countries, especially members of the European Union

Figure 4 presents a visualization of the results of cluster analysis on a global scale. Individual countries are shown here according to their classification into the relevant clusters, which allows for a clear display of their geographical distribution and mutual similarities in terms of the analysed environmental taxation indicators.

Figure 4 Map of the world showing the division of countries into clusters

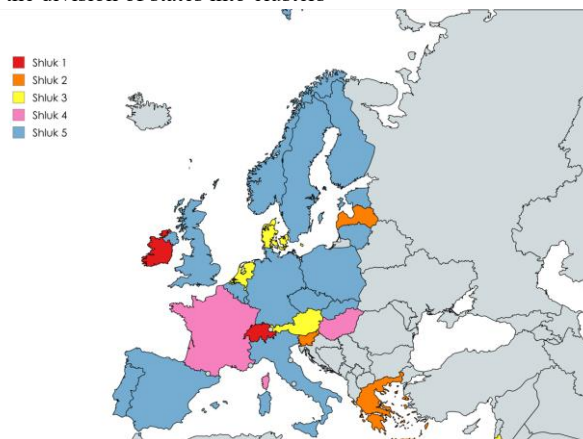


Source: MapChart, own processing

At the same time, the map shows that countries with a similar structure of environmental taxes are not necessarily geographically close. The results thus suggest that the similarity between individual countries is due more to the characteristics of their tax systems than to their geographical location. The map view therefore suitably complements the results of cluster analysis and allows for a clearer interpretation of the spatial distribution of individual groups of countries.

The following Figure 5 provides a more detailed view of the European region where the concentration of analysed countries is the highest. A detailed view of Europe allows you to better identify the differences between individual countries and their classification into specific clusters. The spatial distribution of individual clusters shows that the analysed countries do not form completely uniform geographical units. The first cluster is made up mainly of countries located outside the European continent, while the fifth cluster mainly includes the countries of Northern, Western and Central Europe. Other clusters show a rather dispersed geographical distribution across the European and non-European space.

Figure 5 Map of Europe showing the division of states into clusters



Source: MapChart, own processing

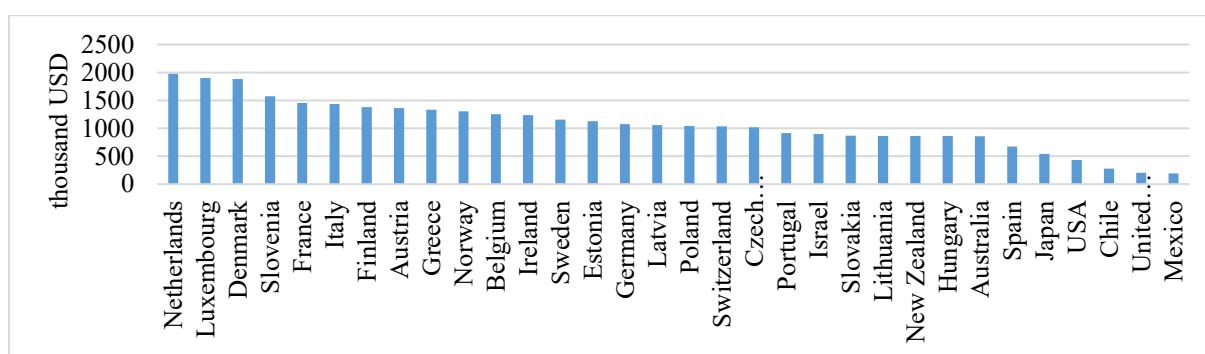
3.3 Factors explaining the results of cluster analysis in a broader context

Two factors explain the results of the clustering process. The first is the indicator of absolute income per capita per year, which explains whether the placement of states in a cluster with a high tax burden is due to energy taxes or other unidentified factors. The second indicator is gross domestic product at current prices in dollars per 1 inhabitant, expressed in purchasing power parity. This indicator makes it possible to explain whether countries with a higher burden of environmental taxes impose high taxes on their citizens because of a high standard of living or for some other reason. These other reasons may indicate a responsible approach to the environment, traditions or high costs of the state to eliminate the consequences of environmental damage, etc.

Environmental tax revenues per capita

An explanatory factor for placing the results of the analysis in a broader context is the indicator of environmental tax revenues per capita of a given state in thousands of USD. It can help explain whether the clustering of states is due to factors other than the size of energy taxation.

Figure 6 Environmental tax revenues per capita (USD 1,000) in OECD countries



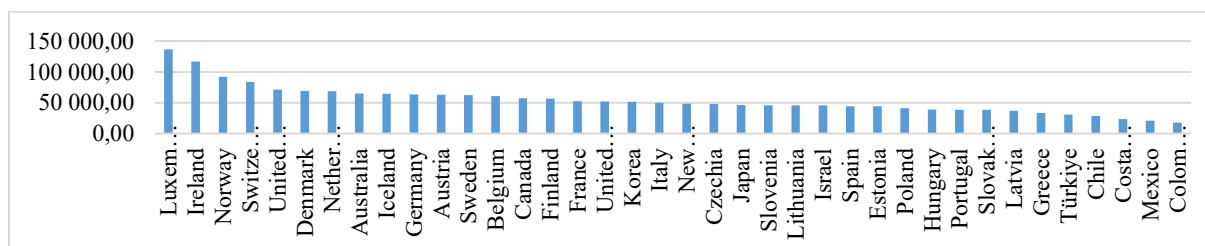
Source: (OECD Data Explorer, 2026) , own processing

In general, we can assume that higher absolute amounts per capita are achieved by countries with a higher standard of living. However, this does not have to be the rule. The approaches of OECD countries to environmental taxation are different. For example, the standard of living of people in the USA, Switzerland or the United Kingdom is relatively high, yet the income from environmental taxes is low. This indicator specifies whether the countries with the highest values of ratio indicators, i.e. Indeed, Latvia, Greece and Slovenia have the highest absolute tax burden on the population of environmental taxes. High taxation can be confirmed in the case of Slovenia. The high values for Latvia and Greece can be explained by lower economic performance and lower overall tax revenues. In the case of the Czech Republic, the value of this indicator is below the level of the most economically developed countries, which corresponds to its position within the analysed group.

Gross Domestic Product per Capita in PPP in OECD Countries

This indicator makes it possible to assess the standard of living of the population in different countries. In the area of taxation, it can be assumed that a higher standard of living allows the state to collect higher taxes. Here it makes it possible to evaluate whether states collect higher environmental taxes due to a higher standard of living or for another reason, e.g. a different approach to environmental policy, etc.

Figure 7 Gross Domestic Product in USD per Capita in OECD Countries, PPP covered, Current prices



Source: (OECD Data Explorer, 2026), own processing

4 Conclusion

An analysis of environmental taxes in selected OECD countries confirmed the existence of significant differences in both their level and structure. The results show that environmental taxation in most countries is based mainly on energy taxes, which make up the dominant part of tax revenues. It can be added that the predominance of energy taxes does not necessarily mean their higher environmental efficiency, but rather their practical applicability within fiscal policy. Other types of environmental taxes that burden environmental pollution or the extraction of natural resources are rather complementary.

Differences between individual countries in the level of environmental taxation can be further linked to their economic development, energy mix, traditions and approach to environmental policy. More developed countries often report higher absolute revenues from environmental taxes. This is reflected, for example, in the per capita indicator of environmental taxes, which was an explanatory factor together with the indicator of living standards. Nevertheless, environmental taxes are an important instrument of environmental policy, especially in the Member States of the European Union. On the other hand, relative indicators, such as the share of GDP or tax revenues, better capture the actual intensity of environmental taxation and allow for more relevant international comparisons.

A comparison of individual indicators showed that the Czech Republic is at the average level of environmental taxation in international comparison, with a predominance of energy taxes. However, the absence of significant deviations may also indicate a limited use of environmental taxes as an active tool of environmental policy. From the point of view of the broader context, it can be stated that environmental taxes represent an important instrument of environmental policy, especially in the Member States of the European Union. However, the effectiveness of this instrument depends not only on the level of taxes, but also on their structure and overall institutional framework. The identified differences between countries point to the existence of different approaches to the use of environmental taxation.

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ESG Reporting in the Czech Republic: Current Status and Development Since 2023

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Abstract: The paper deals with the evaluation of development of approaches to the ESG reporting used by chosen companies in last three years. Apart from companies that report by law or completely voluntarily, some companies are forced to create sustainability reports by their business partners and end customers, who are increasingly interested in this area. The group of companies under evaluation consists primarily of firms ranked among the top 10 large companies in the 2023 Forbes ESG rating and builds on the findings of a previous study, to which this paper loosely refers. The aim of this study is to critically evaluate the approach of a selected group of companies to sustainability reporting and the progress of this approach from 2023 to 2025.

Keywords: sustainability, ESG, reporting, statements, ESG ratings

JEL Classification: G32, G33, C35

1 Introduction

Initiatives to report non-financial information related to sustainability and social responsibility are not a phenomenon of recent years. As early as 1997, the Global Reporting Initiative (GRI) was established with the aim of creating a universal standard for measuring and disclosing the impacts of business activities on the economy, society, and the environment. As noted by Bais et al. (2024), the GRI has become an essential tool for harmonizing reporting practices and increasing the reliability of non-financial information. GRI standards are based on the principles of accuracy, comparability, balance, and materiality, which ensure the quality and transparency of disclosed data. Also significant is GRI's collaboration with the European Financial Reporting Advisory Group (EFRAG), which integrates GRI principles into the European ESRS standards established under the CSRD directive. (Bais et al., 2024) While GRI is based on the concept of “impact materiality”—that is, the impact of a company's activities on society and the environment—the SASB (Sustainability Accounting Standards Board) applies the principle of financial materiality, which examines the influence of sustainability aspects on a company's financial performance (Global Reporting Initiative & Sustainability Accounting Standards Board, 2021).

The SASB was established in 2011 in the United States and focuses on sector-specific standards for financially relevant ESG factors. This approach has made the SASB a popular tool among investors who use ESG data to assess risks and opportunities. In 2021, SASB and the IIRC (International Integrated Reporting Council), the organization behind the integrated reporting framework, were integrated into the IFRS Foundation to unify financial and sustainability reporting. (Bais et al., 2024) This complementarity between GRI (impact on the environment) and SASB (impact on the company) essentially foreshadowed a concept that later became a legislative requirement in the European Union. In the European context, the main regulatory framework is the CSRD (Corporate Sustainability Reporting Directive), which was adopted in November 2022 and replaces the earlier NFRD (2014/95/EU). As noted in a study by Hummel & Jobst (2024), the CSRD expands the scope of entities subject to reporting requirements and introduces the fundamental principle of “double materiality.” This requires companies to disclose not only the impacts of their activities on society and the environment, but also how these factors affect their own economic situation.

Following the directive, the European Sustainability Reporting Standards (ESRS) were developed to harmonize the structure and methodology of ESG reporting across the European Union. The first set of these standards was adopted by the European Commission in July 2023. These standards are closely linked to the GRI principles and partially incorporate the sector-specific logic of the SASB. An important component of the European framework

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is the EU Taxonomy, which defines consistent criteria for “environmentally sustainable” economic activities. This classification system (set forth in EU Regulation 2020/852) serves as a tool for directing investments toward activities that contribute to achieving climate neutrality and the European Union’s environmental goals. The EU Taxonomy sets out six environmental objectives, the fundamental principle of which is Do No Significant Harm (DNSH), which requires that no activity labelled as sustainable should harm other environmental objectives. (KPMG International, 2023) Empirical research by Chrzan & Pott (2024) demonstrates that the introduction of standardized taxonomic indicators increases the transparency of companies’ environmental performance, enabling professional investors to better detect so-called greenwashing. However, the study also notes that this positive effect on transparency is more pronounced among professional investors, while private investors may react positively to the mere presence of taxonomic information, regardless of its actual content.

In the context of ESG (Environmental, Social, Governance) reporting, the terms “impact-material issues” and “financially material issues” refer to how an organization identifies and assesses its key sustainability areas. These concepts are particularly crucial in the context of the European CSRD Directive and ESRS standards, which introduce the principle of “double materiality.” Impact materiality, i.e., issues where a company’s activities have a significant impact on its surroundings. In other words, these issues concern how a company appears to the outside world and influences the world around it. A criterion is considered impact-material if its impact is severe (in terms of scope, intensity, and irreversibility) and also likely to occur. Financially material issues, on the other hand, have a significant impact on a company’s financial performance and value. Since modern ESG reporting requires the use of so-called double materiality, the included issues must be material in both respects—that is, both in terms of impact and financially. In practice, companies use a so-called materiality analysis, where they identify ESG topics, assess their impact and financial significance, and visualize them in a materiality matrix. The result is that the focus of the reporting is clearly defined—namely, key ESG risks and opportunities—while also meeting the requirements of the CSRD/ESRS. Under the European Sustainability Reporting Standards (ESRS), topic categorization is formalized and standardized in the E series for environmental topics, the S series for sustainability, and the G series for governance.

A rapid implementation of the Corporate Sustainability Reporting Directive (CSRD) is underway in the Czech Republic, fundamentally reshaping not only sustainability reporting processes but also the statutory obligation to obtain independent assurance on ESG disclosures. The obligation to obtain limited assurance is gradually extending to an increasing number of enterprises, although the national legislative process has not yet been fully completed. The ESG Omnibus 2025 further illustrates a significant regulatory shift: the number of entities required to report has decreased from approximately 1,200 to around 270 (250), while the expectations regarding data quality and the rigour of assurance engagements continue to intensify — including a future transition towards reasonable assurance. The ESG Omnibus 2025 provides simplification of the situation enhancing the efficiency of reporting and due diligence requirements in the domain of corporate sustainability. It reduces the regulatory burden – narrowing the scope of entities obliged to report and postponing the effectiveness of selected obligations. It has impact to the competitiveness due to enabling undertakings to maintain economic growth without disproportionate administrative constraints. The Omnibus has two components: the “stop-the-clock” directive and substantive amendments. This directive, adopted on 14 April 2025, postpones the deadlines for implementing certain obligations. It provides legal certainty for undertakings in the second and third reporting waves, ensuring they will not need to prepare sustainability statements without clarity regarding the final rules. Substantive amendments: this segment introduces concrete changes to the Accounting Directive, the Audit Directive, and the CSRD and CSDDD frameworks. It was adopted on 24 February 2026. First reporting wave based on CSRD remains unchanged; no amendments affect undertakings already falling under the initial CSRD requirements. Second and third reporting waves (from 2028 onwards) are applied to companies with more than 1,000 employees, and annual net turnover exceeding EUR 50 million, and/or Assets exceeding EUR 25 million at the balance-sheet date. In addition, the undertaking must meet at least one of these financial thresholds for inclusion in the expanded reporting perimeter.

In their paper, Yadav et al. (2025) note that ESG reporting is developing from a purely administrative requirement into a strategic management tool that helps companies achieve their sustainable development goals. The adoption of modern technologies, such as artificial intelligence and big data analysis, enables more efficient collection, processing, and evaluation of ESG data, thereby increasing its accuracy and usefulness in management decision-making. ESG reporting is thus becoming part of a broader transformation toward Industry 5.0, where economic goals are intertwined with social responsibility and technological innovation. Similarly, the article “The Impact of Sustainability Disclosures on the Value of Companies Following Digital Transformation Strategies”

discusses how companies that actively implement sustainability strategies and report on them transparently experience an increase in corporate value and stability in the stock market. (Grishunin et al., 2022) Despite these benefits, however, there are significant limitations and challenges associated with ESG reporting. Gyönyörová et al. (2021) point out the absence of a uniform methodology and large discrepancies between the assessments of different rating agencies, which complicates the comparability of results. These discrepancies are often caused by so-called rating bias, i.e., the influence of a company's size, region, or industry. The lack of uniformity in methodologies leads to situations where the same company may receive very different ESG ratings depending on the model used.

The European Union has adopted Regulation (EU) 2024/3005 in response to the issues regarding ESG rating activities, which aims to increase the transparency and credibility of ESG ratings. The regulation establishes rules for ESG rating providers, in particular requirements for the disclosure of rating methodologies, the management of conflicts of interest, and the supervision of rating agencies' activities. The aim of this regulation is to reduce differences between individual ratings, improve their comparability, and strengthen investor confidence in ESG ratings of companies. (Regulation (EU) 2024/3005 of the European Parliament and of the Council of 27 November 2024 on the transparency and integrity of Environmental, Social and Governance (ESG) rating activities, and amending Regulations (EU) 2019/2088 and (EU) 2023/2859 (Text with EEA relevance), 2024)

2 Methods

The aim of this study is to critically evaluate the approach of a selected group of companies to ESG reporting and the progress of this approach from 2023 to 2025.

This paper aims to illustrate the development of ESG reporting in recent years using the example of five organizations from two very different sectors (energy: ČEZ Group, E.ON Group and banking: KB Group/Komerční banka, ČSOB Group, Moneta Group/Moneta Money Bank). As a point of comparison, it presents the ratings assigned by selected rating agencies during the period under review. The organizations under consideration are large companies operating in the Czech Republic and, according to the ESG rating by Forbes ČR magazine, have ranked among the top 10 companies since 2023. This paper builds on research conducted in 2023 (Pražáková, Vejsadová, 2024), when ESG reporting was in its infancy and, according to the legislation at the time, was expected to apply to nearly all companies within a relatively short period, whether directly or through collaboration within supply chains. At that time, we used Forbes Czech Republic's ESG rating to guide the selection of companies analysed, and it became our primary evaluation framework. Our goal was to evaluate companies that had successfully navigated ESG reporting from its very beginnings. This article expands on the original findings and assesses the evolution of reporting in recent years.

ESG reports reflect the influence of the industry in which the company operates, whether in the selection of assessed risks, engagement with stakeholders, or the reporting framework itself. Since only one company from the energy sector was included in the original ESG rating by Forbes ČR, we decided to add another representative to the sample of companies for better comparison, and despite minor differences in the business models of both organizations, it is possible to compare their approaches to ESG reporting. In the second sector evaluated—banking—there were already enough organizations included in the original rating for comparison, so we did not need to expand the sample.

Evaluation methodology – used measures

The results of the used measures are presented in the Table 1 listed below and it is possible to divide them in the two groups depending on their focus on external evaluations of organizations or on the companies' own ESG reporting activities.

External evaluation

The column ranking includes 3 ratings of the ESG reports and activities of the evaluated organisations and presents the current rating of each company. There is only one exception, the E-on group, for which we do not know the value of the Forbes ESG Rating CZ. The table below presents these three ratings: Forbes ESG Rating CZ 2024, CDP rating and MSCI rating. The ratings listed in the column remain stable over the entire period or showed only marginal changes. We also observed S&P Global ESG ratings and the Sustainability Risk Score in the reports of the companies we analysed, so we have now included them in our research. In both cases, we evaluate the annual changes in individual companies' ratings. The changes were always calculated for the given year based

on the data from the previous year. The reported year-on-year changes were calculated using a chain index method, and the results were rounded.

The reported ratings differ in their underlying logic, scope, and assessment methodology; given the considerable complexity and breadth of the individual rating frameworks, only their key characteristics are presented:

- Forbes ESG Rating CZ 2024 is a national benchmarking assessment focused on the overall maturity of corporate ESG practices and the transparency of sustainability management and reporting among Czech companies.
- CDP Rating is a disclosure-based rating that primarily evaluates the extent, quality, and effectiveness of an organization's environmental reporting and management, with a particular focus on climate, water, and forest-related issues.
- MSCI ESG Rating is an investor-oriented assessment that measures a company's resilience to financially material ESG risks and opportunities relative to its industry peers, resulting in a comparative rating from AAA to CCC.
- S&P Global ESG Rating is a comprehensive performance-based evaluation that assesses how effectively a company manages material ESG risks, opportunities, and impacts through an industry-specific Corporate Sustainability Assessment, producing a score from 0 to 100.
- Sustainalytics ESG Risk Score is a risk-based metric that quantifies the level of unmanaged ESG risk exposure remaining after mitigation measures, thereby indicating the potential sustainability-related risk faced by a company.

Reporting activities

Reporting years/Type of the report - This indicator reflects the period during the company has been reporting on non-financial, sustainability, and, more recently, ESG information. The column also provides information on the type of report that the company currently publishes. These are either individual reports (I) or reports that were incorporated into the annual report (A). For the second type of report, the year in which comprehensive reporting began is also indicated.

GDOs / Topics ESRS – The last column presented the information the Sustainable Development Goals. The last column indicates whether the reports are based on the Sustainable Development Goals (GDOs) or ESRS topics (link to the Taxonomy and full reporting).

3 Research results

In our previous article, we noted that the quality of individual reports varies significantly depending on whether companies are already required to report (either independently or as part of a group or chain) or are doing so purely on a voluntary basis (Pražáková, Vejsadová Dryjová, 2024).

External evaluation

Since European regulations on ESG ratings have not yet come into effect, it is still possible that rating agencies may not fully disclose the metrics they use. However, based on our review of materials from the most widely used rating agencies, most of them have already complied with these regulations. For our study, we used both ratings publicly available on the rating agencies' websites and those ratings whose values must be disclosed by the rated companies themselves—otherwise, they are available, for example, to registered customers for a fee. In these cases, we used materials from the individual companies analyzed (websites or ESG reports) as our direct source.

We have included the results of a total of five ratings in this article, extending the original list—which included the CDP, MSCI, and Forbes ESG ratings for the Czech Republic—to include the S&P ESG rating and the Sustainalytics rating. The S&P Global ESG rating is a maximization rating; therefore, positive changes indicate an improvement in the overall score, while negative changes reflect a decrease in the company's overall rating. In contrast, the Sustainalytics Risk Score is designed to calculate a company's risk level and is therefore a risk-mitigation rating. Positive changes thus indicate an increase in the company's risk level, while negative changes indicate a decrease—and therefore an improvement in the rating agency's overall opinion of the company being assessed. All the organisations mentioned had already achieved excellent results at the start of the period under review; the ČSOB Group achieved the highest rating in Sustainalytics, with a score approaching 10. Other entities

in the banking sector reported higher scores, but the differences are not significant and, given the differences in the business models of the groups being compared, are entirely to be expected. For energy companies, the risk score is higher (around 20), which is consistent with their business focus.

Table 1 The overview of the basic measures

Organisation	External evaluation			Reporting activities	
	The ranking	S and P Global ESG 2023/ 2024/ 2025 annual change	Sustainalytics risk score 2023/ 2024/ 2025 annual change	Reporting years / Type of the report individual (I) or part of the annual report (A)	GDOs*/Topics ESRS**
ČEZ	Forbes ESG rating (TOP 10) CDP – B MSCI - AA	0/0/+4.77%	0/-13.6%/-1.3%	5/A (2024)	Topics
E-ON	X CDP – A, MSCI . AA	0/+13.5%/0	0/0/0	4/A (2025)	Topics with links to original goals
Moneta Money Bank	Forbes ESG rating (TOP 10) CDP – A- MSCI – AA	X/X/X	+12.2%/0/0	9/I	Topics
ČSOB	Forbes ESG rating (TOP 10) CDP – A MSCI – AAA (KBC group rating)	0/4.7%/9%	0/+11.2%/-6.4%	15/I	GDOs mainly 3,7,8,12,13
Komerční banka	Forbes ESG rating (TOP 10) MSCI – AA CDP – B	0/0/+3.7%/	0/+1.74%/-1.74%	8/A (2024)	Topics

Notes: *GDOs - the Sustainable Development Goals, **Topics ESRS - European Sustainability Reporting Standards Topics

Source: Own processing

The originally assigned ratings—CDP and MSCI—remained constant over the three years under review. Changes, on the other hand, can be observed in the S&P Global ESG and Sustainalytics ratings. The S&P Global ESG rating reaches a maximum value of 100 and is a maximization metric, in which most of the monitored companies achieved positive points, with an average increase of 7.75 points, corresponding to a 5–11% increase. None of the monitored companies declined. The Sustainalytics score, which is presented as a risk rating, conversely declined; like the previous rating, this indicates a positive development for the monitored companies and thus confirmed the trend of increasing ESG reputation across all monitored companies. The exception is Moneta Money Bank, for which we were unable to find current S&P ESG rating values.

Reporting activities

In this section of the analysis, we focused on companies' experiences with reporting (as reflected in the number of publicly available reports, which roughly correspond to the length of time companies have been addressing this issue), the volume and development of individual reports, and, last but not least, the use of GDOs or ESRS Topics in the reports. In an era characterised by a heightened awareness of sustainability, it is imperative that ESG reports not only address the concerns of legislators and capital providers, but also those of customers, potential customers and employees. It is therefore essential that ESG disclosure tools can provide ESG information that is not only in compliance with the requirements of regulators and investors but also aligned with the objectives of marketing (BARCS, 2023).

In our sample, the number of traceable reports varies from 4 to 15, with companies in the energy sector representing the lower end of the range and those in the banking sector tending to have a reporting history of nearly 10 years. Differences can also be identified in the form of reporting, as energy sector representatives incorporate ESG reports into their overall annual reports. In the case of ČEZ, this has been the case since 2024, and a year later, the second energy company began reporting in this manner as well. In the banking sector, we identified both types of reporting: standalone ESG reports as well as ESG reports included in annual reports. The length of the text dedicated to ESG reporting has not changed significantly between the individual companies surveyed compared to the previous year. However, when ESG reporting is integrated into the annual report, in most cases the text is slightly reduced, and the number of graphic elements is decreased. There are, however, significant differences between individual companies, caused to an extent by industry requirements (the energy sector versus banking), reporting obligations, and the demands of parent companies. While, for example, ČEZ has been fully audited in 2025—including ESG reporting—this requirement applies to some other companies only within the context of their consolidated group. In the case of ČEZ, compliance with the requirements of the EU Taxonomy and ESRS reporting has been declared. In 2023, all the analysed organisations were using the Sustainable Development Goals (SDGs); by 2025, a noticeable trend towards adopting topics in compliance with the European Sustainability Reporting Standard (ESRS) had become evident.

4 Conclusions

The findings indicate that all analysed companies maintained a strong ESG position throughout the study period, as evidenced by consistently favourable ratings across the evaluated assessment frameworks. While the CDP and MSCI ratings remained stable over the three years examined, the S&P Global ESG and Sustainalytics ratings revealed measurable changes. The increase in the S&P Global ESG rating, combined with the decline in Sustainalytics risk scores, suggests a positive development in ESG performance and a strengthening of ESG reputation among the monitored companies. These trends were observed across both the banking and energy sectors, although sector-specific differences remained evident.

The analysis of ESG reporting practices demonstrated a relatively high level of reporting maturity among all organisations studied. Banking institutions generally exhibited a longer reporting tradition, whereas energy companies increasingly integrated sustainability disclosures into their annual reports. Although the overall volume of ESG reporting changed only marginally over time, substantial differences persisted among companies as a result of industry-specific requirements, reporting obligations, and group-level governance structures. A notable finding was the gradual transition from reporting structured around the Sustainable Development Goals (SDGs) towards reporting aligned with the European Sustainability Reporting Standards (ESRS), reflecting the growing influence of European regulatory requirements and the increasing standardisation of sustainability disclosure.

Overall, the results suggest that the analysed companies are successfully adapting to evolving ESG expectations and regulatory developments. The convergence of improving ESG ratings and the increasing adoption of ESRS-based reporting indicates a broader trend towards greater transparency, accountability, and integration of sustainability considerations into corporate management and reporting practices. ESG reporting has become an integral part of the modern business environment, where it serves as a communication tool between a company and its stakeholders while also functioning as a strategic mechanism for risk and reputation management. Companies' motivations for reporting non-financial information are diverse. The literature most often explains them through legitimacy theory and stakeholder theory. According to these theories, companies seek to justify their existence in society and respond to pressure from investors, regulators, or customers by disclosing information. (Adardour et al., 2025) As noted by Mohammad & Wasiuzzaman (2021), companies engage in ESG

reporting primarily to strengthen investor confidence, reduce capital costs, and improve access to financing. Martiny et al.(2024) note that a higher level of ESG disclosure positively correlates with financial performance and reduces information asymmetry between the firm and investors. Another issue is the risk of so-called greenwashing, where companies deliberately overstate their positive impacts and conceal the negative aspects of their operations. The rise in ESG's popularity has led some firms to use reporting more as a marketing tool than as a genuine means of accountability. (Gyönyörová et al., 2021) This practice is facilitated by the flexibility of the ESG concept itself, which was created as a broad umbrella for various concepts, allowing companies to select only those metrics that suit them. (Pollman, 2022)

ESG ratings are certainly viewed by many companies as a display case for their successes. Given the numerous rating agencies and other organizations that evaluate individual companies using various ESG parameters, it is sometimes difficult—especially for small and growing businesses—to correctly assess which rating to pursue first and which one therefore offers a potentially significant advantage. Pressure to improve access to financing can also be a key factor, as ESG assessments from international rating agencies and clear decarbonization plans are important for banks, for example. Czech companies began securing the first credit lines tied to ESG ratings as early as the summer of 2023, and ESG-linked loans represent an attractive financing option, as do the issuance of so-called green bonds. Furthermore, reporting in line with the ESG pillars helps increase transparency and, hopefully, also aids in the fight against greenwashing. The governance pillar ensures a connection between strategic management, transparency, and ethical decision-making. High-quality corporate governance supports higher standards of stakeholder engagement and transparent reporting.

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- Skupina ČEZ Výroční finanční zpráva za rok 2024. https://www.cez.cz/webpublic/file/edee/esg/dokumenty/vyrocní-zpravy/cez_cz_vfz_2024.pdf
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Beyond GDP: The Ethics Perception Index (ETPI) as a Measure of Institutional Foundations for Sustainable Development

Alexander Shemetev¹

Abstract: This paper introduces the third generation of the Ethics Perception Index (ETPI) and Regional Ethics Perception Index (RETPI) – quantitative tools measuring ethical development at national and subnational levels. While GDP captures material prosperity, it misses the institutional foundations of sustainable development. The ETPI addresses this by combining seven standardised components (corruption control, economic freedom, human development, education, human rights, environmental performance, natural resource depletion) into a transparent 0–100 composite index. The RETPI extends this with regional modifiers based on public engagement with ethics (e.g., Google Trends), enabling subnational analysis. The framework incorporates time-series analysis, missing-data protocols (ME-Matrix), and coefficient-based metrics for ethical resilience and recovery following shocks. Applied to global and European regional data (1995–2024), results confirm Scandinavian leadership – Denmark (95.9), Finland (94.8), Sweden (93.7) – validating the framework. The RETPI reveals significant intra-national variation: regions such as Keski-Suomi (Finland) and Bayburt (Turkey) outperform their capitals in ethical engagement. A critical distinction is clarified: ETPI and RETPI measure institutional conditions enabling ethical behaviour, not individual moral character. High scores indicate strong preconditions for ethics (educated populations, rule of law, active public discourse); unethical behaviour in such contexts represents a conscious choice. These are the first replicable, longitudinal, regionally adaptable ethics-focused indices, providing policymakers and researchers a tool for assessing the ethical underpinnings of resilience, sustainability, and inclusive development.

Keywords: ETPI · RETPI · ethics · sustainable development · institutional quality · resilience

1 Introduction

Quantifying ethical performance at national and subnational levels is a largely unexplored area of comparative social science. Although there are numerous composite indices that capture dimensions that are normatively relevant to ethics, such as the Corruption Perceptions Index (CPI), the Worldwide Governance Indicators (WGI), the Human Development Index (HDI), the Social Progress Index (SPI), the World Justice Project Rule of Law Index, the Economic Freedom Index (EFI) and the Environmental Performance Index (EPI), none of these indices were explicitly designed as a holistic measure of ethics. Instead, they function as proxies for ethics rather than direct metrics.

Furthermore, no composite index has been designed to measure 'ethical performance' as a unified construct at the national or regional level. Existing instruments target either organisational ethics (the Ethical Climate Index (Arnaud, 2010)), individual moral intuitions (the Moral Foundations Questionnaire (Iurino & Saucier, 2020)) or cross-national attitudes (the World Values Survey (Inglehart et al., 2016)), but none aggregate institutional and behavioural indicators into a single ethics-focused score. Most indices also operate exclusively at the national level, obscuring intra-national variation, and predominantly rely on perception-based data (CPI, WGI), which introduces subjectivity and cultural bias (Razafindrakoto & Roubaud, 2010). None systematically integrate institutional 'stock' indicators with dynamic 'flow' indicators of public ethical engagement, nor do they offer modular flexibility for indicator substitution.

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Based on these observations, five gaps emerge: (1) the absence of a national ethics index designed for this purpose; (2) the dominance of perceptual data without public engagement metrics; (3) limited sub-national adaptability; (4) the absence of metrics for measuring resilience and recovery in ethical performance; and (5) rigid indicator sets without modular substitution options. The ETPI and RETPI indices presented in this study address these issues by offering a transparent, replicable and longitudinally consistent framework that can be adapted to different regions and is aware of resilience issues. This framework can be used to measure ethical performance across nations and regions.

2 Aim and methods

Several composite indices measure constructs that are normatively related to ethics. However, none of these were purpose-built as an ethics index. The Human Development Index (HDI) (United Nations Development Programme, 2025), for example, measures health, education and living standards, but omits ethical dimensions such as freedom and environmental concerns (Dar, 2004). The Worldwide Governance Indicators (WGI) capture governance quality, but they rely on expert perceptions, which introduces cultural bias. Moreover, the WGI's six dimensions appear to measure a single construct rather than distinct aspects (Langbein & Knack, 2010). The Corruption Perceptions Index (CPI) (Transparency International, 2020) measures perceived public-sector corruption; however, expert assessments can diverge significantly from household survey data (Razafindrakoto & Roubaud, 2010). The Social Progress Index (SPI) (Social Progress Imperative, 2025) measures non-economic societal performance, but it partly relies on survey-based indicators and was not designed to specifically measure ethics. The Good Country Index (GCI) correlates strongly with political freedom and cognitive ability, suggesting that it captures socio-economic development rather than ethics per se (Rindermann & Carl, 2020). The Business Ethics National Index (BENI) (Schwartz & Weber, 2006) measures formal business ethics activity rather than ethical performance and 'does not measure the extent to which business activity in a country is ethical' (p. 401). The Ethical Climate Index (ECI) (Arnaud, 2010) is designed for organisational contexts rather than nations. The Moral Foundations Questionnaire (MFQ) measures individual-level moral intuitions, but it lacks cross-cultural validity for national comparisons (Iurino & Saucier, 2020).

Six key gaps emerge from the literature: (1) There is no purpose-built composite index of national ethical performance (the BENI measures activity, not performance, and the E-HDI augments the HDI, but remains a development measure). (2) Most indices rely on perceptual or survey-based data (e.g. CPI, WGI and MFQ), which introduces cultural and social desirability bias (Libório et al., 2025). (3) There is limited sub-national adaptability – the HDI, CPI, WGI and SPI operate almost exclusively at the national level, obscuring intra-national variation. (4) No existing ethics index incorporates formal metrics for estimating the resilience and recovery of ethical performance following shocks. (5) Most composite indices are tied to fixed indicator sets and lack modular 'LEGO-style' architecture for transparent substitution. (6) No index integrates public ethical engagement as a dynamic regional modifier of institutional quality.

This study addresses these gaps by introducing the third generation of the Ethics Perception Index (ETPI) and the Regional Ethics Perception Index (RETPI): quantitative tools that measure ethical development at national and subnational levels. Based on seven standardised components (CPI, EFI, HDI, Education Index, Human Rights Index, EPI and Natural Resource Depletion), the ETPI provides a transparent and replicable composite index. The RETPI incorporates regional modifiers based on public engagement with ethics (e.g. Google Trends). The framework introduces modular 'LEGO-style' indicator substitution, a formal missing-data protocol (ME-Matrix) and coefficient-based metrics for ethical resilience and recovery. Together, these indices aim to provide policymakers and researchers with robust, longitudinal and regionally adaptable tools for assessing the ethical underpinnings of resilience, sustainability and inclusive development.

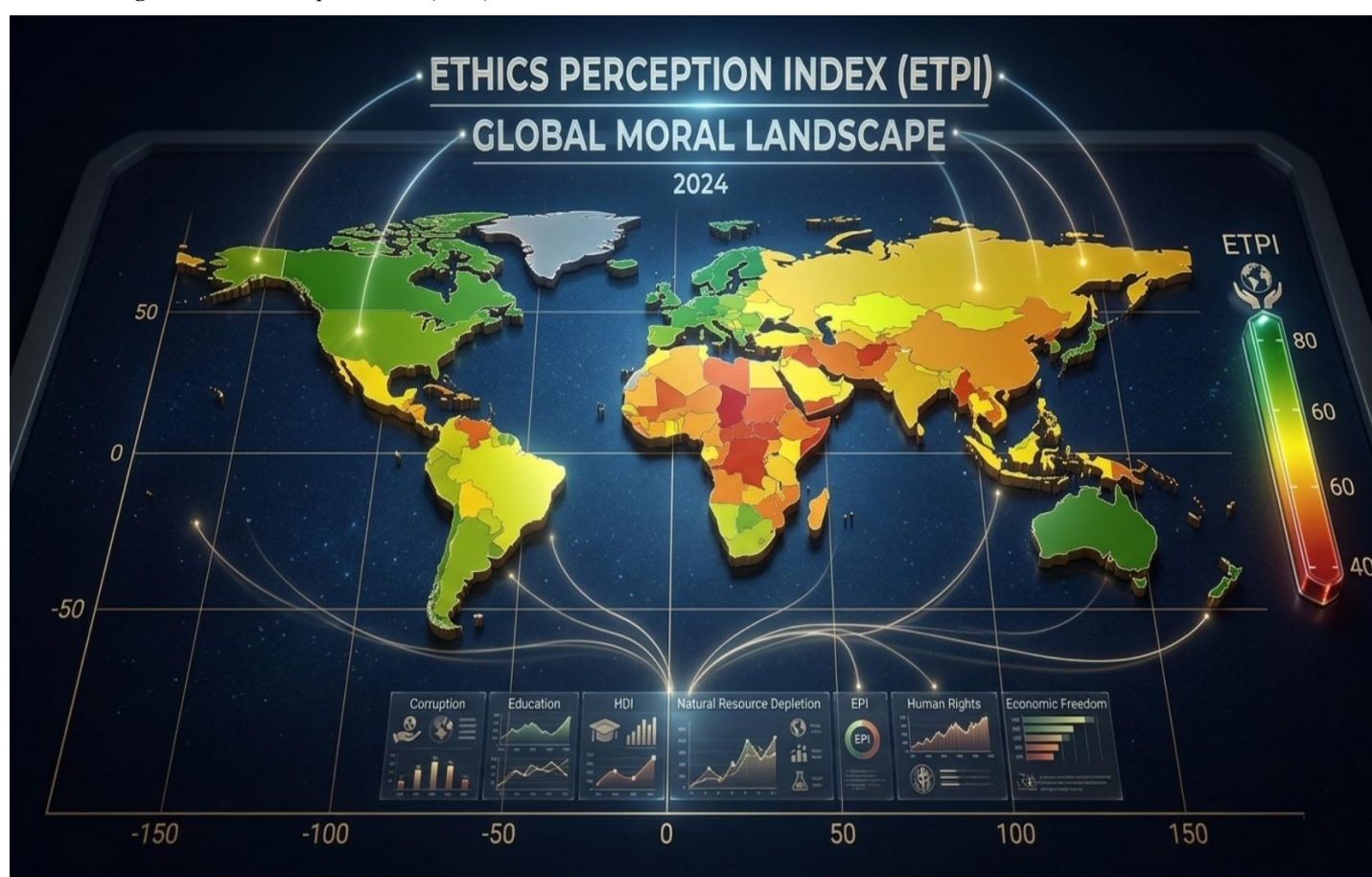
The ETPI and RETPI are composite indices that quantify ethical development at national and subnational levels. The framework distinguishes between 'stock' indicators, which reflect slow-changing structural conditions, and 'flow' indicators, which reflect dynamic public engagement. The ETPI comprises seven equally weighted, publicly available components (see Table 1). Equal weighting avoids subjective bias, and alternative schemes must be explicitly reported. The modular 'LEGO-style' architecture allows transparent component substitution.

All components are estimated by using ETPI and RETPI methodologies (Shemetev, 2025, 2026) handles missing data in the following ways: (a) using observed values when available, (b) temporarily flagging missing data for future updating, and (c) carrying forward the latest available data (LD) when recent values are unavailable.

3 Results

Figure 1 shows that the ETPI for 174 countries in 2024 identifies Scandinavian countries as global leaders: Denmark (95.9), Finland (94.8) and Sweden (93.7), followed by Switzerland (92.2), the Netherlands (90.7), the UK (90.6), Germany (90.6) and Ireland (90.5). The upper-middle tier includes Australia (88.1), Estonia (88.8), Iceland (89.2), Norway (89.9), Singapore (85.4), Japan (85.8) and Canada (85.2). The US (85.1) scores highly in terms of human development (96.0) and education (88.5), but faces moderate challenges in terms of economic freedom (77.5), corruption (Corruption Perceptions Index: 75), and environmental sustainability (Environmental Performance Index: 65.5). Countries with room for improvement include Hungary (75.5), Botswana (74.7) and Brazil (68.4), the latter of which offsets environmental struggles (EPI: 55.5) with strong human development (78.6) and natural resource management (91.0). Lower-middle performers include Kazakhstan (63.2), Turkey (62.9) and Morocco (61.8). China (57.4) faces significant challenges in terms of human rights (17.6) and environmental performance (36.5), but it benefits from low natural resource depletion (NRD: 98.1) and high human capital (HDI: 81.5). A full listing for 1995–2024 can be found in Annex A.

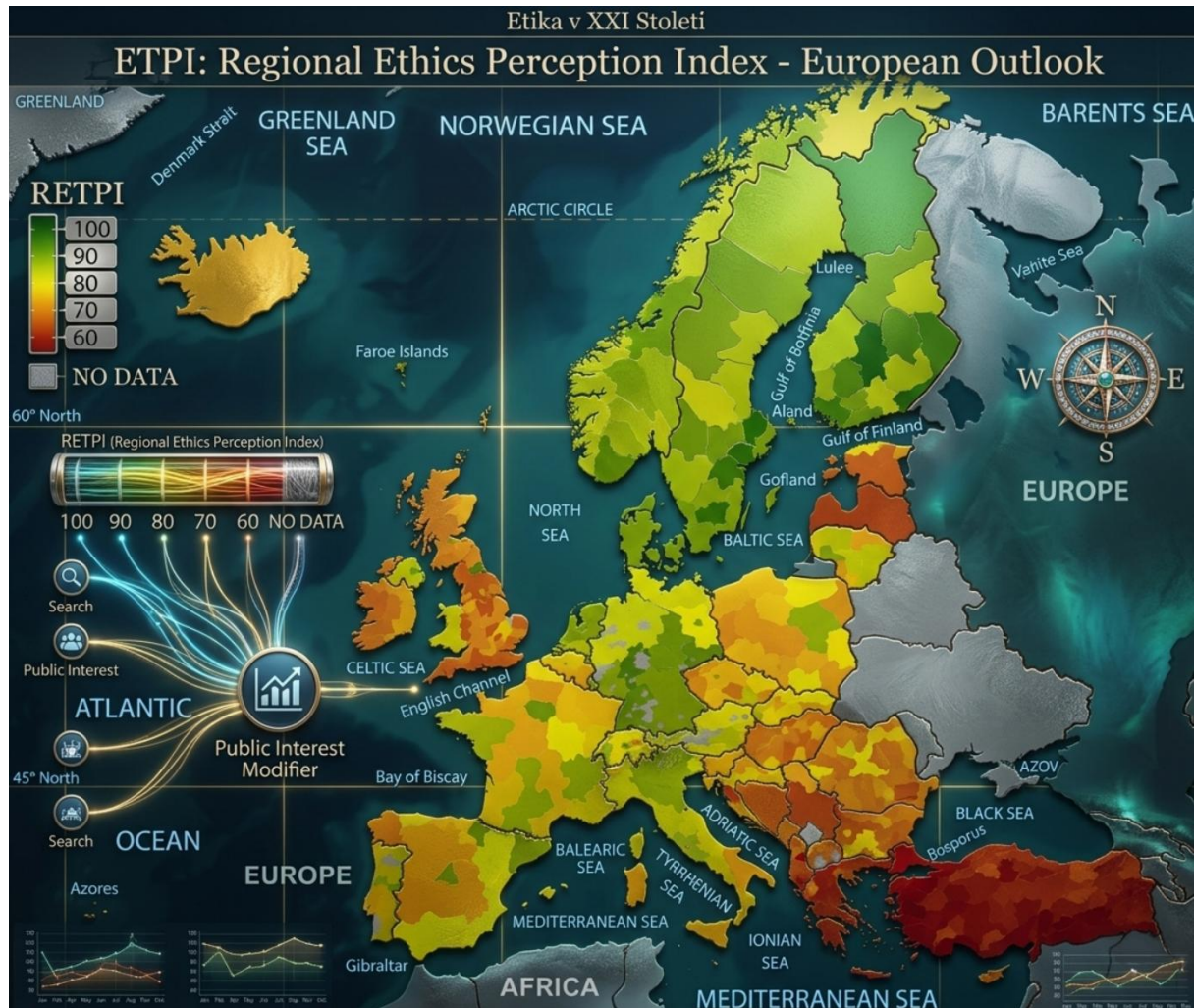
Figure 1 Ethics Perception Index (ETPI), 2024



Source: Own work in R.

The RETPI (Figure 2) reveals significant intra-national variation. Some countries demonstrate consistent ethical engagement (Latvia, Serbia, Greece). Capital regions often lead: Prague, Bratislava, Madrid, Paris and Tallinn. However, there are exceptions: Keski-Suomi and Etelä-Karjala in Finland outperform Helsinki; Bayburt and Çankırı in Turkey surpass Istanbul; Bergstraße and Frankfurt in Germany exceed Berlin; and Camden and the City of London in the UK compete with Belfast and Bradford.

Figure 2 RETPI for Europe, rescaled to global ETPI (2024)



Source: Own work in R. Notes: Moldova, Belarus, the Caucasus states, Russia and Ukraine are omitted because, although these countries are located in geographical Europe, they are affected by military conflicts, which has an impact on ethics. These countries therefore deserve a separate study. There is no data for the Kosovo region. Map scale factor = $\sec(\phi)$, where ϕ is the latitude in radians, and $\sec(\phi) = 1/\cos(\phi)$ (Snyder, 1987).

Scandinavia confirms its position as a top-tier ethical performer. Rather than setting Scandinavian countries as benchmarks, we use empirical min–max scaling to avoid normative bias.

4 Discussion

Existing ethics-related indices tend to focus on specific areas such as corporate behaviour (DJSI and the French Ethics Index), employee perceptions (GBES), personal freedoms (WIOMF), and single-country surveys (the Australian Ethics Index). As they mostly rely on subjective survey data, limited samples or single-country designs, it is difficult to make cross-national comparisons and broader institutional conditions that shape ethical behaviour are overlooked. Although valuable, the Global Social Progress Index (SPI) operates only at the national level and uses perception-based indicators. See the Background section for direct citations of the sources of these indices. In contrast, the ETPI and RETPI offer a transparent, replicable framework that combines seven standardised components to produce a single quantitative score. They operate at both the national (ETPI) and subnational (RETPI) levels, a feature absent from all competing indices.

It is important to note that these indices measure the institutional conditions that enable ethical behaviour rather than individual moral character. High ETPI scores indicate strong preconditions, such as an educated population, a functioning legal system and low levels of corruption, that enable individuals to act ethically. Unethical behaviour in such contexts therefore represents a conscious choice despite every institutional advantage. Conversely, ethical behaviour in low-scoring countries reflects remarkable moral agency in the face of structural barriers (Bandura, 1999). This distinction has clear policy implications: high-scoring countries should focus on

individual accountability, while low-scoring countries should prioritise institutional development across the ETPI components. While no index can capture every aspect of human ethical behaviour, the ETPI and RETPI are currently the most comprehensive, transparent and adaptable tools available for the quantitative assessment of ethics.

5 Conclusion

This paper introduces the third generation of the Ethics Perception Index (ETPI) and the Regional Ethics Perception Index (RETPI), which are quantitative tools that measure ethical development at national and subnational levels. The ETPI is based on seven standardised components and provides a transparent, replicable composite index, while the RETPI extends this by incorporating regional modifiers that capture public engagement with ethics. The results confirm the leadership of the Scandinavian countries (Denmark: 95.9; Finland: 94.8; Sweden: 93.7) and reveal significant intra-national variation, thereby validating the framework's value for subnational analysis. Temporal analysis links shifts in the ETPI to major socio-political events, confirming the sensitivity of the indices to real-world dynamics.

A key contribution of the paper is to clarify what these indices measure: institutional conditions that enable ethical behaviour rather than individual moral character. High scores indicate strong preconditions for ethics, such as the rule of law, education and low levels of corruption. In such contexts, unethical behaviour represents a conscious choice, whereas ethical behaviour in countries with low scores reflects remarkable moral agency in overcoming structural barriers.

The ETPI and RETPI were developed through three generations of refinement and offer several advantages over existing alternatives such as the SPI, CPI, WGI, GBES, DJSI and WIOMF. They are purpose-built for ethics, operate at national and regional levels, rely on standardised numerical data and are fully replicable. Future research should expand RETPI coverage to non-European regions and refine resilience metrics. These indices provide policymakers and researchers with robust tools for evaluating the ethical basis of sustainable and inclusive development.

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Between Uncertainty and Responsibility: Descartes' Ethics and the Environmental Challenges of the 21st Century

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Abstract: The paper analyzes the possibilities of reinterpreting Descartes' provisional ethics as a normative framework for action under conditions of epistemological uncertainty, which are characteristic of the current environmental crisis. It shows that climate change and other ecological problems make it impossible to base decision-making on complete certainty, and therefore require a specific ethical approach. Descartes' emphasis on rationality, decisiveness, and self-control is confronted with the precautionary principle, the theory of risk society, and the ethics of responsibility. Attention is also devoted to consumerism and the question of individual responsibility.

Keywords: Descartes, environmental ethics, epistemological uncertainty, responsibility, risk society, sustainability

JEL Classification: I31, Q56

1 Introduction

The environmental crisis of the 21st century represents a complex problem affecting the natural, economic, and social sphere. Climate change, loss of biodiversity, and degradation of natural resources show that human activity fundamentally influences planetary systems (IPCC, 2021; Rockström et al., 2009). However, a specific feature of this situation is epistemological uncertainty, which limits the ability to accurately predict the consequences of human action.

Despite the progress of science, it is not possible to achieve absolute certainty, which creates tension between the requirement of rational decision-making and the limits of knowledge (Beck, 2004). The environmental problem thus becomes not only a technical issue, but above all an ethical one. Uncertainty concerns not only the magnitude of individual phenomena, but also their mutual interactions and long-term impacts. Decision-making therefore takes place in a situation where only incomplete information is available, which must be interpreted and applied in the context of specific value frameworks. As Jonas (1997) points out, modern civilization bears responsibility for the long-term consequences of its actions, and this responsibility cannot be postponed until knowledge becomes complete. Ethics thus acquires a fundamental role in the interpretation of risks and the formulation of adequate responses to them.

The aim of the paper is to show that Descartes' provisional ethics can serve as a suitable framework for decision-making under conditions of uncertainty. Its emphasis on rationality and decisiveness makes it possible to bridge the gap between insufficient knowledge and the necessity to act. At the same time, it provides conceptual tools for understanding the relationship between individual action and the structural conditions of modern society. The reinterpretation of this classical philosophical approach opens space for its application in environmental ethics, where it is necessary to combine analytical reflection with practical decision-making. The text therefore aims not only at theoretical analysis, but also at indicating broader implications for environmental policy and everyday ethical choices of individuals.

2 Methods and Approaches to Processing

The methodological framework of this study is based on qualitative philosophical research employing conceptual analysis, hermeneutic interpretation, comparative analysis, and interdisciplinary synthesis. The paper

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is theoretical in nature and does not seek empirical verification of hypotheses; rather, it aims to develop a coherent normative framework for environmental decision-making under conditions of epistemological uncertainty (Gadamer, 2004; Creswell & Poth, 2018). The primary research objective is to determine whether René Descartes' concept of provisional morality can be reinterpreted as an ethical framework applicable to contemporary environmental challenges characterized by scientific uncertainty, systemic risks, and the necessity of timely decision-making.

The study addresses the following research question: *To what extent can Descartes' provisional ethics provide a philosophically coherent basis for responsible environmental decision-making under conditions of epistemological uncertainty?* To answer this question, several complementary methodological approaches are employed.

First, conceptual analysis is used to identify the essential principles of Descartes' provisional morality, particularly rationality, decisiveness, prudence, and self-control. These concepts are reconstructed from Descartes' original philosophical texts and interpreted within their historical context.

Second, hermeneutic interpretation is applied to examine the contemporary relevance of these concepts in environmental ethics. Rather than treating Descartes' work solely as a historical document, the study interprets his ideas as a living philosophical resource capable of addressing modern ethical dilemmas associated with climate change, biodiversity loss, and ecological uncertainty.

Third, the article employs a comparative philosophical method, confronting Descartes' ethical framework with selected contemporary theories, including Hans Jonas' ethics of responsibility, Ulrich Beck's theory of the risk society, the precautionary principle, and contemporary discussions of sustainable development and environmental governance. This comparison identifies both convergences and conceptual differences among these approaches.

Finally, the research applies an analytical-synthetic procedure. Individual philosophical concepts are first examined separately and subsequently integrated into a comprehensive theoretical model describing responsible environmental action under uncertainty. The synthesis combines perspectives from philosophy, environmental ethics, ecology, political theory, and sustainability studies.

The literature selection follows the principle of theoretical relevance rather than bibliometric representativeness. Priority is given to seminal works in environmental philosophy, contemporary climate science (particularly IPCC reports), and influential theories concerning responsibility, risk, and sustainability (Booth, Sutton, & Papaioannou, 2021). Classical philosophical sources are interpreted together with current interdisciplinary literature to ensure both historical continuity and contemporary applicability.

Methodologically, the paper adopts a normative-interpretative perspective. It does not merely describe environmental problems but evaluates ethical principles capable of guiding decision-making where complete scientific certainty is unattainable. The study therefore combines descriptive philosophical analysis with normative argumentation aimed at formulating practical ethical recommendations.

The principal limitation of this research lies in its theoretical character. The proposed framework has not been empirically tested through case studies or behavioural research. Consequently, future research could complement the present conceptual model with empirical analyses of environmental policy, institutional decision-making, or public attitudes toward risk and responsibility. Despite this limitation, the theoretical synthesis provides a coherent conceptual foundation for further interdisciplinary research linking philosophy, environmental ethics, and sustainability governance.

3 Research Results

3.1 Descartes' Provisional Ethics

Descartes formulates the concept of provisional ethics in his *Discourse on the Method* as a practical solution to a situation in which it is not possible to achieve definitive certainty of knowledge (Descartes, 1992). Within the framework of his methodological skepticism, he systematically questions traditional sources of knowledge, thereby arriving at a situation of temporary epistemological uncertainty. This radical doubt, however, does not mean the possibility of suspending action, since a human being remains an agent of everyday life even in the period of philosophical search for certainty. It is precisely this paradox between theoretical uncertainty and the practical necessity to act that leads Descartes to formulate provisional ethics as a set of temporary rules.

The basic principles of this ethics (respect for laws and customs, decisiveness in action, and self-control) represent a framework that makes it possible to stabilize human behavior in an uncertain environment. Decisiveness plays a key role here, as it prevents paralysis of action caused by doubt. Descartes emphasizes that even a decision made on the basis of incomplete information is better than inaction, if it is the result of reasonable deliberation (Descartes, 1992). This position can be interpreted as an early form of decision theory under uncertainty, where the ability to converge toward practical action even without complete evidence is important (Jesus, 2022).

Another significant element is the emphasis on self-control, which Descartes understands as the ability to regulate one's own desires and to adapt to reality rather than to forcibly change it. This principle has not only an ethical but also an epistemological dimension, as it shows that human action must take into account the limits of knowledge as well as control over the world (Džbáňková et al., 2026). In a modern context, this aspect can be interpreted in connection with environmental ethics as a call to limit excessive consumption and to accept responsibility for one's own actions (Jonas, 1997).

Contemporary philosophy interprets Descartes' provisional ethics not only as a historical artifact, but as a more general model of practical rationality. As Cottingham (1998) points out, Descartes shows here that moral action cannot be postponed until the achievement of absolute knowledge, but must be based on the ongoing evaluation of the situation. This approach is close to modern pragmatic theories of ethics, which emphasize contextual decision-making and adaptation to changing conditions.

In the context of environmental problems, this conception acquires a new significance. Contemporary society faces situations in which decisions on climate policy, energy transition, or biodiversity protection cannot be based on complete certainty (IPCC, 2021). Descartes' emphasis on rational and decisive action under conditions of uncertainty thus represents an inspiring model for environmental ethics as well as policy. It makes it possible to formulate an approach that is neither dogmatic nor relativistic, but is based on the responsible use of available information.

From this perspective, Descartes' provisional ethics can be understood as a bridge between theoretical skepticism and practical action. Its significance lies not only in the historical context of its origin, but above all in its ability to address contemporary problems that are characterized by a similar structure of uncertainty. In this sense, it represents an important source of inspiration for modern environmental thinking.

3.2 Epistemological Uncertainty in Ecology

Environmental problems of the present are characterized by a high degree of complexity, which fundamentally limits the possibilities of precise prediction of their development. Climate systems, biodiversity processes, as well as global biogeochemical cycles represent nonlinear and interconnected structures, the dynamics of which are difficult to model (IPCC, 2021; Rockström et al., 2009). As a result, despite advanced scientific knowledge, a significant degree of uncertainty remains, which concerns both the magnitude of individual phenomena and their long-term consequences.

This epistemological uncertainty has several levels. The first of these is empirical uncertainty, resulting from insufficient data and limited accuracy of measurement. The second level is model uncertainty, which is related to the necessity of simplifying complex natural processes when representing them in scientific models. The third level is systemic uncertainty, resulting from the inherent unpredictability of complex systems, in which small changes can trigger extensive and unexpected consequences (Beck, 2004; IPCC, 2021). These levels often overlap and reinforce one another.

From an ethical point of view, it is essential that this uncertainty does not weaken the need for action, but on the contrary strengthens it. As Beck (2004) emphasizes, modern society is not capable of eliminating risks, but must learn to work with them systematically. Environmental decision-making thus shifts from the domain of certainty to the domain of managing probabilities and potential scenarios. In this sense, ethics cannot rely on absolute truths, but must reflect the conditions of incomplete knowledge.

This situation is also addressed by contemporary environmental philosophy, which emphasizes the importance of so-called fallibilism, that is, the conviction that all knowledge is temporary and open to revision (Oreskes, 2004). This approach rejects the idea of definitive certainty and emphasizes the need for adaptive decision-making. Environmental policy must therefore be able to respond to new knowledge and adjust its strategies over time.

In this context, Descartes' provisional ethics can be interpreted as a surprisingly *aktual* model of action. Descartes explicitly proceeds from the assumption that human beings act under conditions of incomplete knowledge, and must therefore accept a certain degree of uncertainty as the initial state (Descartes, 1992). His emphasis on decisiveness and practical rationality can be understood as a response to a situation in which it is not possible to wait for final confirmation of truth.

An important aspect is also the temporal dimension of environmental problems. Many ecological processes have a long-term character and their consequences manifest themselves only with a time lag. This means that decisions made today influence the conditions of life of future generations (Jonas, 1997). Uncertainty is thus not limited only to the present, but also includes a projection into the future, which is necessarily burdened with unknown variables.

From this perspective, epistemological uncertainty must be understood not as a deficit, but as a structural feature of modern knowledge. This shift makes it possible to formulate an ethics that does not require absolute certainty, but places emphasis on the responsible handling of risk. Environmental action thus becomes a process in which it is necessary to continually balance between available knowledge, probable scenarios, and value orientations.

Within this framework, Descartes' provisional ethics represents one of the possible philosophical foundations of such an approach. It offers a model of action that is capable of integrally linking uncertainty of knowledge with the necessity of practical decision-making. Its significance thus lies in the fact that it provides a conceptual framework for situations that are typical of contemporary environmental reality.

3.3 Risk Society, Responsibility, and the Precautionary Principle

The concept of the risk society, formulated by Ulrich Beck, points to the fact that modernization processes lead not only to economic and technological progress, but at the same time produce new types of global risks (Beck, 2004). These risks have a specific nature: they are often invisible, complex, temporally delayed, and difficult to quantify. The environmental crisis represents their paradigmatic example, as it includes processes whose impacts exceed both geographical and generational boundaries.

A fundamental feature of these risks is their systemic character. They are not isolated threats, but consequences of the structural functioning of modern society, especially industrial production, globalization, and technological development. In this context, the character of responsibility also changes: it is no longer limited to the immediate consequences of action, but also includes long-term and indirect effects. As Jonas (1997) emphasizes, ethics must reflect the fact that human action has the potential to influence the very conditions of the existence of future generations. Responsibility thus becomes anticipatory, oriented toward the future, not only retrospective.

This change of perspective places new demands on ethical thinking as well as practical decision-making. In a situation where it is not possible to precisely predict all consequences of action, responsibility cannot be understood as control over outcomes, but rather as the ability to act prudently under conditions of uncertainty. It is precisely here that the importance of Descartes' provisional ethics becomes evident, as it offers a model of action that makes it possible to combine rationality, decisiveness, and awareness of the limits of knowledge (Descartes, 1992). Descartes emphasizes that uncertainty must not lead to inaction, but on the contrary requires prudent and consistent action based on available information.

This philosophical framework is complemented in contemporary environmental ethics by the precautionary principle, which has become one of the key instruments of environmental policy. According to this principle, the lack of full scientific certainty must not be a reason for postponing preventive measures in cases where there is a risk of serious or irreversible damage to the environment (IPCC, 2021). The precautionary principle thus represents a practical implementation of the ethics of responsibility under conditions of epistemological uncertainty.

Its significance lies primarily in the fact that it transforms the relationship between science and politics. Instead of waiting for definitive confirmation of hypotheses, it emphasizes the need to act on the basis of probabilistic estimates and scenarios. This approach corresponds to the nature of current environmental problems, which cannot be solved *ex post*, but require preventive interventions. At the same time, however, it raises questions concerning the proportionality of measures, the distribution of costs, and the legitimacy of decision-making processes, which further emphasizes the necessity of ethical reflection.

The relationship between Descartes' provisional ethics and the precautionary principle can be understood as a relationship between a philosophical foundation and its practical application. Both approaches share the conviction that action must proceed even without absolute certainty, and that responsibility consists in the reasonable handling of uncertainty. While Descartes provides a general framework of practical rationality, the precautionary principle concretizes this framework in the field of environmental policy.

The connection of these concepts makes it possible to formulate an approach to environmental problems that is neither rigidly technocratic nor relativistic. On the contrary, it creates space for decision-making that respects the limits of knowledge, but at the same time emphasizes prevention and responsibility. Under the conditions of the risk society, ethics thus becomes an indispensable tool of orientation, which makes it possible to face the complex challenges of the present.

3.4 The Precautionary Principle, Consumerism, and the Ethics of Self-Limitation

The precautionary principle represents one of the key instruments of contemporary environmental ethics and policy. Its basic formulation is based on the assumption that the lack of full scientific certainty must not serve as a reason for postponing measures in a situation where there is a risk of serious or irreversible damage to the environment (IPCC, 2021). This principle reflects the specific nature of environmental problems, which are characterized by complexity, temporal delay, and potentially irreversible consequences.

From a philosophical point of view, the precautionary principle can be understood as a shift from the epistemological ideal of certainty to an ethics of responsible action under conditions of uncertainty. Decision-making here is not based on absolute proof, but on a value assessment of risks and probable impacts. This approach is in accordance with Descartes' emphasis on decisiveness, according to which it is necessary to act even with incomplete knowledge, if the decision is based on rational consideration (Descartes, 1992). Descartes' provisional ethics thus offers a philosophical foundation for understanding precaution not as passivity, but as an active and responsible approach to uncertainty.

The precautionary principle, however, cannot be reduced only to a technical instrument of risk management. It also has a significant normative dimension, because it implies a certain conception of responsibility toward the future and toward natural systems as a whole. As Jonas (1997) points out, modern technological society has the ability to fundamentally change the conditions of life on Earth, and therefore ethics must be directed toward the protection of future generations. Precaution thus represents a concrete expression of this responsibility at both the political and practical level.

The effectiveness of this principle is, however, closely connected with broader socio-economic conditions, especially with the character of contemporary consumer society. According to Bauman (2007), it is based on the permanent stimulation of consumption and the identification of the individual through material goods. Consumption here does not represent only an economic activity, but also a cultural norm that shapes the values and lifestyle of modern human beings. This model, however, is environmentally unsustainable in the long term, as it leads to the excessive extraction of natural resources and the production of waste.

Consumerism simultaneously weakens the ability of the individual to reflect on the consequences of their actions, because it supports a short-term orientation toward the satisfaction of needs. The ethics of responsibility as well as the precautionary principle, however, presuppose the ability to take into account the long-term impacts of decisions. In this sense, a tension arises between the dominant cultural model of consumption and the requirements of environmental sustainability.

Descartes' emphasis on self-control and the ability to regulate one's own desires offers an alternative ethical framework that can mitigate this tension. Self-limitation is here not understood as a restriction of freedom, but as its precondition. An individual who is able to control their needs is not dependent on constant consumption and can act more autonomously and responsibly (Descartes, 1992). This aspect is especially important in the context of the environmental crisis, where individual action plays a significant role in the aggregate impact on the environment.

From an environmental perspective, the precautionary principle and the ethics of self-limitation can thus be understood as mutually complementary approaches. The first operates primarily at the level of institutions and policies, while the second emphasizes individual action and lifestyle. Both approaches, however, share a basic assumption: that responsible action must reflect the limits of natural systems and the uncertainty associated with their disruption.

The integration of these approaches makes it possible to formulate a more comprehensive model of environmental ethics, which connects normative principles with practical strategies. Within this framework, ethics is not limited to abstract considerations, but becomes a concrete tool of orientation in the everyday decision-making of both individuals and institutions. It is precisely this ability to connect theory and practice that represents a key prerequisite for an effective response to the environmental challenges of the present.

3.5 Practical Rationality

One of the key problems of contemporary environmental ethics is the tension between normative ideals and their practical realization. Although there is a broad consensus on the need for sustainable development, climate protection, or the preservation of biodiversity, concrete measures often lag behind declared goals. This discrepancy is not caused only by a lack of political will, but also by epistemological uncertainty, the complexity of problems, and the conflict of value priorities. In this situation, the concept of practical rationality gains fundamental importance as the ability to act responsibly under conditions of incomplete knowledge.

Descartes' provisional ethics represents one of the early models of practical rationality. It emphasizes that a human being must act even when complete certainty is not available, and that decisiveness is a key prerequisite of meaningful action (Descartes, 1992). This approach can be understood as an alternative to an idealized model of rationality that presupposes perfect information and full control over the consequences of action. Under real conditions of environmental problems, such a model is unsustainable, since decision-making must rely on limited and often incomplete knowledge.

In modern philosophy, the concept of practical rationality is further developed, for example, in Jürgen Habermas's theory of communicative action, which emphasizes the importance of rational discussion and consensus in solving social problems (Habermas, 1987). In the environmental context, this means that decision-making is not only a matter of individual judgment, but also of a collective process in which different values, interests, and interpretations of risks confront each other. Practical rationality thus acquires an intersubjective dimension and becomes a tool for coordinating action in a complex society.

Another important aspect is the relationship between practical rationality and risk management. As Beck (2004) shows, modern society is characterized by the production of systemic risks that cannot be fully eliminated, but only managed. Practical rationality in this context consists in the ability to evaluate probabilities, consider alternative scenarios, and make decisions that minimize potential damage. However, this process is not purely technical, but also includes an ethical assessment of what level of risk is acceptable and who bears its consequences.

From an environmental point of view, practical rationality is closely connected with the precautionary principle and the ethics of responsibility. Decision-making must reflect not only present impacts, but also long-term consequences for future generations (Jonas, 1997; IPCC, 2021). This means that practical rationality is not oriented only toward efficiency, but also toward justice and sustainability. In this sense, it represents a broader framework that integrates scientific knowledge, ethical values, and political decision-making.

Practical rationality also has a significant role at the level of individual action. Everyday decisions concerning consumption, mobility, or the use of energy resources have a cumulative impact on the environment. As Bauman (2007) points out, contemporary society often supports short-term and impulsive behavior that is in conflict with the principles of sustainability. Practical rationality here means the ability to reflect on the broader consequences of one's own decisions and to adapt one's actions accordingly. In this context, Descartes' ethics can be understood as an inspiration for the development of both personal and collective responsibility. Its emphasis on self-control, prudence, and consistency of action provides a basis for an ethics that is not grounded in abstract principles, but in concrete practice. Practical rationality thus represents a bridge between theory and everyday life.

In conclusion, it can be stated that practical rationality is an indispensable element of environmental ethics under conditions of uncertainty. It makes it possible to overcome the dichotomy between knowledge and action and provides a framework for responsible decision-making at all levels - from individual behavior to global policy. In this sense, it represents a key tool for orientation in the complex and changing world of the present.

4 Conclusion

Descartes' provisional ethics, originally formulated as a temporary solution to methodological skepticism, proves to be surprisingly *aktuell* in the context of the environmental challenges of the 21st century. Its emphasis on

decisiveness, rationality, and self-control offers an appropriate framework for action under conditions of epistemological uncertainty, which is a characteristic feature of contemporary ecological problems (Brissey, 2024; IPCC, 2021). This approach emphasizes that uncertainty is not a reason for postponing action, but rather an impulse for responsible and prudent decision-making.

The analysis has shown that linking Descartes' ethics with modern concepts such as the theory of the risk society (Beck, 2004), the ethics of responsibility (Jonas, 1997), or the precautionary principle makes it possible to create a comprehensive framework of environmental ethics. This framework reflects not only the limits of knowledge, but also the necessity of an active approach to solving environmental problems. Ethics here is no longer based on the search for absolute certainty, but on the ability to work with probability, risk, and the long-term consequences of human action.

At the same time, it becomes evident that environmental responsibility cannot be reduced only to the institutional or political level, but must also include the individual dimension of action. The consumer character of modern society creates pressure for the constant increase of consumption, which is in direct contradiction with the principles of sustainability (Bauman, 2007). Descartes' emphasis on self-control thus acquires a new significance as a foundation of an ethics that connects personal responsibility with global environmental challenges.

The future of environmental ethics will probably not lie in achieving complete epistemic certainty, but in the ability to act responsibly under conditions of permanent uncertainty. This means developing such forms of rationality that are capable of integrating scientific knowledge, ethical values, and practical decision-making (Habermas, 1987; Cimákasky & Polansky, 2012). It is precisely this type of practical rationality that can contribute to bridging the gap between declared goals and real action.

Descartes' legacy thus cannot be understood only as a historical stage in the development of philosophy, but as a still inspiring source for the reflection of contemporary global problems. His emphasis on an active approach to uncertainty, responsibility, and discipline in action can significantly contribute to the formation of an ethical framework that corresponds to the demands of the current environmental crisis. In this sense, Descartes' provisional ethics represents not only a methodological tool, but also a normative challenge to responsible action under conditions of a complex and uncertain world.

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Ethical Aspects of the Metaphysical Presuppositions of Economics in an Environmental Context: The Perspective of the “Last Man” and the “Übermensch”

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Abstract: The article analyzes the ethical implications of the metaphysical presuppositions of economics under conditions of environmental crisis through the concepts of the “last man” and the “Übermensch.” It employs hermeneutic and comparative methods to examine the ontological, anthropological, and axiological frameworks of economic thought. The results indicate that the

se frameworks shape the human relationship to nature and reflect two opposing types: the passive consumer and the creative, responsible agent. In conclusion, the article argues that overcoming the ecological crisis requires a transformation of the economic paradigm toward the values represented by the Übermensch.

Keywords: metaphysics, economic and ethical aspects of environmentalism, last man, Übermensch, sustainability

JEL Classification: B41, Q50

1. Introduction

The contemporary environmental crisis reflects not only technological and institutional limitations but also deeper structures of meaning underlying human action (Meadows et al., 2004; Rockström et al., 2009). Economics, as a central framework organizing social life, is grounded in implicit metaphysical presuppositions that shape how reality, human beings, and the natural environment are understood (Daly & Farley, 2011; Heidegger, 1977).

These presuppositions have direct ethical consequences. The dominant economic paradigm, oriented toward growth and efficiency, systematically privileges instrumental relations to nature and contributes to ecological degradation (Stern, 2007; Foster et al., 2010). The environmental crisis can therefore be interpreted not merely as a failure of policy or technology but as a structural outcome of underlying conceptual frameworks.

This article analyzes these foundations through Nietzsche’s archetypes of the “last man” and the “Übermensch” (Nietzsche, 2001), understood as ideal types that represent contrasting orientations toward responsibility, value creation, and the human–nature relationship. Weber’s concept of disenchantment provides an interpretive background for understanding the historical shift toward calculability and instrumental rationality (Weber, 1978).

2. Methodology

The study combines hermeneutic interpretation with comparative analysis. The hermeneutic approach uncovers implicit assumptions within economic discourse and situates them in broader philosophical contexts (Gadamer, 2010). In this perspective, economics is treated as a value-laden framework that shapes both interpretation and practice.

The comparative method examines the archetypes of the “last man” and the “Übermensch” as Weberian ideal types (Weber, 1978). The comparison is conducted across three dimensions: ontological (conception of reality), anthropological (model of the human being), and axiological (structure of values).

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This framework is complemented by critical reflection aimed at identifying structural limitations of the current economic paradigm and outlining conditions for its transformation under environmental constraints (Daly & Farley, 2011; Rockström et al., 2009).

3. Research Results

3.1 Metaphysical Foundations of Economic Thought

Modern economic thought is inseparably linked to the metaphysical turn of early modern rationality, which brought about a fundamental transformation in the relationship between human beings and reality, particularly nature. This shift, associated with the development of the scientific revolution, Cartesian dualism, and Enlightenment rationalism, redefined nature from a bearer of intrinsic meaning and value into an object of knowledge, calculation, and technical control (Descartes, 1996; Heidegger, 1977; Merchant, 1980).

From an ontological perspective, this transformation entails the reduction of complex reality to a system that can be grasped through measurable and quantifiable variables. This reduction is not merely epistemological but carries significant normative implications, as it determines what is considered relevant and valuable. Within this framework, the natural world is reinterpreted as a set of resources whose significance is derived from their utility in processes of production and exchange (Daly & Farley, 2011). Weber's concept of the "disenchantment of the world" (Entzauberung) aptly captures this process as a transition from a value- and symbolically saturated understanding of reality to its instrumental and calculative apprehension (Weber, 1978).

This ontological transformation is closely intertwined with a specific anthropological construction. In economic theory, the model of *homo economicus* becomes dominant, conceptualizing human action as the rational optimization of utility under given constraints (Sen, 1999). Although analytically effective, this model simultaneously constitutes a normative reduction of human existence, as it marginalizes dimensions such as ethical responsibility, relationality, and long-term orientation (Polanyi, 2001). Consequently, human rationality is narrowed to instrumental calculation oriented toward efficiency and the maximization of immediate utility.

At the axiological level, this reduction manifests itself in the dominance of market-mediated forms of value. Value is primarily defined through price, leading to the systematic marginalization or exclusion of those aspects of reality that are not easily monetizable, such as biodiversity, ecosystem stability, and the cultural and aesthetic dimensions of nature (Costanza et al., 1997). This structural bias cannot be understood merely as a technical problem of imperfect markets, but rather as an expression of deeper limitations within the value framework itself.

The result is a form of economic rationality that systematically privileges short-term efficiency over long-term stability and externalizes environmental costs across space and time (Stern, 2007). Environmental degradation thus does not appear as an accidental failure of the system, but as a logical consequence of its underlying assumptions. As demonstrated by the concept of planetary boundaries, economic activity that is not embedded within ecological limits leads to the destabilization of key regulatory mechanisms of the biosphere (Rockström et al., 2009).

This situation suggests that the resolution of the environmental crisis cannot be reduced to technological innovation or institutional adjustment. Rather, it requires a critical reflection on and re-evaluation of the metaphysical foundations of economic thought itself. Alternative approaches, such as ecological economics and the concept of the circular economy, attempt to address this gap by emphasizing the embeddedness of the economy within natural systems and the need to integrate ethical and ecological dimensions into economic rationality (Daly & Farley, 2011; Geissdoerfer et al., 2017).

From this perspective, the environmental crisis can be interpreted as a symptom of a deeper mismatch between the prevailing model of rationality and the conditions of its own existence. The metaphysical foundations of economics therefore emerge not as an abstract philosophical issue, but as a decisive factor shaping the concrete form of economic institutions, decision-making processes, and the human relationship to the natural world.

3.2 The "Last Man" as an Expression of Economic Reductionism

The "last man" represents a mode of existence characterized primarily by an orientation toward stability, comfort, and the minimization of existential demands (Nietzsche, 2001). Within the previously outlined economic framework, this figure can be understood as a subject whose preferences and identity are structured by externally given patterns rather than autonomous value formation.

Instead of critically interrogating prevailing economic arrangements, the last man internalizes them as self-evident. In this context, consumption functions not merely as a means of satisfying needs, but as a central mechanism of identity construction and social positioning (Bauman, 2007; Fromm, 1976). The horizon of evaluation becomes narrowed, as economic expansion is implicitly associated with progress, while alternative conceptions of well-being remain marginal.

A key feature of this anthropological type is the erosion of reflexivity. The capacity to distance oneself from dominant structures is weakened, resulting in a form of practical conformity rather than deliberate agency. Economic institutions are thus experienced not as contingent and transformable, but as naturalized conditions of existence. This limits the ability to formulate and pursue alternative trajectories (Herrfahrdt. et al., 2020).

This reduced reflexive capacity manifests itself in a discrepancy between cognitive awareness and behavioral patterns. Environmental challenges may be recognized at an abstract level, yet they rarely translate into substantial changes in everyday practices. Immediate concerns tend to prevail over deferred consequences, reinforcing a present-oriented mode of decision-making in which longer-term implications remain insufficiently integrated.

In this sense, the last man does not simply participate in existing economic processes but contributes to their reproduction at the level of everyday action. His orientation stabilizes patterns that maintain ecological pressures, not through active intention, but through the absence of transformative engagement. The persistence of unsustainable dynamics can therefore be linked not only to institutional configurations but also to this specific mode of subjectivity.

3.3 The “Übermensch” as an Alternative

The “Übermensch” represents an alternative mode of subjectivity defined by reflexive autonomy, creative agency, and the capacity to transcend given evaluative frameworks (Nietzsche, 2001; Heidegger, 1977). In contrast to the adaptive orientation of the last man, this archetype is characterized by an active engagement with the conditions that shape human action and by the ability to reinterpret them in light of broader existential and ethical considerations (Foucault, 2002; Sen, 1999).

Within the economic domain, this orientation entails a reconfiguration of rationality rather than its rejection. Decision-making is no longer confined to immediate optimization within predefined parameters but is expanded to include reflection on the parameters themselves. This shift introduces a reflexive dimension into economic reasoning, where the criteria guiding action become objects of critical evaluation rather than fixed constraints (Sen, 1999; Polanyi, 2001). In this sense, rationality is not abandoned but deepened through its integration with ethical deliberation.

A defining feature of this approach is the integration of temporality into deliberation. The horizon of action extends beyond present-oriented considerations toward an awareness of long-term consequences and systemic interdependencies. This temporal expansion enables the incorporation of factors that remain marginal within narrowly defined decision frameworks, particularly those linked to ecological stability, planetary limits, and intergenerational justice (Rockström et al., 2009; Stern, 2007). Such an orientation aligns with broader discussions on sustainability that emphasize the necessity of long-term responsibility.

The capacity for value creation further distinguishes this archetype. Rather than reproducing existing patterns, the Übermensch engages in the formulation of new evaluative orientations that can reshape both individual practices and institutional arrangements. This creative activity is not limited to innovation in the technical sense but involves the transformation of interpretive frameworks through which needs, goals, and constraints are defined (Fromm, 1976; Geissdoerfer et al., 2017). In this respect, the Übermensch can be understood as a bearer of cultural transformation rather than merely an economic actor (Hernandez et al. 2020).

In this context, the relationship between human action and the natural environment is rearticulated on the basis of interdependence. Nature is no longer approached as a passive backdrop for economic activity but as a constitutive condition of human existence that must be integrated into decision-making processes. This perspective is consistent with approaches in ecological economics that conceptualize the economy as embedded within the biosphere and dependent on the stability of natural systems (Daly & Farley, 2011; Costanza et al., 1997).

Another important aspect of this orientation is the capacity to engage with uncertainty in a non-defensive manner. Instead of seeking to eliminate indeterminacy through control, the Übermensch treats it as an inherent feature of complex and dynamic systems. This openness creates space for adaptive responses and for the

exploration of alternative pathways that cannot be derived from existing models (Rockström et al., 2009; Geissdoerfer et al., 2017).

From this perspective, the *Übermensch* does not appear as an abstract ideal but as an analytical construct that illuminates the possibility of transforming the scope of economic rationality. It indicates a shift from a closed system of calculation toward a reflexive and context-sensitive mode of reasoning, capable of integrating ethical responsibility, ecological constraints, and long-term considerations into the structure of decision-making itself (Sen, 1999; Daly & Farley, 2011).

3.4 Comparative Analysis of Archetypes and Their Ethical Implications

The differences between the archetypes of the “last man” and the “*Übermensch*” can be interpreted as a manifestation of a deeper divergence between two distinct configurations of economic rationality, rooted in differing ontological, anthropological, and axiological presuppositions.

At the ontological level, this divergence is reflected in the very mode of apprehending natural reality. The perspective of the “last man” is grounded in an understanding of nature as a set of available means, whose significance is derived from their function within economic processes. In contrast, the “*Übermensch*” is based on the assumption that nature constitutes a complex and intrinsically valuable structure, whose existence cannot be fully reduced to instrumental functions. This distinction corresponds to broader debates within ecological economics, which emphasize the need to differentiate between economic and intrinsic value in natural systems (Daly & Farley, 2011; Costanza et al., 1997).

At the anthropological level, the distinction takes the form of a contrast between adaptive and reflexive modes of subjectivity. The “last man” is characterized by a tendency to conform to existing structures, which are perceived as stable and given frameworks of action (Stefani et al., 2022). By contrast, the “*Übermensch*” represents an agent capable of problematizing the very conditions of action and actively participating in their transformation. This contrast can be interpreted, in light of theories of power and social order, as the difference between the internalization of discursive structures and their reflexive transcendence (Foucault, 2002; Sen, 1999).

The axiological dimension further reveals that the difference between these archetypes lies not merely in their preferences, but in the very mode of value constitution. While the former operates within narrowly defined criteria of efficiency and functionality, the latter expands the evaluative framework to include responsibility, interdependence, and long-term sustainability. This shift resonates with critiques of utilitarian rationality, which highlight its limitations in adequately capturing complex social and ecological relations (Polanyi, 2001; Sen, 1999).

The temporal dimension also plays a crucial role in structuring decision-making processes. The “last man” operates within a limited temporal horizon dominated by immediate concerns, whereas the “*Übermensch*” incorporates long-term consequences and systemic interconnections into action. This broader temporal orientation allows for the inclusion of factors related to ecological stability and intergenerational continuity (Rockström et al., 2009; Stern, 2007).

These differences should not be interpreted in isolation, but as interconnected aspects of two distinct logics of rationality. The first is characterized by closure and a focus on immediate outcomes, while the second is open, reflexive, and capable of integrating broader contextual considerations. The distinction is therefore not merely a matter of degree, but of structural configuration.

From this perspective, the environmental crisis can be understood as a manifestation of a structural incompatibility between the dominant model of economic reasoning and ecological limits. The predominance of market-mediated criteria leads to the marginalization of factors that are not immediately quantifiable, resulting in the systematic exclusion of long-term and systemic dimensions of decision-making (Foster et al., 2010; Daly & Farley, 2011).

The ethical dimension of this problem thus extends beyond the issue of correcting market failures or implementing partial adjustments. It concerns the very definition of the scope of rationality, that is, which types of values, temporal horizons, and relational considerations are included in decision-making processes. In this sense, the environmental crisis cannot be reduced to a malfunction of the system, but must be understood as a consequence of its underlying conceptual structure.

The comparative analysis therefore demonstrates that addressing environmental challenges depends not only on institutional change, but primarily on a transformation of the framework within which such problems are conceptualized. A shift toward a more open form of rationality—capable of reflecting on its own presuppositions and integrating ethical and ecological dimensions—emerges as a key condition for long-term sustainability.

4. Conclusion

The analysis developed in this article demonstrates that the environmental crisis cannot be adequately understood as a set of isolated technological or institutional failures. Rather, it reflects deeper inconsistencies embedded in the conceptual foundations of contemporary economic thought (Hernandez et al., 2020). These inconsistencies arise from a configuration of rationality that privileges narrowly defined criteria of performance while systematically neglecting broader ecological and ethical considerations.

By employing the archetypes of the “last man” and the “Übermensch” as analytical constructs, the study has shown that alternative orientations of human agency correspond to fundamentally different configurations of economic reasoning. The contrast between adaptive conformity and reflexive engagement reveals that the problem is not merely one of individual behavior, but of the structural conditions that shape how decisions are framed and evaluated (Nieto et al., 2020).

From this perspective, the environmental crisis appears as an expression of a misalignment between prevailing modes of economic interpretation and the ecological conditions upon which they depend. This misalignment is reinforced by a framework in which value is predominantly mediated through market-based criteria, thereby limiting the capacity to incorporate long-term and systemic considerations (Daly & Farley, 2011; Foster et al., 2010). As a consequence, sustainability challenges are not external disruptions, but outcomes that follow from the internal logic of the system.

The significance of the “Übermensch” lies in its capacity to illuminate the possibility of a transformation in the structure of rationality itself. This transformation does not imply the abandonment of economic reasoning, but its extension toward a more integrative form that incorporates ethical responsibility, temporal depth, and ecological constraints (Sen, 1999; Rockström et al., 2009). In this sense, the concept serves as a heuristic device for articulating an alternative mode of thought capable of responding to contemporary challenges.

Such a shift entails more than incremental adjustments within existing institutional arrangements. It requires a redefinition of the aims and criteria that guide economic activity, including the way in which prosperity and progress are conceptualized. This aligns with broader discussions in ecological economics and sustainability science, which emphasize the need to re-embed economic systems within the limits of natural processes and to reconsider the normative assumptions underlying growth-oriented models (Daly & Farley, 2011; Geissdoerfer et al., 2017).

At the same time, this transformation has a distinctly ethical dimension. It involves expanding the scope of responsibility beyond immediate interactions to include long-term consequences and indirect effects across social and ecological systems (Stern, 2007). Such an expansion cannot be achieved solely through regulatory mechanisms, but depends on the capacity of agents to critically reflect on the conditions of their own action.

In this context, Weber’s notion of disenchantment can be reinterpreted not only as a descriptive diagnosis of modernity, but also as a point of departure for critical reflection (Weber, 1978). The challenge is not to abandon rationality, but to move beyond its one-sided reduction to calculability, thereby restoring the capacity to recognize dimensions of reality that resist purely instrumental interpretation.

In conclusion, addressing the environmental crisis requires a transformation that operates simultaneously at the levels of conceptual frameworks, institutional arrangements, and forms of subjectivity. The central issue is not simply how to optimize existing systems, but how to redefine the principles according to which they are organized. In this sense, the transition toward a more reflexive and integrative form of rationality emerges as a necessary condition for the long-term viability of human civilization.

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Ethical Aspects of Advertising Disclosure in Influencer Marketing from the Perspective of Generation Z

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Abstract: This paper addresses the ethical aspects of advertising disclosure in influencer marketing from the perspective of Generation Z. Using eye-tracking technology, it examines how the form and placement of commercial disclosure affect whether it is noticed, and how content involving a child figure is perceived in ethical terms. The experiment involved 61 participants from Generation Z, who viewed simulated Instagram posts with different ways of disclosing commercial cooperation. The results showed that disclosure placed at the start of the caption attracted markedly higher visual attention than disclosure at the end of the caption or among hashtags. A post without transparent disclosure was rarely perceived as trustworthy, even though participants usually recognised its commercial nature. The experiment also included an ethically problematic stimulus in which a product not intended for children is promoted through a child figure. This case was linked to lower trust in both the influencer and the brand. The findings point to a difference between formal and actual transparency and to its ethical importance for the protection of young audiences.

Keywords: Influencer marketing· Advertising disclosure· Ethics· Eye-tracking· Generation Z

1 Introduction

Influencer marketing is now one of the main forms of marketing communication on social media. Through their perceived authenticity and credibility, influencers shape the attitudes, preferences, and purchasing decisions of their audiences (Kochhar, 2025). This influence is strongest among Generation Z, which is one of the most active groups of social media users and at the same time a key target group for brands. Up to 82.4 % of Generation Z report that influencers are among their main sources of information about new products (Li, 2025), and more than 90 % of marketers use social media in their strategies (Schaffer, 2025). As the volume of commercial content grows, so does the importance of disclosing it transparently.

Generation Z's trust in influencers is linked to so-called parasocial relationships, that is one-sided bonds that followers build with a content creator even though they do not know each other personally. This perceived closeness increases the influencer's effect on the audience's decisions and at the same time blurs the line between a personal recommendation and paid promotion. Influencers act as opinion leaders whose recommendations shape consumer attitudes (Casaló et al., 2020). They differ according to their reach and type of audience, from nano and micro influencers with a narrow and active community to macro and mega influencers with a wide reach, and the number of followers alone does not determine their actual influence (De Veirman et al., 2017). The strength of the parasocial relationship tends to be higher with smaller creators, whose content the audience perceives as more authentic. This perceived authenticity is the reason why insufficient advertising disclosure can be ethically problematic, since the audience may not recognise the commercial message at all. Ethically problematic content in this study refers to advertising communication involving a child figure in the promotion of a product not intended for children, which may exploit perceived innocence, emotional trust, or age-inappropriate beauty norms. Advertising disclosure is a textual or visual element that communicates the commercial nature of a post to the audience (Amazeen & Wojdyski, 2020). Transparency is a basic principle of responsible influencer marketing because it allows audiences to distinguish commercial messages from authentic recommendations (Haenlein et al., 2020), and transparent disclosure is one of the key factors shaping the perceived credibility of influencers (Joshi

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et al., 2023). Besides being a legal obligation, it also has an ethical dimension, since consumers have the right to know when they are exposed to advertising. In the Czech Republic this area is not governed by a separate law and relies on the general framework of the Act on the Regulation of Advertising (No. 40/1995 Coll.) and the Consumer Protection Act (No. 634/1992 Coll.). Practice, however, lags behind. A 2024 analysis by the European Commission found that 97 % of influencers published commercial content, but only 20 % of them disclosed it transparently (Agius, 2024).

This is where the main ethical problem arises. Meeting a legal requirement and being genuinely clear to the audience are not the same thing. Even a formally correct disclosure can remain ineffective if its visual design is inconspicuous and the consumer overlooks it (Boerman & Müller, 2022). What matters is therefore not only whether the content is disclosed, but also whether the audience notices it. Formal transparency may thus differ from actual transparency, and this difference is a matter of responsibility towards the audience rather than mere compliance with a regulation.

Actual visual attention can be measured with eye-tracking technology, which records where a user looks while viewing content. This method has already been used to study the disclosure of commercial content. According to previous findings, verbal disclosure at the start of the caption tends to be more effective than disclosure among hashtags (Jánská et al., 2023), and among children, disclosure shown before a video attracts more attention than disclosure shown at the same time as the video (Van Reijmersdal et al., 2022). The perception of disclosure is more sensitive among younger and more vulnerable groups, who may not distinguish commercial messages from authentic recommendations (Lim, 2024; De Jans & Hudders, 2020). Marketing aimed at vulnerable groups requires careful ethical consideration so as not to exploit their vulnerability (Brenkert, 2020), which is especially relevant for children, who build a strong emotional bond with influencers (Kołaszewska & Kacprzak, 2022). In this study, ethically problematic content refers to promotional communication involving a child figure in the endorsement of products unrelated to children's needs and associated with adult-oriented appearance norms. Such content may raise ethical concerns because it can exploit the perceived innocence and emotional trust associated with children while simultaneously normalising age-inappropriate beauty expectations. This issue has not yet been sufficiently examined among Czech Generation Z using eye-tracking. The sensitivity is even greater in the case of ethically risky products (Taylor, 2020).

The aim of this paper is therefore to use eye-tracking to examine how the form and placement of commercial disclosure affect whether it is noticed by Generation Z, and how ethically problematic content involving a child figure is perceived.

2 Aim and methods

The aim of this paper is to use eye-tracking technology to examine how the form and placement of commercial disclosure affect whether it is noticed by Generation Z, and how this group perceives ethically problematic content involving a child figure. Two research questions were derived from this aim.

RQ1: How does the placement of commercial disclosure affect whether it is noticed by the consumer?

RQ2: How is ethically problematic content involving a child figure perceived in relation to trust in the influencer and the brand?

Based on previous research and theoretical background, four hypotheses were formulated.

H1: The absence of transparent disclosure of commercial content was associated with lower perceived trustworthiness within the experimental setting.

H2: Disclosure placed at the start of the caption is noticed more than disclosure at the end.

H3: Verbal disclosure at the start of the caption is noticed more than disclosure among hashtags.

H4: The ethically problematic involvement of a child figure in promoting a product not intended for children is associated with lower trust in the influencer and the brand.

The main research method was eye-tracking technology, which measures and analyses eye movements and makes it possible to determine where a user directs their visual attention (Singh & Singh, 2012). The measurement took place in the static behavioural laboratory of the Faculty of Social and Economic Studies of Jan Evangelista Purkyně University using a Tobii device. The study recorded fixations, that is short stops of the gaze at a particular point, and heatmaps showing the distribution of visual attention. Before the measurement, areas of interest (AOI)

were defined and used to evaluate fixations and heatmaps. These areas included the photograph, the caption, and any disclosure of commercial cooperation.

The experiment involved 61 participants from Generation Z, that is people born between 1995 and 2010 (Li, 2025). Originally 63 people took part, but two of them were excluded because they did not meet the age criterion. Owing to the ethical requirements of the laboratory, only people over 18 could take part. Data collection took place during a single day in four groups that rotated in thirty-minute intervals.

Nine simulated Instagram posts were used as stimuli, created with artificial intelligence tools and edited in the Canva application. Simulated content was chosen to control the experimental conditions and also for legal and ethical reasons, since the use of real posts would complicate their subsequent publication. The posts differed in the way commercial cooperation was disclosed. The commercial nature was indicated verbally at the start of the caption, verbally at the end of the caption, through hashtags, or with a platform tag for paid partnership next to the profile name. One post was not disclosed at all. The stimuli also included a pair of posts focused on ethical perception. In the potentially ethically problematic post, a child figure was involved in promoting an anti-wrinkle product, while in the control post a child promoted a sunscreen intended for children's skin. Anti-wrinkle products were selected because they are associated with adult beauty norms and age-related appearance concerns that are not relevant to children.

After the eye-tracking part, the same 61 participants completed a short questionnaire. For each post they rated on a five-point scale whether it was clear to them that it was a paid partnership, and they identified the main purpose of the post. For the posts with a child figure, they also rated the ethical perception of the content and their trust in the influencer and the brand. This supplementary questionnaire linked the measured visual attention with the participants' subjective ratings.

3 Results

The results combine heatmaps and fixation data from the eye-tracking measurement with the participants' subsequent ratings. Attention is expressed through the number of fixations in the caption area, their total duration, and the participants' agreement that the post was a paid partnership, rated on a five-point scale where a lower value means stronger agreement.

3.1 Placement and form of disclosure

The placement of the commercial disclosure strongly affected whether participants noticed it. As Table 1 shows, the disclosure placed at the start of the caption attracted the highest visual attention, with 1,613 fixations and a total duration of 303.15 seconds. Disclosure at the end of the caption or among hashtags received markedly less attention, and in all posts the fixations were concentrated in the opening part of the caption rather than at its end. Participants also recognised the paid nature of the post most clearly when the disclosure appeared at the start of the caption, with a mean of 1.3, and 95.1 % of them correctly identified the post as advertising.

These results support both H2 and H3. The disclosure at the start of the caption was noticed more than the disclosure at the end, which confirms H2. It was also noticed more than the disclosure placed among hashtags, which confirms H3. In the posts using hashtags, participants directed their attention mainly to the visual elements of the post and to the beginning of the caption, while the hashtags at the end received the lowest concentration of fixations.

The distribution of fixations across the defined areas of interest showed that the visual elements of the post attracted the most attention, especially the influencer's face and the promoted product. The caption received fewer fixations than the visual part, and within the caption attention was concentrated in its opening section. In the post with disclosure at the start of the caption, the number of fixations in this area reached 1,613 with a total duration of 303.15 seconds, whereas in the posts with disclosure at the end of the caption the number of fixations was around 995 to 997 and the total duration fell below 175 seconds. This difference suggests that users read the caption rather quickly and from the beginning, so a disclosure placed at its end has a lower chance of being noticed.

Table 1 Visual attention and ad identification by disclosure placement

Disclosure placement	Aggregated fixation count	SD (fixation count)	Total fixation durations (s)	“Clearly an ad” (1–5)	Identified (%)
No disclosure	982	11.4	166.20	1.9	60.7
Start of caption	1,613	21.3	303.15	1.3	95.1
End of caption (1)	997	11.8	174.24	1.5	93.4
End of caption (2)	995	12.6	162.55	1.7	72.1
Hashtags (1)	1,279	15.7	219.14	1.4	60.7
Hashtags (2)	755	9.8	127.95	1.6	70.5

Source: Own elaboration based on experimental data

Note: SD is the standard deviation of the per-participant fixation count within the caption AOI

Figure 1 Heatmap of disclosure placed at the start of the caption



Source: Authors' eye-tracking experiment

3.2 Absence of disclosure

In the post without any commercial disclosure, the content was styled as an expert recommendation in which a cosmetician praised a skincare product. Even without a label, participants tended to recognise the commercial nature of the post, since 60.7 % identified its main purpose as product or brand promotion and 70.5 % considered it correctly labelled as advertising, although no label was present. However, only 4.9 % of participants rated this post as the most trustworthy of all stimuli. This indicates that the ability to recognise advertising does not in itself secure trust, and that the absence of transparent disclosure is associated with low perceived trustworthiness. H1 is therefore supported.

3.3 Ethically problematic content

The ethical part of the experiment compared two posts featuring a child. In the control post, a child promoted a sunscreen intended for children's skin, while in the potentially ethically problematic post a child was involved in promoting an anti-wrinkle product not intended for children. As the heatmap in Figure 2 shows, the highest visual attention was drawn to the faces of the influencer and the child and to the product label, while the platform tag “Paid partnership” in the upper part of the post received only 183 fixations.

The participants' ratings point to a difference between the two posts. The control post was perceived as rather ethically acceptable, with a mean of 2.4, whereas the problematic post was rated closer to neutral, at 3.1. Trust in

the influencer was lower for the problematic post than for the control post, at 3.5 against 2.9, and the same pattern appeared for trust in the brand, at 3.5 against 3.1. The promotion of the ethically problematic product was thus linked to lower trust in both the influencer and the brand. The difference in trust was evaluated descriptively. With only a single pair of stimuli it was not formally tested. H4 is therefore not confirmed, although the data indicate a consistent trend of lower trust toward the ethically problematic post.

This result should be interpreted with caution, as it is based on a single pair of stimuli. Involving a child in promotion is nonetheless ethically sensitive. Children are a vulnerable group, and according to De Jans and Hudders (2020) they can recognise advertising but understand its commercial intent only to a limited extent. When a child is additionally paired with a product not intended for children, this inappropriateness may contribute to the lower perceived trustworthiness of the post. The observed trend may therefore reflect not only the riskiness of the product, but also the way it is presented. In practical terms, this suggests that influencers and brands should be especially cautious about involving children in commercial content.

Figure 2 Heatmap of the ethically problematic stimulus (mother and child, anti-wrinkle product)



Source: Authors' eye-tracking experiment

These findings are consistent with previous research. The higher effectiveness of verbal disclosure at the start of the caption compared with hashtags is in line with the conclusions of Jánská et al. (2023). The results also confirm that users pay more attention to the visual elements of a post than to a textual disclosure, which corresponds to the findings of Boerman and Müller (2022). The results thus support the idea that the effectiveness of disclosure is determined not by its mere presence, but by its placement and form.

4 Conclusion

Using eye-tracking technology, this paper examined how the form and placement of commercial disclosure affect whether it is noticed by Generation Z and what ethical dimension transparency has in influencer marketing. The study involved 61 participants from this age group.

The results showed that whether disclosure is noticed depends on its placement. The highest visual attention was drawn to disclosure at the start of the caption, which was noticed more than disclosure at the end and more than disclosure among hashtags. This confirmed hypotheses H2 and H3. Hypothesis H1 was also confirmed, since a post without transparent disclosure was rarely perceived as trustworthy, even though participants usually recognised its commercial nature. Hypothesis H4 is not confirmed; the difference in trust for the ethically problematic content was evaluated descriptively and not formally tested, given the single pair of stimuli. The data, however, indicated a consistent trend of lower trust.

The main finding is that the mere presence of disclosure is not enough. If disclosure is placed outside the area to which the audience's attention is directed, it remains effectively unnoticed, even when it formally meets legal

requirements. The responsibility of influencers and brands therefore does not end with the formal disclosure of cooperation. Only a disclosure that the audience has a real chance of noticing can be considered genuinely transparent. This difference is even more important for young audiences and for content involving a child figure.

The results lead to a practical recommendation to place the disclosure of commercial cooperation at the start of the caption or directly in the visual part of the message, where it has the highest chance of being noticed. This recommendation can also be used when creating and updating ethical codes of influencer marketing, such as the Czech Influencer Code of Ethics (Ferovynfluencer.cz, 2026), and when educating influencers and marketers.

The study has several limitations. The stimuli used were simulated and could therefore have been perceived differently from real posts. The sample consisted only of Generation Z users, which limits the generalisability of the results. Further research could verify the identified ethical trend on a larger sample and take into account additional factors, such as the type of influencer or the content focus of the post.

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Ethical Dimensions of Experimental Research on Misinformation: Boundaries of Manipulation in Behavioral Studies

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Abstract: This paper examines ethical challenges in experimental research on misinformation and voting behaviour, with a specific focus on the boundaries of legitimate manipulation when participants are exposed to misleading or false stimuli. Methodologically, it is designed as a conceptual-analytical paper drawing on a targeted narrative review selected for its relevance to four intersecting domains: misinformation studies, cognitive mechanisms of correction and debriefing, research ethics, and experimental political science. The paper identifies key ethical decision points in the design of planned behavioural experiments, including informed consent, exposure to stimuli, debriefing and post-experimental responsibility. The main contribution of the paper is an extended ethical framework that understands research ethics as a continuous process before, during and after exposure to misinformation stimuli. The framework is based on proportionate consent, controlled and limited manipulation, active debriefing, follow-up protection and responsible communication of findings.

Keywords: research ethics; misinformation; behavioural experiment; voting behaviour; debriefing

1 Introduction

Misinformation, disinformation and fake news have become significant objects of interdisciplinary research across psychology, political science, media studies and public policy (Broda & Strömbäck, 2024; Jerit & Zhao, 2020). Psychological literature focuses particularly on mechanisms of belief in false content, its sharing and resistance to correction (Ecker et al., 2022; Pennycook & Rand, 2021). In political communication and electoral research, attention is paid to whether and under what conditions exposure to false or misleading information may affect voters' attitudes, candidate support or voting behaviour (Barrera et al., 2020; Cantarella et al., 2023).

Research on misinformation does not raise only questions related to its dissemination, reception and correction. A specific problem emerges when misinformation becomes not only the object of research, but also a methodological tool. Experimental research makes it possible to control the type of content presented to participants and to examine its effects on evaluation, trust, willingness to share information or subsequent decision-making. In the case of misinformation, however, this procedure is ethically sensitive because the researcher may have to present participants with misleading or false content in order to analyse mechanisms that are themselves the object of critical investigation.

This dilemma is particularly visible in experimental political science. Barnfield (2023) points out that misinformation may function as an experimental treatment when researchers intentionally provide participants with false political information. Such a procedure raises not only ethical but also inferential questions. Participants may respond not only to the content of the message, but also to its credibility, unusualness or the context of the experimental situation. The ethical and methodological dimensions are therefore closely interconnected.

The core tension addressed in this paper is the relationship between data validity and participant protection. If the stimulus is too artificial or transparent, it may not sufficiently imitate a real information environment. If it is

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too realistic, persuasive or emotionally activating, research may come close to the mechanisms of manipulation it seeks to analyse. Experimental realism can therefore be understood simultaneously as a methodological advantage and an ethical risk.

The aim of this paper is to define the boundaries of legitimate manipulation in experimental research on misinformation. The text does not present completed empirical findings. It is conceived as a methodological and ethical reflection on planned experimental research focused on misinformation stimuli and voting behaviour. The main research question is: How can research be designed so that it is methodologically robust and at the same time ethically appropriate?

2 Aim and methods

The paper is conceived as a conceptual-analytical study based on a targeted narrative review of scholarly literature. The aim of the methodological procedure is not to test empirical hypotheses or to present results from primary data collection, but to identify key ethical dilemmas associated with experimental research on misinformation. This approach corresponds to the stage in which the planned empirical project is still being prepared, particularly with regard to stimulus construction, ethical assessment and the design of the research protocol.

The literature was selected through a targeted narrative approach with regard to its relevance to the ethical and methodological issues addressed in the paper. The selection included scholarly journal articles, review and conceptual studies, empirical research, and ethical guidelines dealing with misinformation, fake news, correction and debriefing, deception in research, and the use of misinformation as an experimental treatment in political science. The selected literature was organized into four thematic areas: interdisciplinary misinformation research, cognitive psychology of corrections and the continued influence effect, research ethics, and experimental political science. This approach made it possible to connect general ethical principles with the specific risks of planned experimental research on misinformation and voting behaviour, and to formulate a practical framework for assessing the boundaries of legitimate manipulation in behavioural studies.

The first area concerns interdisciplinary research on misinformation, disinformation and fake news. This area includes primarily review and conceptual studies showing that misinformation research is developing across psychology, political science, media studies and public policy (Broda & Strömbäck, 2024; Jerit & Zhao, 2020). It also includes studies focused on the psychology of fake news and on factors that influence the reception, evaluation and sharing of false or misleading content (Lazer et al., 2018; Pennycook & Rand, 2021).

The second area includes cognitive psychology of corrections and the continued influence of false information. Lewandowsky et al. (2012) describe the continued influence effect, that is, a situation in which false information may continue to influence judgement even after a subsequent correction. Ecker et al. (2022) further summarize psychological, social and affective factors that contribute to belief in misinformation and resistance to correction. This area is important for the present paper because it explains why debriefing cannot be understood merely as a formal message at the end of an experiment.

The third area of literature concerns research ethics, the use of deception and the specific ethics of misinformation research. The ethical principles published by the American Psychological Association in Ethical Principles of Psychologists and Code of Conduct permit the use of deception only when it is scientifically justified, effective non-deceptive alternatives are not feasible and participants are subsequently informed about the true nature of the study (American Psychological Association, 2017). In misinformation research, this principle is particularly important because manipulation does not concern only concealing the precise hypothesis, but may involve exposure to misleading or false content. Greene et al. (2023) further develop this problem in a scoping review of ethical practices in misinformation studies, while Murphy and Greene (2023) propose understanding the ethics of this area through three interconnected elements: deception, dialogue and debriefing. Greene and Murphy (2023) also empirically show that thorough debriefing can reduce false memories and beliefs after exposure to fake news.

The fourth area focuses on experimental political science and the use of misinformation as an experimental condition. Barnfield (2023) argues that misinformation can function as a treatment in political science experiments designed to measure the effects of false political information on participants' attitudes or decisions. This approach raises not only ethical but also inferential questions, because participants may respond not only to the content of the message, but also to its credibility, unusualness or the context of the experimental situation. This area is important for connecting ethical reflection with the issue of voting behaviour.

The analytical procedure consisted of identifying the main ethical decision points in a simplified experimental sequence: recruitment of respondents, informed consent, exposure to stimuli, measurement of responses and debriefing combined with correction. For each phase, potential ethical risks and practical requirements were assessed. The output is an extended ethical framework that understands ethics as a continuous process rather than a one-off administrative step.

3 Results

The result of the conceptual analysis is the identification of four main areas that require ethical attention in experimental misinformation research: informed consent, the boundaries of controlled manipulation, debriefing and social responsibility after the experiment.

The first area is informed consent. In experiments involving misinformation, full disclosure of the purpose of the study may disrupt measurement. If participants are informed in advance that their reactions to misinformation are being examined, they may consciously control their responses or react less spontaneously. At the same time, participants cannot be left completely uninformed about the nature of the risk. Proportionate consent should therefore inform participants about contact with political or media content of varying credibility, about the possibility of encountering controversial or misleading messages and about the right to withdraw at any time, without revealing in advance the exact mechanism being tested.

This means that informed consent should not be understood as a purely legal or administrative form. It is necessary, but in misinformation experiments it may not be sufficient as the only ethical safeguard. Murphy and Greene (2023) therefore emphasize the importance of dialogue with participants and subsequent debriefing. Ethics here does not consist only in what participants are told before exposure, but also in how they are informed after the study about what happened.

The second area is controlled manipulation. Experimental manipulation is not unethical in itself; it is a common part of experimental logic. In the context of misinformation, however, it must be justified with particular care. Exposure to misleading or false content may be defensible only if it is scientifically necessary, cannot be replaced by a less risky procedure, is proportionate to the research aim and is time limited. The stimulus should be sufficiently realistic to test the response, but it should not be unnecessarily aggressive, polarizing or stigmatizing.

Barnfield (2023) adds an important political science perspective. If researchers use misinformation as a method, they may affect not only individual participants but also produce collective or political consequences. This argument is particularly important in research on voting behaviour, where false or misleading content may concern institutions, parties, candidates or public policy. Ethical responsibility therefore concerns not only the psychological well-being of the individual participant, but also the integrity of the broader information environment.

The third area is debriefing. Debriefing cannot be understood as a formality or as a brief statement that some materials were not true. Given the continued influence effect, correction may not automatically remove the psychological effects of false information (Lewandowsky et al., 2012; Ecker et al., 2022). Nyhan and Reifler (2010) showed that corrections of political misperceptions may not always be straightforward. This supports the requirement that debriefing should be specific, comprehensible and, where possible, verifiable.

At the same time, it would be inaccurate to claim that debriefing does not work. Greene and Murphy (2023) followed 1,547 participants one week after exposure to COVID-19 fake news and after detailed debriefing. They found a reduction in false memories and beliefs related to previously seen fake stories. Their study therefore shows that thorough debriefing can be effective if it is specific, repeatedly identifies false content as false and provides factual correction.

Greene et al. (2023) show why this issue is important in practice. Their review indicates that fewer than 30% of misinformation studies reported any debriefing, and almost no authors assessed its effectiveness. This means that debriefing is often assumed to be an ethical safeguard, but in published studies it may not be sufficiently described, standardized or empirically evaluated. For future research design, it follows that debriefing should be designed as a separate part of the method.

The fourth area is social responsibility after the experiment. Ethical risks do not end with the completion of data collection. If research is embedded in a regional context, it is necessary to avoid stigmatizing the studied

population. The regional context may be relevant in terms of socioeconomic conditions, regional inequalities or trust in institutions, but it must not be presented as a diagnosis of individuals. The paper therefore does not make empirical claims about the inhabitants of the region; it treats the region as a possible research context, not as a label.

Based on these four areas, the paper proposes an extended ethical framework. This framework understands research ethics as a process rather than as a one-off administrative step. It includes the period before exposure, during exposure, after exposure and after publication. Table 1 summarizes the main ethical tasks and practical implications in each phase.

Table 1 Extended ethical framework for experimental misinformation research

Phase	Main ethical task	Practical implication
Before exposure	Proportionate consent and risk minimization	Inform participants about the type of risk, ensure the right to withdraw and avoid unnecessary stimulus intensity.
During exposure	Protection during contact with stimuli	Limit stimulus intensity, monitor emotional burden and ensure data protection.
After exposure	Active correction and restoration of trust	Provide specific debriefing, identify false content, offer factual correction, verify understanding and, where appropriate, allow data withdrawal.
After publication	Responsible interpretation and communication	Avoid stigmatizing language, clarify the limits of the study and communicate findings without reinforcing stereotypes or information disorder.

Source: Authors' synthesis based on American Psychological Association (2017), Barnfield (2023), Greene et al. (2023), Greene and Murphy (2023), and Murphy and Greene (2023).

The proposed framework rests on three practical principles. The first is proportionality: the stimulus should be realistic, but not stronger than required by the research aim. The second is reversibility: after the study, participants should have a real opportunity to understand what happened and, where appropriate, to refuse further use of their data. The third is responsibility: findings should be interpreted and communicated in a way that does not reinforce stereotypes, stigma or information disorder.

This framework does not replace formal ethical review. Rather, it specifies the questions that should be considered before submitting and conducting an experimental study involving misinformation stimuli. Its contribution lies in linking methodological quality with ethical responsibility. Research on misinformation should not merely determine how manipulative content works; it should also ensure that it does not itself contribute to further informational harms.

4 Conclusion

Experimental research on misinformation faces a specific ethical dilemma. In order to study real cognitive and behavioural responses, it requires a certain degree of realism and controlled exposure. This realism, however, may create a risk that participants are temporarily misled or exposed to content whose psychological effects cannot always be fully removed by subsequent correction. Experimental design therefore cannot be evaluated only according to the validity of the data obtained, but also according to the degree of participant protection and the quality of subsequent explanation of the research procedure.

The main conclusion of this paper is that methodological quality and ethical responsibility are not opposing requirements. On the contrary, they are mutually dependent. Research that is not ethically considered may lose credibility; research that gives up methodological precision, conversely, does not produce reliable knowledge. In the area of misinformation, it is therefore necessary to seek a design that is at the same time realistic, proportionate, reversible and responsibly communicated.

The contribution of the paper is conceptual. The text does not present empirical findings about a specific group of voters. It offers a methodological and ethical framework that may be used when preparing experimental research on misinformation and voting behaviour. This framework emphasizes that informed consent, exposure, debriefing and publication of results are not isolated steps, but interconnected phases of a single ethical process.

The aim is not to reject experimental methods in misinformation research, but to design them in such a way that they contribute to understanding informational harms without creating new harms. In the context of digital platforms, artificial intelligence and the growing persuasiveness of manipulative content, such reflection is a necessary part of responsible behavioural research. Research on misinformation should be not only methodologically precise, but also reflexively responsible.

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From Dehumanization to Augmentation: Ethical AI Management as a Catalyst for Sustainable Industry 5.0

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Natália Turčeková⁴

Abstract: This bibliographic and conceptual analysis explores AI integration in enterprise management during the transition to Industry 5.0. While digital transformation often prioritizes speed over values, this study proposes a multidimensional framework - systemic, applicational, and ethical - to ensure AI supports sustainable development. A biomass supply chain case study illustrates how AI-driven transparency supports sustainability and mitigates environmental impacts. The findings indicate that AI's ethical potential lies in human augmentation rather than labor substitution, fostering a corporate culture that balances technological resilience with ecological responsibility and human cognitive contribution within the modern bioeconomy.

Keywords: Artificial Intelligence Management, Industry 5.0, Human Augmentation, Sustainable Bioeconomy, Biomass Supply Chain Transparency, Enterprise Efficiency,

JEL Classification: O32, O44, Q55, M11, J24

1 Introduction

The contemporary corporate landscape is undergoing a profound paradigm shift. While the era of Industry 4.0 focused primarily on digitization, cyber physical systems, and the relentless pursuit of operational speed, it frequently marginalized the human element and broader ecological impacts. The emergence of Industry 5.0 represents a necessary macro architectural correction, repositioning human centricity, sustainability, and socio-technological resilience at the core of enterprise strategy. At the center of this transformation lies Artificial Intelligence (AI).

Managing the integration of AI is fundamentally a managerial challenge rather than a purely technological one. As enterprises transition from viewing AI as a simple automation tool to treating it as a new teammate, traditional governance structures become obsolete. The core dilemma facing modern management is the choice between dehumanization, characterized by unbridled labour substitution, algorithmic opacity, and short-term cost reduction, and augmentation, where technology systematically enhances human cognitive capabilities and workplace fulfilment.

Furthermore, this digital transition occurs simultaneously with an ecological imperative. In the modern business environment, sustainability can no longer be treated as an isolated corporate social responsibility (CSR) department; it must serve as the primary organizational operating system. As industries distance themselves from fossil fuel dependencies, the entire economic foundation is shifting back to biological resources, effectively turning every modern enterprise into a participant in the circular bioeconomy. Therefore, ethical AI management must act as a catalyst, aligning internal computational efficiency with external planetary boundaries. To address these intersecting socio-technical and ecological challenges, this paper seeks to answer the fundamental research question - RQ1: How can a multidimensional managerial framework guide ethical AI integration to ensure human augmentation and ecological sustainability during the transition to Industry 5.0?

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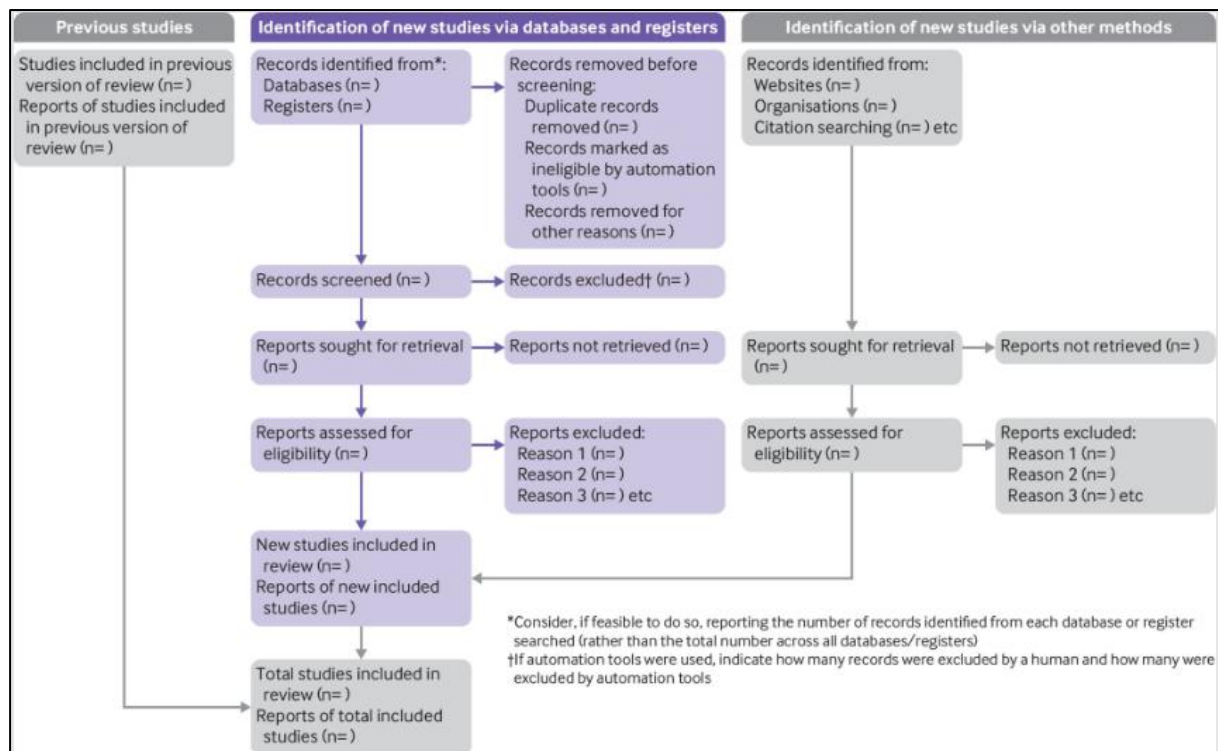
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To systematically resolve this query, the investigation explores three core dimensions of the problem: first, how AI optimizes enterprise technical efficiency as the organizational brain (Systemic Pillar); second, how these computational choices translate into resilient, circular operational workflows (Applicational Pillar); and third, how the resulting system preserves human labour dignity and ecological accountability (Ethical Pillar). The practical utility of this layered approach is subsequently demonstrated through a conceptual biomass supply chain case study, establishing a rigorous theoretical baseline for ongoing industrial validation.

2 Methods

This study was conducted as an adapted, PRISMA = informed conceptual and thematic synthesis designed to resolve the central research question regarding the role of ethical AI management in human augmentation and ecological sustainability within Industry 5.0. To achieve a comprehensive, interdisciplinary analysis that spans economic theory, organizational governance, and applied circular logistics, the methodology executes a multi-stage qualitative screening protocol structured across the core reporting principles of the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement (Page et al., 2021). The selection of a PRISMA, informed conceptual review methodology ensures that the identification, screening, eligibility assessment, and inclusion of the scientific corpus remain completely transparent, objective, and reproducible. As illustrated by the structural process in Fig. 1, this qualitative framework tracks the systematic filtering of literature from broad initial database queries down to a highly specialized core sample of managerially focused publications, establishing a rigorous protocol even though exact database record tallies are not reported.

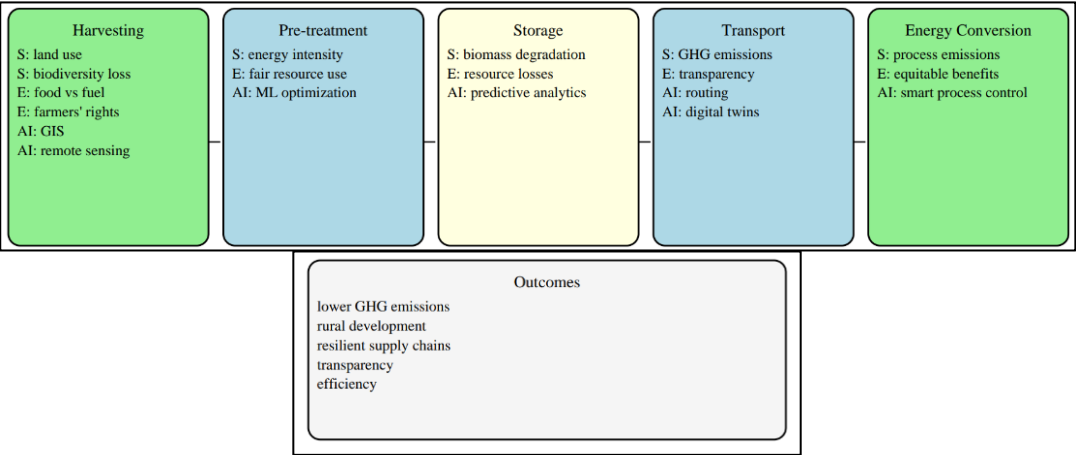
Figure 1 PRISMA 2020 flow diagram template for systematic reviews



Source: Page et al. (2021)

To bridge the gap between high-level literature screening and concrete operational reality, the conceptual synthesis phase maps the selected literature against two established, domain specific evaluation models. First, technical efficiency and operational workflows are categorized using the five-stage supply chain decision model developed by Mafakheri and Nasiri (2013), which divides biomass logistics into harvesting, pre-treatment, storage, transport, and energy conversion.

Figure 2 Conceptual framework of sustainability and ethical challenges in AI-driven biomass supply chains

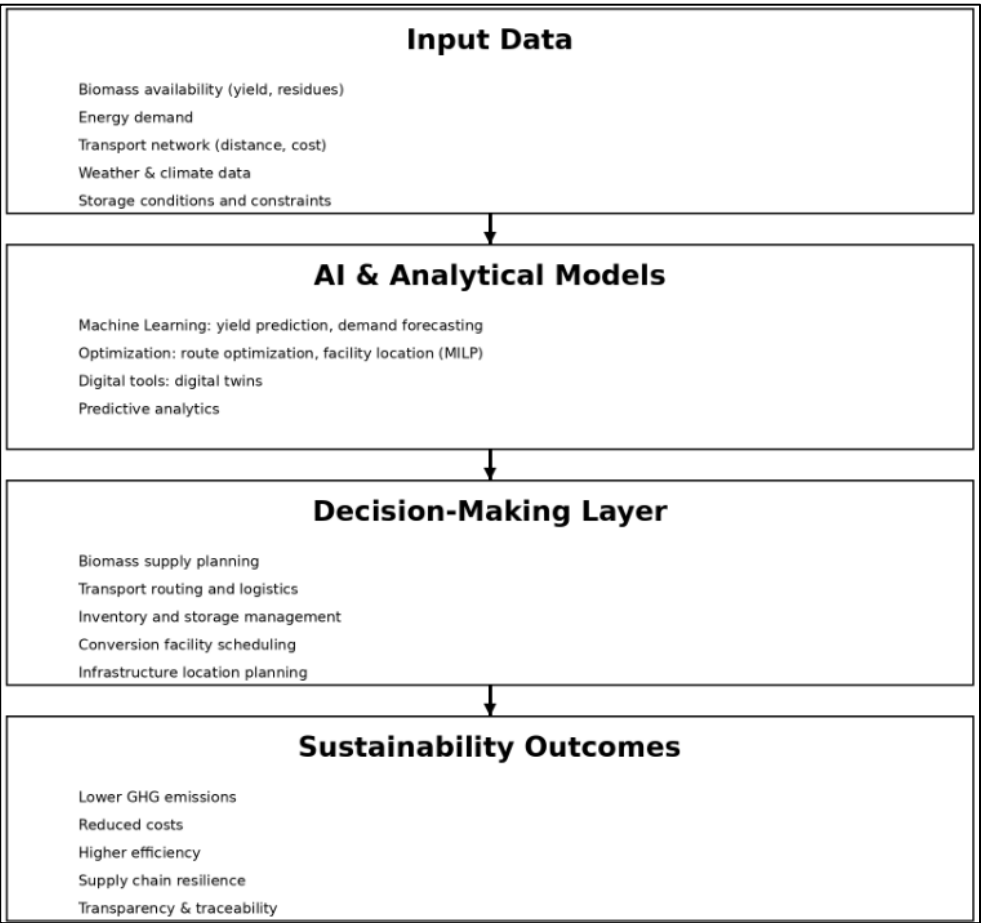


Source: Author’s own elaboration based on the reviewed literature in this paper

Notes: S = Sustainability; E = Ethical; AI = Artificial Intelligence

Second, the socio-technical and land use friction points identified in the corpus are critically evaluated using the normative 6-point ethical matrix proposed by the Nuffield Council on Bioethics (2011). By embedding these structured industrial and moral frameworks directly into the qualitative synthesis phase of the PRISMA protocol, the methodology moves beyond simple thematic grouping, providing a rigorous analytical baseline capable of answering the core research question through clear, logical linkages between the systematic selection process and the upcoming conceptual results.

Figure. 3 AI-driven decision-making framework in biomass supply chains



Source: Author’s own elaboration based on the reviewed literature in this paper

Data sources and selection criteria - To address the central research question, literature harvesting was executed across the Web of Science, Scopus, and Google Scholar databases, systematically limited to peer-reviewed articles and conference papers published after 2020 to capture contemporary advancements in generative models and machine learning. Inclusion criteria required: 1) direct relevance to both AI and economic/management concepts; 2) publication in recognized peer-reviewed venues; and 3) full text availability in English. The search query utilized intersecting keyword strings: "artificial intelligence" AND "business economics" OR "innovation" OR "firm performance" OR "bioeconomy" OR "biofuel" OR "bioenergy" OR "yeast". To ensure a comprehensive interdisciplinary scope, these sources were integrated with specialized technical and economic bioeconomy publications selected based on their direct relevance to sustainability and precision farming. Selection bias was mitigated by intersecting databases and enforcing strict exclusion criteria: 1) studies published before 2020; 2) editorials, book reviews, or grey literature; 3) articles focusing purely on technical coding or software implementation without discussing managerial or business implications; and 4) publications not available in English.

Data processing - The processing of the literature corpus followed a PRISMA-informed funnel distillation. The initial database search yielded approximately 217 unique records. A rigorous two step screening followed: first, a title and abstract review led to the exclusion of 102 documents that failed to meet discipline or quality criteria. Second, the remaining 115 records were assessed for deep conceptual relevance, resulting in the exclusion of 74 studies that were purely technical or outside the macroeconomic scope. This systematic filtering isolated a final corpus of 21 core business economics publications. This core was subsequently combined with 20 high impact technical and economic sources focused on precision agriculture and applied bioenergy. In total, 41 distinct peer-reviewed publications were selected for the final conceptual synthesis, establishing a robust foundation for the study.

Analytical tools - The primary analytical tool employed was inductive conceptual thematic analysis, mirroring the systematic phases of grounded theory. The 41 sources corpus was managed manually to prioritize intellectual synthesis over automated mapping across a three-stage process. First, key mechanisms, such as resource augmentation, organizational agility, cost structure transformation, genetic editing, and supply chain tracing were subjected to open coding, allowing descriptive labels to emerge directly from the text segments. Second, these initial codes were compared, refined, and merged based on conceptual symmetry to construct overarching conceptual clusters (e.g., AI as a Shift in Production Factors and AI and Sustainability in the Supply Chain). Third, these conceptual clusters were validated against the primary research question to confirm conceptual relevance and ensure analytical depth and methodological transparency.

Interpretation - The final stage involved the conceptual interpretation and synthesis of the developed clusters across both the business economics and bioeconomy streams of literature. This phase focused on establishing explicit linkages and structural intersections between the synthesized themes, specifically mapping how traditional exogenous inputs convert into endogenous, data driven value creation. To ground this interpretation in operational reality, the clusters were mapped against the five-stage supply chain decision model (harvesting, pre-treatment, storage, transport, energy conversion) established by Mafakheri and Nasiri (2013), and the normative 6-point ethical matrix proposed by the Nuffield Council on Bioethics (2011). The credibility of the findings rests on the transparency of this thematic synthesis, which maps the practical applications connecting ethical AI management to sustainable development in the bioeconomy.

3 Research results

The analysis of recent literature reveals several distinct, yet interconnected, research clusters. The presentation of these findings is structured to directly address RQ1 defined in the Introduction. The primary themes identified are (1) The 3-Pillar Framework for Ethical AI Management in Enterprise Performance, and (2) Sustainability and Ethical Challenges in Biomass Supply Chains.

The 3-Pillar Framework for Ethical AI Management in Enterprise Performance

The systematic synthesis of the collected literature demonstrates that the integration of Artificial Intelligence (AI) into corporate operations is fundamentally shifting business economics from exogenous technical progress to data-driven endogenous value creation (Rahmani, Rezadeh, Haghparast, Chang, & Ting, 2023). Rather than treating AI as a traditional, isolated capital upgrade, contemporary management requires a structured, multidimensional architecture to navigate the thin boundary between predatory labour dehumanization and

cognitive augmentation (Bauwens & Batistič, 2025). This structural transformation is mapped across three vital operational layers: the Systemic, Applicational, and Ethical pillars.

At the systemic level, AI acts as the primary information aggregator, systematically reducing informational asymmetry and workflow entropy within the corporate hierarchy (Koukouvouinou & Holmström, 2024). Bounded rationality has historically restricted human managers when tracking turbulent market variables or massive datasets, often introducing cognitive biases into risk mitigation strategies (Alomari & Hindawi, 2025). AI systems overcome these cognitive constraints by deploying advanced decision canvas approaches, converting unstructured data streams into predictive market insights and highly optimized strategic choices (Bagchi & Sharma, 2026). Furthermore, these intelligent decision support architectures allow for dynamic risk adjustment, real time variance monitoring, and proactive crisis modelling across multi-tiered integrated management systems (Ispas, Mironeasa, Severin, Cerlincă, & Mironeasa, 2025). The successful processing of these complex information flows ultimately depends on a combination of environmental, organizational, and individual determinants that dictate an enterprise's structural absorption capacity (KUZIÖR et al., 2023).

However, a critical socio-technical risk identified in the literature is the "Black Box" phenomenon, where algorithmic data processing remains entirely opaque to human operators, severely undermining employee and consumer trust (De Lucas López, Gorneanu, Yela Aránega, & Gallego Martín, 2026). In alignment with contemporary regulatory landscapes, specifically the European Union AI Act, the findings indicate that ethical management must enforce Explainable AI (XAI) architectures to protect fundamental rights (Gstrein, Haleem, & Zwitter, 2024; Kusche, 2024). This structural shift moves corporate governance away from blind technological solutionism and toward auditable data practices (BARROS et al., 2026). Ensuring that algorithmic choices are transparent and verifiable allows enterprise leaders to trust AI-generated recommendations, converting regulatory compliance from an operational burden into a verifiable competitive advantage (Souza, De Araujo Wanderley, & Braga de Aguiar, 2025; Zhong, 2024).

The Applicational Pillar governs the physical and digital execution of automated choices, representing an explicit multiplier of total factor productivity within operations research (Gupta et al., 2022). Within this operational layer, the economic value of digital transformation shifts from simple task automation to a comprehensive restructuring of enterprise cost architectures, change management models, and systemic open innovation processes (Burggräf, Wagner, Saßmannshausen et al., 2024; Kuzior, Sira, & Brožek, 2023; Mainardi, 2025). This macroeconomic dynamic can be integrated into a modified corporate production function: $Y = A(AI) \cdot K^\alpha \cdot L^\beta$.

Where Y represents total enterprise output, K represents capital inputs, L represents human labour inputs, and $A(AI)$ represents the technology driven efficiency parameter directly augmented by AI management. Rather than utilizing algorithms to aggressively substitute the labour input (L) a strategy that collapses organizational knowledge, creates hidden structural vulnerabilities, and degrades long-term institutional capability, the framework demonstrates that optimizing the scaling parameter $A(AI)$ drives exponential increases in marginal labour productivity and structural agility (Barros, Pimentel, & Vaz, 2026; Zamani, Smyth, Gupta et al., 2023).

To maintain strict operational safety, quality control, and legal accountability during this transformation, the corporate body must structurally integrate explicit human-machine collaboration protocols, guaranteeing that automated agents function under rigorous Human-in-the-loop (HITL) frameworks (Haesevoets, De Cremer, Dierckx, & Van Hiel, 2021). Furthermore, the operational deployment of these automated agents requires a proactive SWOT based risk management strategy to monitor system capabilities and mitigate data vulnerabilities (Humble, 2024).

The Ethical Pillar establishes the moral philosophy, corporate social responsibility (CSR), and cultural boundaries of digital transformation, serving as a vital shield against corporate dehumanization (Ferrell & Ferrell, 2024). The synthesized corpus reveals that when autonomous AI agents are deployed exclusively for rapid labour substitution and cost minimization, they strip human operators of cognitive agency, trigger widespread employee alienation, and undermine the social legitimacy of the firm (Park, 2026; Wang & Zhang, 2026). Ethical management actively averts this outcome by utilizing AI strictly for resource and cognitive augmentation rather than predatory displacement (Gélinas, Sadreddin, & Vahidov, 2022). By delegating hazardous, repetitive, and low cognitive tasks to automated workflows, the enterprise achieves cognitive offloading, liberating the human workforce to reallocate their time toward high-value creative problem solving, strategic innovation, and complex relationship management.

Furthermore, the findings indicate that long-term sustainability depends on the enterprise actively reinvesting a portion of the efficiency gains, the AI dividend directly into continuous human capital upskilling and Green Innovation (Che, Liu, Wang, & Wang, 2026). This strategic feedback loop ensures that computational speed, personal data privacy, and absolute respect for human dignity coexist in a resilient corporate ecosystem (Chen, Jaffari, Muzaffar, & Rahman, 2026; Weinbaum & Kamp, 2025).

The structural utility of this three-pillar framework becomes clear when moving from general enterprise theory to specific applications within the circular bioeconomy. The Systemic, Applicational, and Ethical pillars do not operate in isolation; instead, they serve as the direct strategic parameters needed to govern complex, data heavy sustainable resource loops. As industries transition away from linear, fossil fuel dependencies, the management of localized supply networks faces massive socio-technical and operational friction points. The transition to Industry 5.0 ultimately demands a value driven enterprise governance model that redefines the integration of Artificial Intelligence within these networks to prevent labour dehumanization and transform algorithmic deployment into a catalyst for human augmentation, continuous upskilling, and green innovation.

To demonstrate how this macro architectural model functions in a live environment, the following analysis applies these exact parameters to a biomass supply network. Through this application, the analytical focus shifts from abstract corporate governance to concrete logistical realities, mapping the organizational "brain" onto spatial-temporal feedstock data tracking, the corporate "body" onto mathematical route optimization, and the organizational "soul" onto the critical mitigation of socio-ecological land use conflicts. This case study confirms that as the modern economy shifts toward biological resources, transparent human-machine collaboration is essential for managing operational data chaos and protecting ecological boundaries. Ultimately, modern leaders must internalize that AI is not replacing the human workforce, but rather expanding its capabilities, building a sustainable future where digital efficiency and absolute respect for human dignity coexist in a resilient corporate ecosystem.

Sustainability and Ethical Challenges in Biomass Supply Chains

While the strategic architecture of the three-pillar model provides a clear macroeconomic foundation for enterprise governance, its practical utility must be validated within complex, resource dependent operating environments. The emerging circular bioeconomy serves as the ultimate testing ground for this framework, forcing an intersection between digital efficiency and physical ecological boundaries. Translating abstract management theory into concrete logistical realities requires shifting from general corporate governance to sector specific operational variables. Within this context, the organizational "brain" must govern highly chaotic environmental data streams, the corporate "body" must optimize material resource allocation, and the organizational "soul" must safeguard socio-ecological values against predatory exploitation.

The urgency of this multi pillar application is underscored by the fact that the significant increase in transportation fuel consumption and accompanying environmental degradation has intensified global concerns regarding finite crude oil reserves, accelerating a strategic macro shift toward renewable energy alternatives (Ashnani, 2014). Bioenergy is promoted primarily due to its potential to reduce fossil fuel dependence, lower greenhouse gas (GHG) emissions, decrease import dependency and support job creation and income in rural areas. However, in recent years growing awareness has emerged that energy crop production may have far reaching negative environmental and socio-economic impacts if natural and socioeconomic constraints are not respected (Erb et al., 2012). Similarly, Kerckhoffs and Renquist (2012) note that biomass sources for both food and biofuels need to be produced sustainably, while also highlighting the ethical issue of competition between food production and biofuel production for agricultural land.

In the biomass conversion stage, decision makers need to deal with a wide range of complex operational and strategic decisions, including location planning for conversion facilities, selection of conversion technology, and capital and operational investment planning.

Mafakheri and Nasiri (2013) categorize biomass supply chain decision problems into five main areas: (1) biomass harvesting and collection; (2) biomass pre-treatment; (3) biomass storage; (4) biomass transport; (5) biomass energy conversion. The AI-driven decision-making processes in biomass supply chains are illustrated in Figure 3 in the methods.

As mentioned before, current biofuels give rise to a number of social and ethical concerns, and the new approaches to biofuels development and production are also likely to be controversial. Therefore, there are six

ethical principles proposed which can be used to evaluate biofuels development and guide policy making. These principles are as follows: (1) biofuels development should not be at the expense of people's essential rights; (2) biofuels should be environmentally sustainable; (3) biofuels should contribute to a net reduction of total GHG emissions and not exacerbate global climate change; (4) biofuels should develop in accordance with trade principles that are fair and recognise the rights of people to just reward; (5) costs and benefits of biofuels should be distributed in an equitable way; (6) a potential duty to develop biofuels if they meet ethical principles and are effective in mitigating climate change, depending on key economic and governance considerations (Nuffield Council on Bioethics, 2011). However, despite these ethical guidelines, levels of optimism bias in the biofuel industry are high, leading to unrealistic expectations from complex technologies and questionable claims about the quantity of resource available (Axon and Darton, 2024).

In order to achieve global deployment of bioenergy in line with net zero emissions targets, the use of advanced and emerging tools and techniques like artificial intelligence, machine learning, remote sensing and GIS, Life Cycle Assessment and Bioenergy with Carbon Capture and Storage are widely recommended (Hiloidhari et al., 2023). According to Štreimikienė (2025), the integration of Industry 4.0 and Artificial Intelligence (AI) technologies has significantly transformed global supply chain operations, with an increasing emphasis on sustainability as a strategic priority. Additionally, AI is a relevant technology with the Resource-Based View, as it can act as a source of competitive advantage by improving both supply chain transparency and corporate sustainability performance (De Sousa Jabbour et al., 2025). Likewise, Samuels (2025) notes that AI integration significantly improves supply chain management by improving demand forecasting, inventory management, and overall decision-making capabilities. For example, machine learning (ML) provides dynamic and data-driven solutions that enhance decision-making by enabling the prediction of biomass yields, forecasting supply and demand, optimizing logistics and facility location, and improving the efficiency of conversion processes (Razmi et al., 2025). According to Zhao et al. (2024), ML supports strategic, operational, and tactical planning and decision-making in this field and can enhance the environmental and economic performance of biomass supply chains. Gonzalez and Wang (2026) also believe that AI technologies, such as digital twins and ML, improve demand forecasting, real-time routing, and cargo consolidation, leading to enhanced prediction accuracy for transport costs thus the integration of AI and multimodal networks builds resilient and sustainable biomass supply chains. However, Wellbrock et al. (2025) point out that, although AI enhances operational efficiency and process optimization, its use also raises significant ethical concerns, particularly regarding data privacy, transparency, and bias. Similarly, Yang et al. (2025) highlight that the adoption of AI may not benefit all members of the supply chain and could negatively impact social welfare. Thus, Raikar et al. (2026) suggest that AI systems should adopt ethical principles, such as fairness, transparency, and sustainability in supply chain management. These ethical challenges are particularly relevant in biomass supply chains, where findings reported by Omotayo et al. (2025) emphasize the need for the equitable, socially responsible, and sustainable deployment of AI in agriculture, highlighting the importance of stakeholder trust and societal acceptance.

4 Conclusion and Summary

The empirical and conceptual findings derived from the analysis of the literature demonstrate a deep, operational interdependence between the three-pillar framework for ethical artificial intelligence management and the complex logistics of sustainable biomass supply chains. These two distinct bodies of research do not exist in isolation, as the systemic, applicational, and ethical boundaries established in enterprise theory serve as the direct strategic parameters required to govern the data heavy, circular loops of the modern bioeconomy. When industries transition away from linear, fossil fuel dependencies, the management of localized biological networks encounters massive socio-technical friction points that cannot be resolved through simple technological solutionism. To bridge this gap, the macro architectural layers of the organic model translate directly into the five distinct operational stages of biomass supply chain decision-making, which include harvesting, pre-treatment, storage, transport, and energy conversion.

This study executed an adapted, PRISMA-informed conceptual and thematic synthesis of 37 core scientific publications to examine the evolving role of ethical Artificial Intelligence management during the industrial transition to Industry 5.0. By confining the analytical scope strictly to the domain of Managerial and Business Economics, the investigation established a clear strategic baseline for understanding how the rapid deployment of autonomous AI agents alters classic firm performance, cost architectures, and supply chain logistics without succumbing to technological solutionism or operational dehumanization. The resulting synthesis validated a

cohesive management architecture that bridges the gap between abstract corporate social responsibility and practical corporate operations, modelling the modern enterprise after the structural layers of an organism.

Systemically, the framework models AI as the organizational brain, employing advanced decision canvas approaches and information aggregation to mitigate workflow entropy and the bounded rationality of human leaders. In absolute compliance with the strict regulatory boundaries of the European Union AI Act, this pillar mandates the structural integration of Explainable AI architectures to ensure that algorithmic processing remains transparent, verifiable, and auditable. Applicationally, the model treats machine learning integration as the organizational body, functioning as an explicit technology driven efficiency parameter within a modified corporate production function. Rather than utilizing algorithms to aggressively substitute human labour, this layer optimizes total factor productivity and marginal labour efficiency under strict Human in the loop safety and quality protocols. Ethically, the organizational soul establishes the vital moral boundary against workplace dehumanization by using AI strictly for cognitive offloading. Delegating hazardous and repetitive workflows to automated agents allows the human workforce to reallocate cognitive resources toward high-value creative problem solving and innovation, while ensuring that a portion of the efficiency gains, the AI dividend is actively reinvested into human capital upskilling and Green Innovation.

The cross-thematic integration of these results demonstrated that these strategic parameters map directly onto the five distinct operational stages of biomass supply chain decision-making, harvesting, pre-treatment, storage, transport, and energy conversion established by Mafakheri and Nasiri (2013). As modern industries distance themselves from fossil fuel dependencies and transition toward biological resources, managing localized biomass supply networks introduces massive data, logistical, and socio-technical friction points. The synthesis demonstrated that the organizational brain processes the chaotic spatial temporal data of distributed biological feedstocks through Geographic Information Systems and Digital Twins. Simultaneously, the corporate body physically optimizes transportation logistics and lowers greenhouse gas emissions by executing Mixed Integer Linear Programming for route and facility allocation. Finally, the organizational soul relies on normative evaluation frameworks, such as the 6-point matrix proposed by the Nuffield Council on Bioethics (2011), to navigate severe socio-ecological trade-offs, particularly the critical land use competition between food security and biofuel production, thereby securing fair trade and equitable benefit distribution in rural economies.

In conclusion, the integration of Artificial Intelligence within Industry 5.0 and the emerging bioeconomy demands value driven enterprise governance that views technology not as an instrument for predatory labour displacement, but as an engine for human augmentation and ecological accountability. Modern organizational leaders must internalize that long-term corporate resilience relies on a unified framework where data visibility, computational velocity, and absolute respect for human dignity operate safely within planetary and ethical limits. While this conceptual synthesis provides a rigorous theoretical baseline, the rapidly evolving nature of autonomous systems means that the true boundaries of human-machine collaboration remain an open question. To advance beyond these theoretical limitations, the next logical step requires moving this multi-pillar architecture from conceptual modelling to empirical, live environment validation. This will be achieved through active collaboration with primary industrial partners, including international technology providers such as IBM, high-capacity automation developers like Mühlbauer Technologies, and advanced automotive manufacturing facilities such as Jaguar Land Rover (JLR) in Nitra, Slovakia, to test, refine, and validate these ethical parameters against real world industrial metrics.

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