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TARTALOMJEGYZÉK

TECHNOLÓGIAI TRENDEK ÉS KIHÍVÁSOK A SPORTRENDEZVÉNYEK PIACÁN

TECHNOLOGICAL TRENDS AND CHALLENGES IN THE SPORTS EVENT INDUSTRY

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ABSZTRAKT

A tanulmány a sportesemények szervezését átalakító technológiai trendeket és azok kihívásait vizsgálja, különös tekintettel a mesterséges intelligencia (MI), a hibrid és online formátumok, az AR/VR, az IoT-eszközök, a blokklánc és az NFT-k szerepére.

A kutatás fő kérdései: Hogyan befolyásolják az új technológiák a rendezvények tervezését és a látogatói élményt? Milyen lehetőségek és akadályok merülnek fel a szervezők számára?

Vegyes módszertani megközelítést alkalmaztunk: irodalomáttekintést, magyarországi nemzetközi események (FINA Vizes Világbajnokság 2022, Atlétikai Világbajnokság 2023, Rövidpályás Úszó Világbajnokság (25m) 2024) esettanulmányait, valamint interjúkat a szervezőkkel.

Az eredmények szerint az MI lehetővé teszi a személyre szabott programajánlásokat, chatbot-kommunikációt és előrejelző elemzéseket; az AR/VR és a gamifikált digitális élmények fokozzák a bevonódást; az IoT és érintésmentes megoldások egyszerűsítik a beléptetést és az adatgyűjtést; a blokklánc és NFT-k növelik a jegyek biztonságát és exkluzivitását. A digitális marketing, influenszerek és rövid videók pedig növelik az elérést és a közönség aktivitását. A fenntarthatósági intézkedések (digitális jegyek, energiatakarékos infrastruktúra, karbonlábnyom csökkentése) szintén hatékonynak bizonyultak.

A tanulmány rámutat, hogy a technológia stratégiai szerepet tölt be a látogatói élmény gazdagításában, valamint a jövőálló és innovatív sportesemények megvalósításában, gyakorlati példákkal a magyarországi eseményekből.

ABSTRACT

This study examines the technological trends transforming sports event management and their associated challenges. The research focuses on the role of artificial intelligence (AI), hybrid and online formats, extended and virtual reality (AR/VR), IoT devices, blockchain, and NFTs in enhancing attendee experience and operational efficiency.

The research questions addressed include: How do emerging technologies impact event planning and visitor engagement? What are the key challenges and opportunities for organizers in integrating these technologies?

A mixed-methods approach was employed, combining literature review, case studies of major international events in Hungary (FINA World Championships 2022, World Athletics Championships 2023, and Swimming Championships (25m) 2024), and interviews with event organizers.

The results indicate that AI enables personalized program recommendations, chatbots, and predictive analytics, while AR/VR and gamified digital experiences increase participant engagement. IoT devices and contactless solutions streamline access and data collection, and blockchain/NFTs enhance ticket security and exclusivity. Digital marketing through influencers

and short-form videos significantly improves reach and engagement. Sustainability measures, such as digital tickets, energy-efficient infrastructure, and carbon footprint reduction, were also found to be effective.
The study concludes that technology plays a strategic role in creating innovative, engaging, and sustainable sports events, demonstrating practical benefits in the Hungarian context.

BEVEZETÉS

A rendezvényszervezés egy dinamikus és szellemileg inspiráló szakmai terület, amely folyamatos alkalmazkodást és fejlődést igényel. Tapasztalatainkra támaszkodva kijelenthetjük, hogy nincs két egyforma rendezvény – mindegyik sajátos kihívásokat és tanulási lehetőségeket kínál. Ez a változatosság elősegíti a szakmai fejlődést, és különösen vonzóvá teszi a pályát azok számára, akik hivatásként tekintenek erre a munkára.

Jelen tanulmány ezeken a gyakorlati tapasztalatokon alapul, és elsődlegesen a feltörekvő technológiai trendek és innovációk szerepét vizsgálja a kortárs rendezvényszervezésben.

Az elmúlt évtizedben a rendezvényszervezés mélyreható átalakuláson ment keresztül, amelyet az új technológiák gyors fejlődése és integrációja hajtott. Ezek az innovációk gyakorlatilag a rendezvényszervezés minden aspektusát átalakították – a logisztikai tervezéstől és lebonyolítástól kezdve, a közönséggel való interakción át egészen az utólagos értékelésig. Az olyan technológiák, mint a mesterséges intelligencia (MI), a kiterjesztett és virtuális valóság (AR/VR), az Internet of Things (IoT), valamint a blokklánc, már nem csupán jövőbe mutató elképzelések, hanem kézzelfogható eszközök, amelyek aktívan hozzájárulnak a résztvevői élmény fokozásához és a szervezési folyamatok hatékonyabbá tételéhez. Ahogy a közönség elvárásai nőnek, és a digitális jelenlét egyre fontosabbá válik, e technológiák stratégiai alkalmazásának ismerete kulcsfontosságúvá vált mind a rendezvényszervezők, mind a kutatók számára.

A tanulmány célja annak feltárása, hogyan alakítják át ezek a feltörekvő technológiák a modern rendezvényszervezést, különös tekintettel a közönség bevonására és az élményalapú innovációra. A kutatás azt vizsgálja, hogyan formálják át az olyan technológiák, mint az MI-alapú személyre szabási eszközök, az immerzív digitális platformok, valamint az átlátható és biztonságos rendszerek (pl. blokklánc), a közönség és a rendezvények közötti kapcsolatot. Ezek a fejlesztések különösen relevánsak a nagyszabású nemzetközi sportesemények kontextusában, ahol a technológiai integráció versenyelőnyt jelenthet, és hosszú távú értéket teremthet a szervezők, a résztvevők és az érintettek számára egyaránt.

A téma időszerűségét tovább erősíti az iparágban tapasztalható egyre élesedő globális verseny, a COVID–19 világjárvány nyomán felgyorsult elmozdulás a hibrid és virtuális formátumok felé, valamint a fenntarthatóság egyre hangsúlyosabb szerepe a rendezvénytervezésben. A szervezők célja, hogy emlékezetes, befogadó és hatékony élményeket nyújtsanak, ebben pedig a technológia kulcsszerepet tölt be. Emellett a fiatalabb generációk digitális preferenciái, valamint a közösségi média – különösen a TikTok és az Instagram – térnyerése arra ösztönzi a rendezvényszervezőket, hogy újragondolják a hagyományos kommunikációs és bevonási stratégiákat, megteremtve ezzel az interaktív és adatalapú rendezvényélmények új korszakát.

A tanulmány az alábbi kutatási kérdések mentén vizsgálja ezeket a folyamatokat:

1. Milyen hatással vannak az MI-alapú szurkolói elköteleződési eszközök a közönség interakciójára, érzelmi bevonódására és általános elégedettségére nemzetközi sportesemények?
2. Milyen működési és stratégiai előnyökkel jár az olyan technológiák alkalmazása, mint az IoT, AR/VR és a blokklánc a rendezvényszervezésben?
3. Milyen módon járulnak hozzá ezek a technológiák a rendezvényszervezési gyakorlat hosszú távú innovációjához, versenyképességéhez és fenntarthatóságához?

A kutatáshoz választott módszertan kvalitatív jellegű, mélyinterjúkra épül. Ez a módszer lehetővé teszi, hogy a felszíni megfigyelésen túlmutató, tapasztalatokon alapuló, árnyalt betekintést nyerjünk. Az interjúkat olyan szakemberekkel készítettük, akik közvetlenül részt vettek a szurkolói élményfokozó megoldások tervezésében, fejlesztésében és megvalósításában három jelentős, Magyarországon megrendezett nemzetközi sportesemény: a 2022-es FINA Vizes Világbajnokságon, a 2023-as Atlétikai Világbajnokságon, valamint a 2024-es Rövidpályás Úszó Világbajnokságon. Ezek az események kiváló esettanulmányként szolgálnak méretük, nemzetközi láthatóságuk és a bevezetett technológiai megoldások sokfélesége miatt – az MI-alapú hasonmáskameráktól kezdve a személyre szabott sportolói bemutatókártyákon át az interaktív közönségaktivációkig.

A tanulmány szerkezete a következőképpen épül fel: a következő fejezet átfogó irodalmi áttekintést nyújt a rendezvényszervezés és a technológia kapcsolatáról, bemutatva a főbb trendeket és elméleti kereteket. Ezt követi a módszertani rész,

amely részletesen bemutatja a kutatás kialakítását és az interjúk lebonyolításának folyamatát. Az eredmények szakaszban összefoglaljuk az interjúk legfontosabb tanulságait, bemutatva, hogyan hatottak a vizsgált technológiák a közönségélményre és a működési teljesítményre. A diszkusszió szakaszban a kutatási kérdések mentén értelmezzük az eredményeket, és megvizsgáljuk azok gyakorlati jelentőségét. Végül a konklúzióban összegzést adunk a főbb megállapításokról, valamint javaslatokat fogalmazunk meg a további kutatásokra és a technológiai innovációk jövőbeli alkalmazására a rendezvényszektorban.
A tanulmány célja, hogy hozzájáruljon ahhoz a mélyebb megértéshez, amely rávilágít arra, hogyan szolgálja a technológia nemcsak a rendezvények hatékonyabb működtetését, hanem a közönség aktív bevonását, az innováció ösztönzését és a fenntartható fejlődést is a rendezvényszervezés területén.

SZAKIRODALMI ÁTTEKINTÉS

A szakirodalom célzott kereséssel, több tudományos adatbázisban (Scopus, Web of Science, ScienceDirect, Taylor & Francis Online, Google Scholar) történt, elsősorban a 2015–2024 között megjelent tanulmányokra fókuszálva, de kiemelt elméleti munkákat korábbi forrásokból is bevontunk. A keresés kulcsszavai a digitalizáció, személyre szabott turizmus, smart tourism, AI alkalmazások és fogyasztói élmény köré csoportosultak. A források kiválasztásának szempontjai a tudományos minőség, relevancia a digitalizáció és sportrendezvények kontextusában, valamint elméleti és módszertani jelentőség voltak.
A szakirodalmi áttekintés leíró jellegű, mivel a cikk fókusza a primer kutatásra és a magyarországi nemzetközi sportrendezvényeken (FINA Vizes Világbajnokság 2022, Atlétikai Világbajnokság 2023, Rövidpályás Úszóvilágbajnokság 2024) szerzett gyakorlati tapasztalatokra irányul. Az elemzés során a technológiai trendeket – például AI-alapú ajánlórendszerek, AR/VR élményfokozás és digitális jegyrendszerek – mutatjuk be, miközben érzékeltetjük a sportfogyasztói élmény és a fan engagement jelentőségét a látogatói bevonódás kontextusában. A nemzetközi szakirodalmi források relevanciája a magyar viszonyokra is értelmezhető, mivel a vizsgált események szervezése és élményfokozó megoldásai globális trendeket követnek.

Új trendek a rendezvényszervezés piacán

A rendezvényszervezési iparág gyors átalakuláson megy keresztül, amelyet az olyan fejlett digitális technológiák integrációja hajt, mint a mesterséges intelligencia (MI), a kiterjesztett és virtuális valóság (AR/VR), a dolgok internete

(IoT), a blokklánc, valamint a fenntarthatóságra fókuszáló innovációk. Ezek a technológiák nemcsak a működési hatékonyságot növelik, hanem gazdagítják a résztvevők élményét és az érintettek bevonódását is.

A Mesterséges Intelligencia és a Chatbot

A mesterséges intelligencia (MI) technológiák lehetővé teszik a dinamikus személyre szabást és a prediktív elemzéseket a rendezvények környezetében. A gépi tanulási modellek elemzik a résztvevők viselkedését, így testreszabott programajánlásokat és intelligens összekapcsolási lehetőségeket kínálnak, amelyek végső soron növelik az elégedettséget és a hálózatépítési eredményeket (Buhalis & Amaranggana, 2015; Wang et al., 2022). A Lisszaboni Web Summit példája jól mutatja ezt a tendenciát, ahol MI-alapú összekapcsolási rendszereket használnak a hasonló érdeklődésű résztvevők összekötésére, amely jól példázza az MI használatát a mindennapokban (Lalli et al., 2021). Emellett a chatbotok virtuális asszisztensként működnek, azonnali válaszokat adva a programokra, helyszíni információkra és jegyértékesítésre vonatkozó kérdésekre, jelentősen javítva ezzel az ügyfélszolgálatot (Gretzel et al., 2020). Ezek az MI rendszerek korábbi eseményekből származó nagy adathalmazokat is felhasználnak a részvételi létszám előrejelzésére és az erőforrások optimális elosztására. *„Az MI rendszerek folyamatosan 'tanulnak a tapasztalatokból', így az eredményhez vezető út minden futtatáskor eltérő lehet."* (WTTC, 2024, p.9.).

Hibrid és Virtuális Események

A COVID-19 világjárvány felgyorsította a hibrid rendezvényformátumok elterjedését, amelyek ötvözik a személyes és a virtuális részvételt. Ezt a váltást széles körben tanulmányozták, és megállapították, hogy bár növeli a hozzáférhetőséget és a részvételt, kihívásokat jelent az immerzív élmények és a közösségépítés fenntartása (Getz & Page, 2020; Neuhofer et al., 2015). Az Apple Keynote és a Microsoft Ignite kiváló példák arra, hogyan lehet magas minőségű élő közvetítéseket interaktív funkciókkal, például élő szavazásokkal és kérdés-felelet blokkokkal kiegészíteni, ezáltal növelve a résztvevők bevonódását. A Tomorrowland „Around the World" virtuális fesztivál pedig 3D-s virtuális tereket és többkamerás nézeteket használt, hogy a fizikai rendezvény dinamikáját utánozza (Filo et al., 2015).

Kiterjesztett és Virtuális Valóság (AR/VR)

Az olyan immerzív technológiák, mint a kiterjesztett (AR) és a virtuális valóság (VR), új lehetőségeket kínálnak a helyszínek és termékek felfedezésére, ezáltal gazdagítva a rendezvényélményt (Neuhofer, Buhalis és Ladkin, 2015). A Coachella fesztiválon például AR-alkalmazások segítségével a résztvevők mobilkészülékeiken keresztül élhették át a látványos előadásokat, ami fokozta az elköteleződést (Sánchez-Cañizares & López-Guzmán, 2012). Hasonlóképpen, a Mobile World Congress rendezvényen VR-demókon keresztül mutatták be a feltörekvő 5G-technológiákat, míg a New York Fashion Week teljesen virtuális kifutó show-kat kínált, amelyek távolról is elérhetők voltak (Tussyadiah et al., 2018). A kutatások szerint az immerzív technológiák növelik az érzelmi bevonódást és az élmények hosszú távú megőrzését a rendezvénykörnyezetekben (Hilken et al., 2017).

Okosszerződések és beszállítókezelés

Az okosszerződések automatizált eszközként szolgálnak a rendezvények logisztikai folyamataiban, mivel előre meghatározott feltételek – például határidők és fizetési ütemezések – alapján érvényesítik a megállapodott szerződési pontokat. Ez az automatizáció kulcsszerepet játszik az adminisztratív hatékonysági hiányosságok csökkentésében, valamint az érintettek közötti vitás helyzetek valószínűségének mérséklésében (Zheng et al., 2020). A technológia alkalmazásával a rendezvények ellátási lánca jelentős átalakuláson mehet keresztül, lehetővé téve a rugalmasabb és átláthatóbb együttműködést a beszállítók és a szervezők között – ez pedig végső soron a rendezvénytervezési folyamat általános hatékonyságát növeli (Chen et al., 2021).

IoT és Okos Eszközök

Az IoT-alapú megoldások, mint például az RFID-technológiával ellátott belépőkártyák és az NFC-s okoskarkötők kulcsfontosságúak a rendezvények működésének hatékonyabbá tételében, a valós idejű tömeganalitika lehetővé tételében és a biztonság növelésében (Gretzel et al., 2020). A Disney MagicBand+ karkötői zökkenőmentes, érintésmentes élményt kínálnak, amely ötvözi a beléptetést, a fizetést és az interaktív attrakciókat – jól szemléltetve az IoT szerepét a látogatói élmény fokozásában (Buhalis & Leung, 2018). A kutatások szerint az IoT-megoldásokkal támogatott környezetek adatvezérelt rendezvénytervezést tesznek lehetővé, például hőtérképek és mozgásirány-optimalizálás révén, ami növeli a biztonságot és a résztvevők elégedettségét

(Leung et al., 2013). A CES rendezvényen az RFID-technológiát valós idejű látogatói nyomon követésre használják, amely lehetővé teszi a szervezők számára a térhasználat dinamikus alakítását (Wang et al., 2022).

Blocklánc és NFT Jegyek

A blokklánc-technológia megbízható, manipulálhatatlan megoldást kínál a jegyértékesítésre, jelentősen csökkentve a csalás és a visszaélésszerű viszonteladás lehetőségét. Emellett az NFT-k új lehetőségeket teremtenek innovatív digitális tartalmak és exkluzív VIP-hozzáférések kialakítására (Regner et al., 2019; Ulrich et al., 2021). A YellowHeart blokklánc-alapú jegyértékesítési rendszere a Kings of Leon koncertjein úttörő kezdeményezés volt, amely az NFT-ket exkluzív tartalmak átadásával kapcsolta össze, így erősítve a rajongói élményt (Müller et al., 2023). A Coachella 2022-es NFT-jegy pilot projektje szintén jól példázza, hogyan lehet a blokkláncot egyedi digitális emléktárgyak létrehozására használni, miközben biztonságos belépést biztosít az eseményekre (Corcoran, 2022). A tudományos kutatások alátámasztják, hogy a blokklánc képes decentralizálni a rendezvényszervezési folyamatokat, ezáltal növelve az átláthatóságot és az érintettek közötti bizalmat (Atzori, 2017).

Social Media és Digitális Marketing

A rövid formátumú videók (TikTok, Instagram Reels), influenszer-együttműködések és a felhasználók által generált tartalmak (UGC) egyre nagyobb szerepet játszanak a rendezvények népszerűsítésében és a közönség bevonásában (Zeng et al., 2021). A VidCon TikTok Live adásai és az NFL kiterjesztett valósággal (AR) kiegészített Super Bowl kampányai hatékony digitális elköteleződési stratégiákat példáznak. A kutatások rámutatnak, hogy a mesterséges intelligencia által generált tartalmak jelentősen növelhetik a marketing elérését és a személyre szabhatóság szintjét (Wang et al., 2022).

Fenntartható Technológiai megoldások

A fenntarthatóság napjainkra a rendezvényszervezés egyik kulcsfontosságú elemévé vált, egyre nagyobb hangsúlyt kapva a digitális jegyek használata, a megújuló energiaforrások alkalmazása és a hulladékcsökkentési stratégiák (Mair & Jago, 2010). A Glastonbury Fesztivál kiemelkedő példát mutat az egyszer használatos műanyagok betiltásával és a napelemmel működő színpadok bevezetésével, ezzel utat mutatva a környezettudatos rendezvényszervezésben (Glastonbury, n.d.). A Coldplay „Music of the Spheres” turnéja az innovációt

képviseli az energiát termelő táncparkettek révén, amelyek kinetikus energiát hasznosítanak, így a technológia egyszerre vonja be a közönséget és csökkenti a környezeti terhelést (Energy Floors, n.d.). Emellett a Google I/O fejlesztői konferencia karbonsemleges tanúsítása azt bizonyítja, hogy a fenntarthatóság nagy léptékű technológiai rendezvényekbe is hatékonyan integrálható (South Pole, 2023).

A feltörekvő technológiák egyre inkább olyan rendezvénymodellt tesznek lehetővé, amely a résztvevők élményeit helyezi középpontba, miközben hatékony és fenntartható ökoszisztémát teremt. Ugyanakkor számos kihívás továbbra is fennáll, többek között az adatvédelem kérdései, a digitális infrastruktúrák energiaigénye, valamint a digitális szakadék, amely a hozzáférést befolyásolja (Getz & Page, 2020; Neuhofer et al., 2015). További kutatásokra van szükség olyan keretrendszerek kidolgozásához, amelyek elősegítik a technológia felelős alkalmazását, biztosítják a rendszerek közötti együttműködést, és vizsgálják a technológiai megoldások hosszú távú hatásait a látogatói élményre és a rendezvények gazdaságosságára (Müller et al., 2023; Ulrich et al., 2021).

MÓDSZERTAN

Kutatásunk célja az volt, hogy a vizsgált jelenségről átfogó és megalapozott képet adjunk, ezért a vizsgálatot primer és szekunder módszerek együttes alkalmazásával végeztük. A szekunder kutatás keretében elsősorban a digitális technológia, a mesterséges intelligencia, az okoseszközök, a közösségi média, a fenntarthatóság, valamint az online és hibrid rendezvények témaköreihez kapcsolódó releváns szakirodalmat tekintettük át. E területek dinamikusan változó jellege miatt különösen fontosnak tartottuk a korábbi és a legfrissebb publikációk elemzését is, amelyeket az interjúkból származó információkkal egészítettünk ki.

A primer kutatás során félig strukturált interjúkat készítettünk olyan, rendezvényiparban dolgozó szakemberekkel, akik munkájuk során rendszeresen találkoznak a digitalizáció és a mesterséges intelligencia kérdéskörével. Négy, jelentős szakmai tapasztalattal rendelkező interjúalany bevonására nyílt lehetőségünk, akik a rendezvények különböző területein tevékenykednek. Ennek köszönhetően az interjúk rávilágítottak az eltérő szakmai nézőpontokra – különösen a mesterséges intelligencia szerepének és jelentőségének megítélésében. Más szempontok érvényesülnek például a szórakoztató programok tervezése során, mint a nézői élmény közvetlen megvalósításában, ami a legmarkánsabb különbségként jelent meg az interjúkban. A legtöbb kérdés esetében azonban alapvető egyetértés volt tapasztalható.

Az interjúk 2025 júniusa és júliusa között készültek, 30–60 perces időtartamban. Az interjúmódszer alkalmazását azért tartottuk indokoltnak, mert lehetővé teszi az érintett szakemberek tapasztalatainak és véleményének mélyebb feltárását, különösen a digitalizáció és a mesterséges intelligencia rendezvényipari alkalmazásának kontextusában. Az interjúalanyok együttműködőek és készségesek voltak, így a kutatás ezen szakasza zökkenőmentesen zajlott. A bevont interjúk számát a kutatás jelenlegi fázisában elegendőnek ítéljük. A beszélgetések előzetesen összeállított interjúvázlat alapján zajlottak, amely elősegítette az adatok rendszerezését és az egyes interjúk összehasonlíthatóságát, miközben figyelembe vettük az egyes szakemberek sajátos tapasztalatait és szakterületét is.

EREDMÉNYEK

Az interjúkra 2025 nyarán került sor, és olyan alanyokat kérdeztünk meg, akiknek releváns tapasztalata van sportrendezvények szervezésében. Volt szerencsénk velük több sportrendezvényen is együtt dolgozni, amelyek egyben a vizsgált események is (FINA 2022, Atlétikai Világbajnokság, Rövidpályás Úszóvilágbajnokság), így első kézből tapasztalhattuk meg szakmai hozzáértésüket.

A következő szakemberekkel készítettünk interjúkat:
Varga Gábor a Sport Events: rendezvény prezentációs vezető
Korpás Gábor a Sport Events: műsorszerkesztő
Mag Zoltán TV-s műsorrendező, sporteseményeken főrendező
Varga-Nagy Lajos, TV-s műszaki menedzser, sporteseményeken rendező.

Mivel az interjúalanyok különböző szakmai területeken dolgoznak, a kutatási eredmények ismertetése során természetes módon jelentkeznek bizonyos véleménykülönbségek. Összességében azonban elmondható, hogy a főbb kérdésekre adott válaszaik számos ponton egybeestek.
Noha a négy interjú száma nem elegendő ahhoz, hogy statisztikailag elkülöníthető csoportokat képezzünk, a mintában mégis kirajzolódnak bizonyos mintázatok. A sportprezentációért és műsorokért felelős két szakember álláspontja szinte minden kérdésben közel azonosnak bizonyult. Hasonló összhang figyelhető meg a másik két interjúalany esetében is, akik elsősorban televíziós műsorok rendezésével foglalkoznak, így szemléletmódjuk eltérő szakmai háttérből táplálkozik. E különbségek hozzájárulnak a vizsgált terület sokoldalúbb megértéséhez.

Az interjúalanyok valamennyien 2017-et jelölték meg kiindulópontként, amikor a Sport Events által szervezett – elsősorban sporttematikájú – rendezvényeken dolgozni kezdtek. Mindegyikük rendelkezett korábbi rendezvényszervezési tapasztalattal, illetve televíziós csatornáknál is tevékenykedtek szakmai profiljuknak megfelelően. Ez utóbbi különösen releváns szempont, mivel a televíziós gyakorlat jelentősen hozzájárult ahhoz, hogy jól ismerjék a nézők és szurkolók igényeit, valamint azt, milyen eszközökkel tartható fenn figyelmük rövidebb vagy hosszabb időtartamon keresztül.

A vizsgálat középpontjában az alábbi kérdéskörök álltak:

- a jelenleg jellemző trendek a sportrendezvények szervezésében;
- Magyarország versenyképessége más országokhoz viszonyítva;
- a digitális technológiák és a mesterséges intelligencia alkalmazásának mértéke a sportesemények előkészítésében és lebonyolításában;
- e technológiák használhatósága, felhasználóbarát jellege és a velük kapcsolatos tapasztalatok;
- a szurkolók, illetve bizonyos tekintetben a versenyzők attitűdje a digitális megoldásokkal szemben;
- a három kiemelt sportesemény (FINA 2022, Atlétikai Világbajnokság, Rövidpályás Úszóvilágbajnokság) szervezése során megfigyelhető hasonlóságok és különbségek a digitalizáció és mesterséges intelligencia alkalmazási módjait illetően;
- valamint a szakemberek jövőre vonatkozó várakozásai és a digitalizáció, illetve az MI jövőbeli trendjeinek megítélése.

Már az első interjút követően világossá vált, hogy a digitális technológiára vonatkozó kérdések önmagukban nem relevánsak, mivel e technológiák alkalmazása ma már alapvető feltétele a rendezvények tervezésének és lebonyolításának. Ennek ellenére – a kutatás szerkezetének megtartása érdekében – a digitalizáció és a mesterséges intelligencia témaköreit továbbra is elkülönítve kezeltük. A mesterséges intelligenciára irányuló kérdések ezzel szemben aktuálisnak és bizonyos értelemben megosztónak bizonyultak, amint arra korábban már utaltunk.

Versenyképesség

A válaszadók egyöntetűen úgy ítélték meg, hogy Magyarország versenyképes a nagy nemzetközi sportrendezvények szervezésében. A legmeghatározóbb

tényező azonban a rendelkezésre álló költségvetés, amely alapvetően befolyásolja a megvalósítható technológiai és műsorelemek körét – különösen figyelembe véve, hogy más erőforrásigénnyel jár egy heti rendszerességű, illetve egy négyévente megrendezett esemény.
A közönségszórakoztatás terén ugyanakkor az egyik interjúalany hiányosságokra hívta fel a figyelmet: gyakran nem érkeznek kellően kiforrott elképzelések megrendelői oldalról, ami megnehezíti olyan program- vagy látványelemek finanszírozását, amelyek „átütő" élményt nyújtanának. Az interjúalanyok ugyanakkor egyetértettek abban, hogy a közönség aktivizálása kiemelt jelentőségű. Azok az élmények maradnak meg hosszú távon a szurkolók számára, amelyek a versenyszámokon kívül – az esemény előtt és után – is bevonják őket a programba, ezért ezen elemek szerepe meghatározó a rendezvény összélményének alakításában.

Digitalizáció szerepe a rendezvényszervezésben

A digitális technológia – amint azt korábban is hangsúlyoztuk – a rendezvények teljes szervezési és lebonyolítási folyamatában alapvető eszközzé vált. Ezzel szemben a mesterséges intelligencia alkalmazása még inkább kísérleti és óvatos megközelítést igényel, mivel a szakemberek jelenleg ismerkednek a lehetőségeivel és korlátaival. Ennek ellenére már most is használják különböző kreatív és operatív feladatokban, például a tervezésben, a világítási koncepciók kialakításában, edukációs tartalmak előállításában, ötletgenerálásban, valamint grafikai feladatoknál is kísérleteznek vele. A használat gördülékenysége továbbra is kérdéses, ugyanakkor az interjúk alapján az MI új távlatokat nyithat meg a rendezvényszervezésben.
A nagyobb események esetében – ahol jelentős műszaki háttér áll rendelkezésre – a digitalizáció és a mesterséges intelligencia integrálása jóval könnyebb, míg kisebb rendezvényeken ezek alkalmazása kevésbé jellemző. A nézők és szurkolók számára kiemelt fontosságú, hogy a belépéstől a távozásig olyan élményben részesüljenek, amely hosszú távon emlékezetes marad. Az interjúalanyok szerint ebben a mesterséges intelligencia is szerephez juthat, például interaktív, szórakoztató játékok formájában – ilyen jellegű megoldás először a 2024-es Rövidpályás Úszóvilágbajnokságon jelent meg. Ugyanakkor volt példa arra (nem a vizsgált események körében), hogy MI-t – konkrétan ChatGPT-t – alkalmaztak kvízkérdések generálására, ám a rendszer nem volt naprakész a szabályváltozások tekintetében. Ez rávilágít arra, hogy az MI által javasolt tartalmakat minden esetben kritikus felülvizsgálatnak kell alávetni.

A szakmai szervezetek nyitottsága a technológiai újításokra vegyes képet mutat. A válaszok alapján egyes szervezetek kevésbé fogékonyak a sportprezentáció vagy az MI-alapú megoldások alkalmazására, míg mások – például a Kézilabda-, Röplabda-, Vívó- és Vízilabda Szövetség – kifejezetten támogatják az innovációt, és külön szakembert is alkalmaznak e feladatokra.

A digitális technológia ma már nélkülözhetetlen a rendezvények működtetéséhez, míg a mesterséges intelligencia jelentős hozzáadott értéket képviselhet azáltal, hogy felgyorsítja és megkönnyíti a szervezési folyamatokat. Az interjúalanyok kiemelték, hogy MI segítségével hatékonyan készíthetők adásmenetek, szerződések, kvízkérdések, illetve gyorsan kereshető elő releváns, könnyen feldolgozható információ. Ugyanakkor e tartalmak esetében elengedhetetlen az ellenőrzés, ahogyan azt a korábbi példa is jelezte. Az MI tehát olyan eszköz, amely megfelelően alkalmazva jelentős előnyhöz juttathatja a szervezőket, akár a tervezésben, akár a szórakoztató elemek kialakításában. Az egyik interjúalany továbbá kiemelte, hogy a képi tartalmak manipulációjára is kiválóan alkalmas, ugyanakkor ez a felhasználási terület komoly programozói hátteret igényel.

A technológiák használhatóságával és időigényével kapcsolatos kérdésekre adott válaszok valamelyest eltértek egymástól, ami elsősorban az interjúalanyok különböző szakmai területeiből adódik. A digitalizáció alkalmazását a szakemberek egyöntetűen egyszerűnek és időhatékonynak ítélték meg: a tervezési és szervezési folyamatok felgyorsulnak, és számos feladat könnyebben elvégezhető a digitális eszközöknek köszönhetően.

A mesterséges intelligencia használata azonban már összetettebb képet mutat. Egyrészt jogi és jogdíjjal kapcsolatos kérdések, másrészt az MI újdonsága és ismeretlensége miatt a használat több időt vehet igénybe. Mivel még nem teljesen világos, hogy pontosan milyen feladatokra alkalmazható biztonságosan és milyen korlátok mellett, gyakran szükség van az MI-nek adott utasítások többszöri finomítására (például ChatGPT esetében). A szakemberek ugyanakkor úgy vélik, hogy a technológia mélyebb megismerésével, idővel jelentősen csökkenni fog a szükséges időráfordítás, és gyorsabbá válik az információk keresése, illetve az ötletek generálása.

A szórakoztató elemek megtervezése és lebonyolítása az MI használatával különösen időigényes lehet. Gyakran nem fér bele egy esemény szűk időkeretébe, vagy a költségvetés nem teszi lehetővé a technológia alkalmazását, így sok esetben egyszerűbb játékok használata mellett kell dönteni. Az AI-alapú megoldások költségei is jelentősek lehetnek. Az előkészületek során előnyt jelenthet, ha a

rendezvényen olyan tapasztalt MC (helyszíni műsorvezető) működik közre, aki szükség esetén át tudja hidalni az esetleges technikai fennakadásokat.

Közönségszórakoztatás

Az MI-alapú játékok – például a face swap típusú megoldások, ahol egy ismert személy arca helyére a kiválasztott néző arcát illeszti be a rendszer – különösen érzékenyek a hibalehetőségekre, ezért az éles alkalmazást megelőzően többszöri tesztelést igényelnek. A nézők jellemzően kedvelik a játékokat, azonban a fogadókészség erősen függ a közönség nyitottságától és attól, mennyire bevonhatóak interaktív aktivitásokba. Ha ez hiányzik, a jelentős költségvetésből megvalósított játékok sem érik el a kívánt hatást.

Az interjúalanyok hangsúlyozták, hogy sokszor a legegyszerűbb eszközök – például a közös kiáltás vagy a „hullámzás" – nagyobb közösségi élményt nyújtanak, mint az okoseszköz-alapú vagy nyelvi, mozgásos, illetve MI-t igénylő játékok. Mindezek következtében a játékok alkalmazhatóságát gyakran korlátozza a költségvetés, az időkeret vagy a közönség aktivitási hajlandósága.

A digitális technológiák és új technológiai megoldások alkalmazása a sportolók szempontjából is releváns kérdés. Az általunk vizsgált nemzetközi sportesemények tapasztalatai azt mutatják, hogy a versenyzők egy része számára az első napokban zavaró lehet, ha a megszokottól eltérő módon kell bevonulniuk a versenytérre – például „intro gate" rendszeren keresztül, ahol látványos bemutatást kapnak, vagy forgókapun át érkeznek a pályára. Emiatt a szervezők lehetőséget biztosítanak próbabevonulásokra, hogy a sportolók komfortosabban alkalmazkodjanak az új környezethez, és fenntarthassák megszokott koncentrációs rutinjukat. Gyakori továbbá, hogy az edzők igyekeznek minimalizálni az ilyen jellegű, a fókuszt esetleg megzavaró ingereket.

A közvetítések szempontjából azonban ezek a show-elemek jelentős szerepet játszanak. A versenyzők megjelenése, pályára lépésének módja a közvetítés dramaturgiájának része, és hozzájárul a rendezvény összhatásához. A sportolók reakciói ezért nagymértékben egyénfüggőek: míg egyeseket kizökkenthet a körítés, mások eleve nem fordítanak figyelmet rá, mivel teljes mértékben az előttük álló feladatra koncentrálnak. Mindazonáltal a mai rendezvényszervezési gyakorlat része, hogy a közönség számára minél élményszerűbb, látványosabb módon mutassák be a versenyeket.

A digitalizáció ugyanakkor a sportolók teljesítményének elemzésében is meghatározó, hiszen számos csapat és stáb használ digitális eszközöket statisztikák gyűjtésére és teljesítménymérésre. Ez is jól mutatja, hogy a digitális

technológiák a sportesemények több területén beépültek a mindennapi gyakorlatba.
A válaszadók egyetértettek abban, hogy a digitális technológia és a mesterséges intelligencia alkalmazásának terén az Egyesült Államok számít a legmeghatározóbb példának, amelyet Anglia, valamint Szaúd-Arábia és Katar követ – utóbbiak elsősorban jelentős anyagi forrásaik miatt. Ezekben az országokban – különösen az USA-ban – komplex, családközpontú szemlélet érvényesül, ahol a sporteseményeket teljes körű szórakoztató programként kezelik, a nézők és szurkolók bevonására helyezve a hangsúlyt.
A digitalizáció és az MI alkalmazása tekintetében Magyarország összességében versenyképesnek tekinthető a sportrendezvények szervezése területén. Az innovatív megoldások alkalmazhatóságát leginkább a rendelkezésre álló költségvetés határozza meg. A válaszadók szerint a további fejlődéshez nemcsak technológiai nyitottságra, hanem nagyobb bátorságra is szükség van ezen megoldások használatában. A közönségszórakoztatás fejlesztése terén pedig az USA által képviselt gyakorlat szolgálhat inspirációként.

A vizsgált rendezvények összehasonlítása

A három vizsgált nemzetközi sportrendezvény egyik legjelentősebb közös vonása, hogy az érintett nemzetközi sportszövetségek – elsősorban az úszó- és atlétikai szövetség – kiemelkedően jól szervezett eseményként értékelték őket. Ez jelentős elismerést jelent Magyarország számára, és egyben azt is bizonyítja, hogy hazánk versenyképes a nagy volumenű nemzetközi sportesemények megrendezésében. A Nemzetközi Úszószövetség (WA) ugyanakkor mindezek ellenére új irányvonal kialakítására törekszik, mivel úgy véli, hogy sportágaik népszerűsége csökkent. A szövetség célja, hogy a közvetítések még inkább „eladhatóvá" váljanak, hangsúlyt helyezve a dramaturgiára, a nézői reakciók kiváltására és az izgalmi faktor növelésére.
Az úszóesemények sajátossága, hogy zárt, sötétebb atmoszférájú létesítményekben zajlanak, ami kevésbé kedvez a dinamikus szurkolói hangulatnak, ellentétben például a gyakran nyitott térben rendezett vízilabda-mérkőzésekkel. Ennek megfelelően a sportprezentációs csapatnak kiemelt figyelmet kell fordítania arra, hogy a közönségszórakoztatás eszközeit az adott környezethez igazítsa.
A három vizsgált esemény további közös eleme a közönség bevonását célzó játékok használata (például „kiss cam", „dance cam"), valamint az úgynevezett intro gate vagy intro card alkalmazása, amely a versenyzők modern, látványos

bemutatását teszi lehetővé LED-falra vetített, néhány másodperces videók formájában. Emellett mindegyik eseményen jelen voltak kabalafigurák, amelyek fő feladata a közönség szórakoztatása és aktivizálása. Míg az Egyesült Államokban a kabalák szerepe jóval komplexebb és sok éves hagyományokra tekint vissza, Magyarországon elsősorban fotózkodási lehetőségként funkcionálnak.

A technológiai és prezentációs újdonságok közül kiemelkedik, hogy a 2022-es FINA Világbajnokságon debütált az intro gate és az intro card, amelyeket később a 2023-as Budapesti Atlétikai Világbajnokságon is alkalmaztak, majd több ország is átvette a megoldást. Szintén figyelemre méltó újítás volt az Atlétikai Világbajnokságon a „walking DJ", aki hordozható DJ-pulttal, a közönséggel közvetlenül interakcióba lépve teremtett hangulatot. Bár rendkívül népszerű volt, a szerepkörre alkalmas személy megtalálása kihívást jelent, mert különleges alkalmazkodóképességet és kiemelkedő hangulatkeltő készséget igényel.

Új elem volt továbbá az élőzenei medal plaza, amelyet a versenyszámok után, de nem közvetlenül a futamokat követően rendeztek meg: a díjátadók a következő nap délutáni/esti programjának részeként zajlottak, közvetlenül a szurkolók előtt. Ez közelebb hozta egymáshoz a versenyzőket és a nézőket, és erőteljesebb ünnepi hangulatot teremtett. Emellett az Atlétikai Világbajnokságon a döntők előtti bevonulások során intro bandek, vagyis élő zenekarok játszottak, tovább növelve a show-jellegű elemek súlyát.

2024-ben a Rövidpályás Úszó-világbajnokságon alkalmaztak először mesterséges intelligenciát a közönségszórakoztatásban, például éneklős játékok és „face swap" formájában. Ugyanezen az eseményen a korábban bemutatott intro kapu megújult változatban, forgókapus technikai megoldással jelent meg.

Az interjúk tanulsága szerint meghatározó tényező, hogy az adott napon milyen összetételű és hangulatú közönség van jelen az esemény helyszínén. Több válaszadó is kiemelte, hogy ami egy adott napon kiválóan működik, az máskor korántsem garantálja ugyanazt a hatást. A gyakorlat azt mutatja, hogy sokszor a legegyszerűbb eszközök – például a telefonok kameráinak felvillantása, a hullámzás, közös éneklés vagy kézlengetés – sokkal erőteljesebb atmoszférát teremtenek, mint a digitális megoldások. Mindez arra utal, hogy bár a digitális technológia hasznos és látványos eszköze lehet a közönségszórakoztatásnak, nem minden esetben alkalmas az elvárt élmény kiváltására.

A kisebb léptékű rendezvényeken a digitális megoldások gyakran kevésbé működnek, míg a nagy nemzetközi események esetében jóval nagyobb eséllyel válnak a műsor szerves részévé. Ugyanakkor létezik olyan példa is, amely azt mutatja, hogy egy teljesen analóg megoldás is képes kiemelkedő közönségreakciót

kiváltani. Az Atlétikai Világbajnokságon és a Rövidpályás Úszó-világbajnokságon a legnagyobb lelkesedést nem a digitális elemek, hanem a pólóágyú váltotta ki: a közönség kifejezetten várta a gázpalackkal működő eszközből kilőtt, előre csomagolt pólókat, és sokan odafutottak a kisorsolt területre, hogy elkapják az ajándéktárgyat. Ez jól mutatja, hogy a kézzel fogható, fizikai meglepetések sok esetben nagyobb élményt nyújtanak, mint a modern digitális vagy mesterséges intelligencián alapuló tartalmak.

Ugyanakkor a digitális technológia alkalmazásának árnyoldalai is egyre inkább megmutatkoznak. A közelmúlt egyik sokat emlegetett példája a 2025 nyarán rendezett Coldplay-koncert esete, ahol a szórakoztatási célú közönségkamerán egy olyan párt mutattak be, akik a későbbiekben kiderült információk szerint nem éltek házasságban egymással, hanem mindkettőjüknek külön családjuk volt. Bár az eset később mémekké és közösségi médiás tartalmak alapjává vált, a kutatás szempontjából sokkal relevánsabb az, hogy ilyen helyzetek milyen etikai, adatvédelmi (pl. GDPR) és emberi jogi kérdéseket vetnek fel. Egyre gyakrabban merül fel az a dilemma, hogy valóban szórakoztató-e az adott műsorelem annak számára, akit akaratlanul szereplővé tesznek.

Az interjúalanyok többször is beszámoltak arról, hogy a digitális technológiára vagy mesterséges intelligenciára épülő interaktív játékokban sok néző nem szívesen vesz részt. Ennek oka lehet félénkség, szereplési bizonytalanság, illetve az, hogy a nyilvános szereplés számukra kellemetlen helyzetet teremt. Mindez arra utal, hogy a közönségaktivizálás során elengedhetetlen figyelembe venni a különböző komfortszinteket, valamint azt, hogy nem minden szurkoló nyitott az interaktív, digitális bevonódásra.

Jövőbeli digitális tendenciák

A kutatás utolsó kérdésköre arra irányult, hogy a szakemberek szerint milyen változások várhatók a digitális technológia és a mesterséges intelligencia alkalmazásában a következő években, valamint hogy ezek milyen hatással lesznek a sportrendezvények szervezésére. Az interjúalanyok egyöntetűen úgy vélik, hogy mindkét terület gyors ütemben fejlődik, és a mesterséges intelligencia a jövőben egyre több rendezvényen jelenik majd meg, különösen akkor, amikor a szakma már magabiztosabban ismeri és átlátja a technológia hatékony felhasználási lehetőségeit.

Véleményük szerint az olyan technikai területek, mint a világítás, a hang- és képtechnika, valamint a drónok alkalmazása tovább fejlődnek, és az AI ezek működésében is egyre hangsúlyosabb szerepet kap. A mesterséges intelligencia a

vizuális tervezés, a vezérlés, az adatelemzés, az automatizálás és a versenyzői bemutatkozó rendszerek (intro cardok) terén is egyre szélesebb körben használhatóvá válik. A szórakoztató játékok esetében szintén növekvő szerepet kap majd az AI, ugyanakkor ezek az elemek várhatóan rövidebb életciklussal fognak működni, ami folyamatos innovációt és nyitottságot tesz szükségessé.
A sportesemények tényleges rendezői ugyanakkor némileg árnyaltabban látják a mesterséges intelligencia jövőjét. Bár egyetértenek abban, hogy az AI-t egyre több területen lehet és kell alkalmazni, felmerül a kérdés, hogy a technológia használatába fektetett idő és pénz minden esetben megtérül-e. Műsorszerkesztés terén egyelőre nem használják, a designfolyamatokban azonban már igen.
Kiemelik, hogy a nézők aktivizálásában továbbra is az egyszerű, közvetlenül bevonó eszközök a leghatékonyabbak. A tapsoltatás, a pólóágyú, a közös éneklés vagy a fizikai aktivitást igénylő bevonódás sokkal erőteljesebb élményt vált ki, mint az olyan digitális megoldások, amelyek telefonos interakcióra vagy emojik utánzására épülnek. A hatékony közönségszórakoztatás kulcsa továbbra is az érzelmek kiváltása és a közönség fizikai aktivizálása marad, amelyet a mesterséges intelligencia csak bizonyos keretek között tud támogatni.

A vizsgált kérdéskörök összefoglalása

Összességében megállapítható, hogy az interjúk révén értékes és releváns gyakorlati információkhoz jutottunk, amelyek kiegészítik és árnyalják az elméleti részben bemutatott ismereteket. Tekintettel arra, hogy a rendezvényszervezés elsősorban gyakorlati jellegű tevékenység, a kutatás során külön hangsúlyt fektettünk olyan konkrét példák és tapasztalatok bemutatására, amelyek közvetlenül hasznosíthatóak a szakemberek számára a mindennapi munkájukban.
A kutatási kérdésekre a fentiekből adódóan, a következő konklúziókat vonhatjuk le.
Az első kutatási kérdés („Hogyan befolyásolják a mesterséges intelligenciával működő szurkolói elköteleződési eszközök a közönség interakcióját, érzelmi bevonódását és általános elégedettségét a nemzetközi sporteseményeken?”) kapcsán az interjúk alapján egyértelműen megállapítható, hogy a mesterséges intelligencia alkalmazása a közönség bevonásában még kezdeti stádiumban van, és a gyakorlatban eddig kevés tapasztalat halmozódott fel. A 2024 végén megrendezett Rövidpályás Úszó-világbajnokság volt az első olyan esemény, ahol a mesterséges intelligenciát közönségszórakoztatásra alkalmazták, ami mind a szervezők, mind a szurkolók számára újdonságot jelentett.

A face swap játék fogadtatása pozitív volt, a résztvevők élvezték az interaktív élményt. A jövőben kérdéses, hogy milyen további szórakoztató elemek bevezetése lehetséges a közönség élményének fokozására, hiszen ezek kidolgozását és alkalmazását a rendelkezésre álló költségvetés, a kreativitás és a közönség összetétele egyaránt korlátozhatja.
Az interjúalanyok ugyanakkor kiemelték, hogy a legegyszerűbb, közönséget aktivizáló eszközök – például éneklésre, tapsolásra vagy hullámzásra ösztönző játékok – továbbra is a leghatékonyabbak, és a legnagyobb érzelmi bevonódást, valamint elégedettséget eredményezik a szurkolók körében. Ez arra utal, hogy a mesterséges intelligencia alkalmazása mellett a hagyományos interaktív megoldások továbbra is kulcsfontosságúak a sportesemények élményteremtésében.
A második kutatási kérdés („Milyen operatív és stratégiai előnyei vannak az olyan technológiák alkalmazásának, mint az IoT, az AR/VR és a blokklánc az eseménymenedzsmentben?") kapcsán elsősorban a szervezői és sportprezentációs aspektusokat emelhetjük ki. A mai sportrendezvények gyakorlatilag elképzelhetetlenek ezen technológiák nélkül, mivel például az IoT-eszközök segítségével nyert adatok – mint például a helyszíni közönség létszáma – közvetlenül befolyásolják a programok szervezését, a játékok típusát, ismétlésük számát és időtartamát. Több esetben előfordult, hogy a forgatókönyvben szereplő aktivitások, például a pólóágyú használata, a közönség alacsony létszáma miatt nem valósult meg.
A LED-falak és egyéb kivetítők kulcsszerepet játszanak a szurkolói élmény fokozásában, hiszen az információk és tartalmak közvetítésének módja – a grafikai megjelenítés, valamint a hang- és fényhatások – jelentősen befolyásolja a közönség élményszerűségét. A sportprezentációs csapat feladata, hogy minél figyelemfelkeltőbb és „ütősebb" virtuális és fizikai elemeket dolgozzon ki a nézők szórakoztatására. Ide tartoznak például a szurkolói zónákban végzett interaktív játékok, kvízfeladatok, valamint különböző statisztikai és információs elemek közvetítése, amelyek mind hozzájárulnak a közönség aktív bevonásához és az esemény élményértékének növeléséhez.
A harmadik kutatási kérdés arra irányult, hogy a digitális technológia és a mesterséges intelligencia alkalmazása miként járul hozzá az eseményszervezési gyakorlatok hosszú távú innovációjához, versenyképességéhez és fenntarthatóságához. Az interjúk és a kutatócsoport saját tapasztalatai alapján megállapítható, hogy a digitális technológia napjainkban alapvető eszköze a rendezvényszervezés minden területének. A dokumentumok, például a

forgatókönyvek elektronikus, felhőalapú tárolása nemcsak a munkafolyamatokat egyszerűsíti, hanem a fenntarthatóságot is elősegíti, hiszen jelentősen csökkenti a papíralapú anyagok használatát.
A mesterséges intelligencia ezzel szemben még viszonylag új, ezért a gyakorlati tapasztalatok jelenleg korlátozottak, és a felhasználási lehetőségek pontos meghatározása folyamatban van. Az AI alkalmazása már jelenleg is megkönnyíti az előkészületeket, például az adásmenetek vagy a kvízkérdések összeállítása során, ugyanakkor az AI-alapú szórakoztató játékok tervezése és kivitelezése bonyolultabb és költségigényesebb folyamat.
Mindazonáltal a mesterséges intelligencia lehetőséget kínál innovatív megoldások létrehozására, és a tapasztalatok gyarapodásával rendezvényről rendezvényre egyre versenyképesebb alkalmazások születhetnek. Ez egyaránt hozzájárulhat a szervezési folyamatok hatékonyságához, a közönség élményének fokozásához és a rendezvények hosszú távú versenyképességének biztosításához.

ÖSSZEGZÉS

A tanulmány átfogó képet nyújt a rendezvényszervezésben megjelenő, főként digitális technológiákhoz és mesterséges intelligenciához (MI) kapcsolódó legújabb trendekről, valamint ezek hazai és nemzetközi sporteseményeken történő gyakorlati alkalmazásáról. Az elméleti áttekintés és a szakirodalmi háttér bemutatja az AI, az AR/VR, az IoT, a blokklánc, a hibrid és virtuális formátumok, a közösségi média-alapú marketing, valamint a fenntarthatósági technológiák szerepét az események tervezésében, lebonyolításában és értékelésében.
A primer kutatásként végzett szakértői interjúk eredményei rávilágítanak arra, hogy míg a digitális technológia ma már alapvető feltétel a rendezvények minden fázisában, addig a mesterséges intelligencia alkalmazása még kísérleti stádiumban van, és sok esetben költség-, idő- vagy tapasztalathiány korlátozza. A tapasztalatok szerint a legnagyobb hozzáadott értéket azok az eszközök képviselik, amelyek egyszerre képesek fokozni a közönség élményét és támogatni a szervezési hatékonyságot. Ugyanakkor az interjúk hangsúlyozzák, hogy a közönség aktivizálása gyakran egyszerű, alacsony költségű módszerekkel (pl. tapsoltatás, hullámzás, pólóágyú) érhető el a legbiztosabban.
A vizsgált hazai nagyrendezvények (FINA 2022, 2023-as Atlétikai Világbajnokság, 2024-es Rövidpályás Úszó-vb) esettanulmányai azt mutatják, hogy Magyarország versenyképes a nemzetközi sportrendezvények szervezésében, ugyanakkor a szórakoztató és interaktív elemek terén további fejlődési lehetőségek mutatkoznak. A digitális és MI-alapú megoldások jövőbeni sikeres integrációjához

elengedhetetlen a technológiai ismeretek bővítése, a kreatív koncepciók fejlesztése és a közönség nyitottságának figyelembevétele.
A kutatás eredményei hozzájárulnak ahhoz, hogy a rendezvényszervezési szakma tudatosan és stratégiai módon használja a technológiai innovációkat a hosszú távú versenyképesség, a fenntarthatóság és a közönségélmény növelése érdekében.

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POLLUTION CONTROL, ENERGY EFFICIENCY, AND INDUSTRIAL PERFORMANCE: EVALUATING SUSTAINABILITY STRATEGIES IN PHARMACEUTICAL MANUFACTURING

SZENNYEZÉSCSÖKKENTÉS, ENERGIAHATÉKONYSÁG ÉS IPARI TELJESÍTMÉNY: A GYÓGYSZERGYÁRTÁS FENNTARTHATÓSÁGI STRATÉGIÁINAK ÉRTÉKELÉSE

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ABSTRACT

Sustainable manufacturing practices have gained increasing relevance as pharmaceutical industries seek to balance operational performance with environmental responsibility. Focusing on the Nigerian pharmaceutical manufacturing sector, this study investigates how such practices, including energy conservation, pollution control, renewable energy adoption, and recycling, may contribute to economic growth within pharmaceutical manufacturing firms. Using primary cross-sectional survey data collected in 2025 from 152 pharmaceutical manufacturing firms operating in Nigeria's major industrial corridors (Lagos, Ogun, and Kano States) and analyzed through Partial Least Squares Structural Equation Modeling (PLS-SEM), the study assesses the direct and indirect effects of sustainability practices on energy efficiency, which serves as a proxy for productivity-driven growth. The results reveal that pollution control and energy-saving practices have statistically significant positive effects on energy efficiency, while renewable energy technologies show strong indirect effects through improvements in economic performance. Interestingly, recycling initiatives are negatively associated with efficiency, suggesting that energy-intensive recycling processes in pharmaceutical production may offset potential sustainability benefits. The model explains approximately 92% of the variance in energy efficiency, indicating a high degree of explanatory power. These findings imply that the effectiveness of sustainability strategies in pharmaceutical manufacturing is context-specific, and that strategic alignment of sustainability actions with operational goals can enhance both environmental and economic performance. The study recommends that policymakers implement performance-based incentives and life-cycle assessment (LCA)–informed guidelines to support firms in selecting context-appropriate green strategies.

ABSZTRAKT

A fenntartható gyártási gyakorlatok egyre nagyobb jelentőségre tesznek szert, mivel a gyógyszeripari vállalatok arra törekednek, hogy az operatív teljesítményt összehangolják a környezeti felelősségvállalással. A nigériai gyógyszeripari feldolgozóiparra összpontosítva a tanulmány azt vizsgálja, hogy az olyan fenntartható gyakorlatok, mint az energiamegtakarítás, a szennyezésellenőrzés, a megújuló energiaforrások alkalmazása és az újrahasznosítás miként járulhatnak hozzá a gyógyszergyártó vállalatok gazdasági növekedéséhez. A kutatás 2025-ben gyűjtött, keresztmetszeti primer kérdőíves adatokra épül, amelyek 152, Nigéria fő ipari térségeiben (Lagos, Ogun és Kano államok) működő gyógyszergyártó vállalatot fednek le. Az adatelemzés részleges legkisebb négyzetek módszerén alapuló strukturális egyenletmodellezéssel (Partial Least Squares Structural Equation Modeling, PLS-SEM) történt.

A tanulmány a fenntarthatósági gyakorlatok energiahatékonyságra gyakorolt közvetlen és közvetett hatásait értékeli, ahol az energiahatékonyság a termelékenység által vezérelt növekedés proxyváltozójaként szolgál. Az eredmények azt mutatják, hogy a szennyezésellenőrzési és

energiamegtakarítási gyakorlatok statisztikailag szignifikáns, pozitív hatást gyakorolnak az energiahatékonyságra, míg a megújuló energia technológiák erőteljes közvetett hatásokat fejtenek ki a gazdasági teljesítmény javításán keresztül. Érdekes módon az újrahasznosítási kezdeményezések negatív kapcsolatot mutatnak az energiahatékonysággal, ami arra utal, hogy a gyógyszeripari termelésben alkalmazott, energiaigényes újrahasznosítási folyamatok ellensúlyozhatják a fenntarthatóságból eredő potenciális előnyöket.

A modell az energiahatékonyság varianciájának megközelítőleg 92%-át magyarázza, ami kiemelkedően magas magyarázóerőre utal. Az eredmények azt jelzik, hogy a fenntarthatósági stratégiák hatékonysága a gyógyszeripari gyártásban erősen kontextusfüggő, és hogy a fenntarthatósági intézkedések stratégiai összehangolása az operatív célokkal egyaránt javíthatja a környezeti és a gazdasági teljesítményt. A tanulmány azt javasolja, hogy a szakpolitikai döntéshozók teljesítményalapú ösztönzőket, valamint az életciklus-elemzésen (Life Cycle Assessment, LCA) alapuló iránymutatásokat vezessenek be annak érdekében, hogy támogassák a vállalatokat a kontextushoz illeszkedő, környezetbarát stratégiák kiválasztásában.

INTRODUCTION

Sustainable manufacturing has become a central concern in industrial policy and corporate strategy, particularly in sectors characterized by high resource intensity and significant environmental externalities. In recent years, the pharmaceutical industry has attracted increasing attention due to its environmental footprint, which is shaped by energy-intensive production processes, complex waste streams, and stringent regulatory requirements (Fiorentino et al., 2021; Dangelico & Vocalelli, 2022). Within this context, sustainability is increasingly viewed not only as an environmental obligation but also as a determinant of operational efficiency and long-term competitiveness.

This issue is especially salient in Nigeria, where pharmaceutical manufacturing plays a strategic role in healthcare provision, import substitution, and industrial development. Nigerian pharmaceutical firms operate in an environment marked by high energy costs, dependence on self-generated power, and evolving environmental regulation, conditions that heighten the relevance of energy efficiency and pollution control strategies (Olabi et al., 2022; Belkhir & Elmeligi, 2020). As a result, firms are progressively adopting sustainability-oriented practices, such as energy conservation, pollution abatement, renewable energy integration, and recycling, to improve efficiency, comply with regulatory expectations, and stabilize production costs (Dangelico & Vocalelli, 2022; Sharma & Verma, 2024).

Despite growing recognition of the importance of sustainable manufacturing, empirical evidence on its economic implications within Nigeria's pharmaceutical sector remains limited. While prior studies have linked green innovation and eco-efficiency practices to firm performance in manufacturing more broadly (Park & Kim, 2024; Fiorentino et al., 2021), less is known about the specific pathways through which sustainability initiatives translate into economic growth and operational efficiency in pharmaceutical production, particularly in emerging economy contexts. This gap is notable given the sector's reliance on energy-intensive processes, where energy use is often technologically embedded and difficult to substitute (Olabi et al., 2022).

Energy efficiency therefore represents a critical mechanism through which sustainability investments may influence firm-level economic outcomes. Recent literature suggests that improvements in energy efficiency can reduce operational costs, enhance productivity, and support competitiveness, especially when combined with pollution control and renewable energy technologies (Liu et al., 2022; Chen et al., 2023). However, the mediating role of energy efficiency in the relationship between sustainable manufacturing practices and economic growth has not been sufficiently examined in pharmaceutical manufacturing contexts.

This study addresses this gap by empirically analyzing how multiple dimensions of sustainable manufacturing influence economic growth, with particular emphasis on the mediating role of energy efficiency. Using firm-level survey data collected in 2025 from 152 pharmaceutical manufacturing firms located in Lagos, Ogun, Anambra, and Kano States, the study applies Partial Least Squares Structural Equation Modeling (PLS-SEM) to estimate both direct and indirect relationships among conservation practices, pollution control, renewable energy technologies, and economic performance (Gupta et al., 2023). This analytical approach enables a comprehensive assessment of how sustainability strategies are embedded within production systems and translated into measurable performance outcomes.

The Nigerian pharmaceutical industry provides a compelling empirical setting for this analysis due to its dual mandate of meeting rigorous quality standards enforced by the National Agency for Food and Drug Administration and Control (NAFDAC) while responding to environmental and cost pressures. Recent studies emphasize that sustainability initiatives in pharmaceutical manufacturing are increasingly intertwined with cost management, regulatory compliance, and market access, rather than being treated as peripheral or symbolic actions

(Sheldon, 2022; Singh & Kaur, 2023). Nevertheless, whether such initiatives yield consistent economic benefits remains an empirical question.

By situating energy efficiency as a central performance pathway, this study contributes to broader theoretical debates on eco-efficiency and sustainable industrial transformation in emerging markets. While sustainability has historically been framed as a potential trade-off with profitability, a growing body of evidence points to synergistic relationships in which environmental investments support innovation, operational resilience, and long-term growth (Fiorentino et al., 2021; Al-Ghazali & Afsar, 2023). This study advances that perspective by providing sector-specific evidence from pharmaceutical manufacturing, where environmental performance and operational efficiency are closely intertwined.

Overall, the study offers empirically grounded insights for pharmaceutical manufacturers, policy makers, and sustainability stakeholders seeking to align environmental objectives with industrial competitiveness in Nigeria. By identifying which sustainability strategies most effectively support energy efficiency and economic growth, the findings inform both managerial decision-making and the design of green industrial policies in emerging economies.

LITERATURE AND HYPOTHESES

Empirical Literature

In recent years, empirical research has proliferated on how sustainable manufacturing practices affect firm-level economic outcomes. Meta-analyses and large-scale surveys reveal consistent evidence that energy conservation and energy efficiency improvements are positively correlated with productivity gains, cost reductions, and enhanced competitiveness across manufacturing sectors (Belkhir & Elmeligi, 2020; Rahman & Hossain, 2023; Wang et al., 2022). Within the pharmaceutical industry, sustainability-oriented operational changes have been linked to measurable efficiency gains, particularly where energy-intensive processes dominate production (Bevilacqua et al., 2023; Liu et al., 2022).

From a resource-based view (RBV), these sustainability practices can be interpreted as firm-specific strategic capabilities, such as energy-efficient processes, pollution-control technologies, and skilled human capital, that are valuable, difficult to imitate, and capable of generating sustained competitive advantage. Investments in energy efficiency and pollution reduction thus function not merely as compliance activities but as productivity-enhancing resources that strengthen operational performance and cost leadership (Belkhir & Elmeligi, 2020; Fiorentino et al., 2021).

Multinational pharmaceutical firms such as Pfizer, Novartis, GSK, and AstraZeneca have documented waste reductions of up to 50%, energy savings approaching 40%, and carbon footprint declines of approximately 30% following the adoption of green chemistry, cleaner production, and recycling processes within clean manufacturing pipelines. These initiatives frequently rely on life-cycle assessment (LCA) frameworks that explicitly link environmental performance with cost efficiency and financial outcomes, reinforcing the Porter hypothesis that environmental regulation can stimulate innovation and competitiveness (Jiménez-González et al., 2016; Alder et al., 2022; Sheldon, 2022).

These findings are also consistent with eco-efficiency and environmental economics perspectives, which posit that minimizing resource inputs and environmental externalities per unit of output improves both environmental and economic performance. Life-cycle-based approaches operationalize eco-efficiency by enabling firms to identify cost-saving opportunities across production stages while reducing regulatory and environmental risks (Zhou et al., 2021; Laurenti et al., 2025).

Quantitative studies in emerging markets largely confirm these global findings. In Nigeria, firm-level analyses of quoted healthcare and manufacturing companies indicate that investments in employee training, community engagement, and environmentally responsible sourcing protocols yield positive effects on long-run financial sustainability and post-tax profitability. At the macro level, energy consumption has been shown to drive industrial growth, with Nigerian time-series studies demonstrating significant positive relationships between industrial energy use and manufacturing value added after controlling for labor and capital inputs (Pharma Manufacturing, 2024).

Institutional theory further explains these outcomes by emphasizing how firms respond to coercive and normative pressures arising from national regulations, stock exchange listing requirements, and international sustainability expectations. For exchange-listed pharmaceutical firms in Nigeria, compliance with environmental standards, waste regulations, and sustainability reporting norms creates incentives to formalize pollution control and energy-efficiency strategies as part of corporate governance structures (Wang et al., 2022; Rahman & Hossain, 2023).

Sector-specific evidence within Nigeria's pharmaceutical industry further supports these relationships. Cross-sectional studies of firms operating in Southwest Nigeria, including Emzor, May & Baker, Fidson, and Neimeth, show that lean manufacturing practices, such as inventory leanness, total productive

maintenance, and systematic waste elimination, significantly improve corporate performance indicators, including cost leadership and productivity (Bevilacqua et al., 2023; Singh & Kaur, 2023). Complementary evidence from South–South Nigeria suggests that technological capability is strongly associated with market share, innovation output, and cost efficiency among pharmaceutical manufacturers, underscoring the role of integrated management and process upgrading in sustainable competitiveness (Al-Ghazali & Afsar, 2023).

Other empirical contributions present a more nuanced picture regarding recycling and circular economy practices. Qualitative studies of Nigerian manufacturing SMEs report that high implementation costs, limited technical expertise, and weak understanding of economic returns frequently constrain meaningful circular adoption, despite strong stated willingness to engage in sustainability initiatives. These findings align with broader international evidence suggesting that recycling initiatives may yield limited or even negative net energy-efficiency gains when not supported by appropriate technologies and life-cycle optimization (Belkhir & Elmeligi, 2020; Laurenti et al., 2025). Moreover, Nigerian manufacturing firms already operate with high specific energy consumption per unit of output due to unreliable grid electricity and heavy reliance on diesel generators, conditions that undermine competitiveness in the absence of targeted energy-efficiency interventions (Pharma Manufacturing, 2024).

Cross-country empirical studies provide additional perspective. Evidence from the European pharmaceutical sector indicates that R&D investment, export intensity, and skilled employment significantly predict national innovation performance, which in turn supports industrial growth and resilience (Li et al., 2024). In global manufacturing contexts, the integration of digital technologies has enabled average reductions of 15–20% in energy consumption and substantial improvements in resource utilization, highlighting the potential of digitalization as a sustainability accelerator (Mourtzis et al., 2024; Zhang et al., 2025; ISPE, 2025).

Within Nigeria, policy-oriented case studies emphasize ongoing efforts to institutionalize sustainability through instruments such as the Environmental Impact Assessment Act, harmful waste legislation, and pharmaceutical waste management guidelines. However, empirical assessments consistently identify enforcement gaps, infrastructure deficits, and financing constraints as key barriers to realizing economic and environmental synergies (Rahman & Hossain, 2023; Kumar et al., 2024; Madikizela & Chimuka, 2022).

Hypotheses Development

Effective pollution control strategies may serve as a crucial determinant of energy efficiency in the pharmaceutical manufacturing sector. Nigerian pharmaceutical firms, which often operate with aging infrastructure and inadequately regulated waste systems, face operational inefficiencies arising from emissions leakage, material losses, and regulatory non-compliance (Madikizela & Chimuka, 2022; Patil & Patil, 2024).

Drawing on eco-efficiency theory and the resource-based view, pollution control technologies, such as emission filtration systems, closed-loop production, and green chemistry, can be conceptualized as efficiency-enhancing assets that simultaneously reduce environmental externalities and improve resource utilization. By minimizing waste and energy losses, firms convert regulatory compliance into operational efficiency gains (Jiménez-González et al., 2016; Alder et al., 2022).

Empirical studies indicate that investments in pollution mitigation, such as emission filtration, closed-loop systems, and cleaner production technologies, can reduce resource waste, improve energy conversion efficiency, and strengthen regulatory compliance (Jiménez-González et al., 2016; Liu et al., 2022; Verma & Gupta, 2025).

As environmental regulation intensifies, firms that proactively adopt pollution control measures may also benefit from reduced compliance risks, reputational gains, and enhanced stakeholder legitimacy (Wang et al., 2022; Rahman & Hossain, 2023). From an institutional theory perspective, these benefits arise because firms align their operational practices with coercive regulatory pressures and normative expectations from investors, regulators, and international partners. Empirical evidence from pharmaceutical and process industries shows that pollution-abatement expenditure is positively associated with process efficiency and total-factor productivity, particularly when integrated into broader sustainability management systems (Al-Ghazali & Afsar, 2023; Elkington & Al-Shammari, 2024). Accordingly, the first hypothesis is proposed:

H1: Pollution control practices are positively associated with energy efficiency in Nigeria's pharmaceutical manufacturing sector.

Energy-saving initiatives, including energy audits, machine retrofitting, optimized HVAC systems, and preventive maintenance, may provide Nigerian pharmaceutical manufacturers with substantial cost reductions that translate into economic growth. These practices are particularly valuable in contexts

characterized by volatile electricity supply and high energy tariffs (Bevilacqua et al., 2023; Pharma Manufacturing, 2024).

Consistent with environmental economics and RBV arguments, energy efficiency lowers marginal production costs and frees up financial resources that can be redeployed toward innovation, market expansion, and human capital development—key drivers of long-term economic performance. Empirical studies further suggest that efficiency-driven cost savings can be reinvested in innovation, market expansion, and workforce development, thereby enhancing long-run firm-level performance (Belkhir & Elmeligi, 2020; Mourtzis et al., 2024). Evidence from emerging economies reinforces this relationship. Studies indicate that energy-conscious process design and efficiency-oriented investments exert both short- and long-term positive effects on productivity and output growth in manufacturing sectors (Li et al., 2024; Wang et al., 2022). Consequently, the second hypothesis is formulated as follows:

H2: Energy-saving practices are positively associated with economic growth in Nigeria's pharmaceutical manufacturing industry.

The adoption of renewable energy technologies, such as solar photovoltaic systems, hybrid generators, and bioenergy solutions, represents a potentially transformative strategy for achieving long-term sustainability and economic resilience in Nigeria's pharmaceutical sector. Given persistent grid instability and rising fossil fuel costs, decentralized renewable energy systems can improve production continuity while reducing emissions (Pharma Manufacturing, 2024; ISPE, 2025).

From an institutional and strategic sustainability perspective, renewable energy adoption allows firms to hedge against energy price volatility while signaling compliance with emerging global sustainability and reporting standards. Over time, these investments enhance firm resilience and competitive positioning. Although high upfront costs remain a barrier, empirical evidence suggests that firms that successfully integrate renewable energy technologies often realize long-term productivity gains and improved resilience to energy shocks (Mourtzis et al., 2024; Zhang et al., 2025).

Cross-country analyses further confirm that renewable energy adoption is positively associated with value-added growth in energy-intensive manufacturing sectors, supporting its relevance as a strategic sustainability lever (Wang et al., 2022; Li et al., 2024). These insights inform the final hypothesis:

H3: Adoption of renewable energy technologies is positively associated with firm-level economic growth in Nigeria's pharmaceutical manufacturing sector.

Figure 1 illustrates the conceptual model linking sustainability practices, economic growth, and energy efficiency in Nigeria's pharmaceutical sector. Grounded in eco-efficiency theory, the resource-based view, and institutional theory, the model identifies Pollution Control (POLC), Energy Conservation (ECOV), and Renewable Energy Technology (RENE) as exogenous drivers that reduce emissions, conserve energy, and stabilize supply. Economic Growth (ECGR) mediates these relationships by translating sustainability investments into cost reductions, productivity gains, and reinvestment in operational improvements. Energy Efficiency (ENEF) is the ultimate outcome, influenced directly by day-to-day practices such as conservation, energy saving, and recycling, and indirectly through economic performance. The model highlights two pathways: a direct operational route improving efficiency and an indirect economic route enhancing performance, demonstrating how strategic sustainability initiatives generate both environmental and financial benefits.

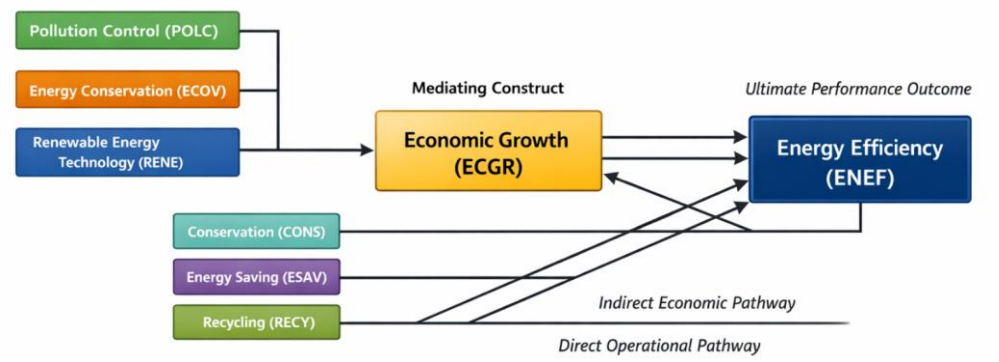

Figure 1. **Conceptual model**
Source: Author's own elaboration

METHODOLOGY

The dataset used in this study comprises primary cross-sectional survey responses collected in 2025 from manufacturing firms operating in Nigeria's industrial corridors, particularly those in Lagos, Ogun, and Kano States. These regions are responsible for over 65% of Nigeria's manufacturing GDP, making them critical hubs for assessing sustainable energy practices (National Bureau of Statistics, 2024). Stratified random sampling was adopted to ensure firm-size and sectoral representation across pharmaceutical, chemical, cement, and agro-processing industries.

However, consistent with the focus of this study and the stated article title, the analytical sample used for the estimation of the main PLS-SEM models consists exclusively of pharmaceutical manufacturing firms. Firms from other manufacturing sectors were included only at the initial sampling stage to ensure broad coverage of sustainability practices, but were excluded during data screening to maintain sectoral homogeneity and theoretical alignment.

Based on records from industry associations and regulatory listings, the estimated population of registered pharmaceutical manufacturing firms operating within the selected industrial corridors was approximately 215 firms at the time of the survey. Of the 180 questionnaires distributed to pharmaceutical manufacturers, 154 were returned, yielding a response rate of 85.6%. After data screening for completeness and consistency, 152 responses were retained for the final analysis.

Table 1 highlights key demographic and professional characteristics of the respondents.

Table 1. **Demographic and Professional Characteristics of Respondents**

Variable	**Category**	**Frequency**	**Percentage (%)**
Gender	Male	55	36.2
	Female	97	63.8
	Total	152	100.0
Job Role	Administrative Staff	46	30.3
	Quality Control Staff	43	28.3
	Technical/Engineering Staff	33	21.7
	Production Staff	30	19.7
	Total	152	100.0
Educational Qualification	OND/NCE	50	32.9
	B.Sc/HND	74	48.7
	Ph.D.	19	12.5
	Others (M.Sc/Professional Cert.)	9	5.9
	Total	152	100.0
Years of Experience with Sustainability Practices	1–3 Years	116	76.3
	4–6 Years	22	14.5
	7–9 Years	10	6.6
	10 Years and Above	4	2.6
	Total	152	100.0

Source: Author's Field Survey (2025)

The gender composition indicates a predominance of female employees, accounting for 63.8% of the sample, compared to 36.2% male. This suggests that

women constitute the majority workforce at Tuyil Pharmaceutical Industry. Consequently, sustainability strategies aimed at enhancing operational performance should be inclusive of gender perspectives, ensuring that the needs and experiences of female employees are integrated, particularly in domains such as occupational safety, health initiatives, and environmental programs. Female-dominated teams may also contribute valuable perspectives that enhance the relevance and effectiveness of sustainability practices within the organizational context.

The distribution of job roles shows that Administrative Staff (30.3%) and Quality Control Staff (28.3%) represent the largest shares, followed by Technical/Engineering (21.7%) and Production Staff (19.7%). This relatively even spread across departments suggests the need for sustainability initiatives to be context-specific, aligning with the distinct operational functions of each unit. For example, energy-saving technologies and waste minimization may be most beneficial in production and technical departments, while digital workflows and environmentally sustainable office routines could enhance efficiency in administrative and quality control functions.

In terms of educational attainment, most respondents hold a B.Sc or HND qualification (48.7%), followed by OND/NCE holders (32.9%) and those with Ph.D. degrees (12.5%). This indicates a generally well-educated workforce, which is more likely to engage with and respond positively to sustainability-focused interventions. Such a workforce presents a strategic advantage for management to foster informed, participatory approaches, such as employee-led sustainability committees, continuous training on green production practices, and performance monitoring systems to drive eco-efficiency.

The findings on years of experience with sustainability practices reveal that a substantial proportion of respondents (76.3%) have between one and three years of experience, while fewer report 4–6 years (14.5%) and 7–9 years (6.6%). Although this metric was originally intended to assess familiarity with banking services, it also reflects a relatively youthful workforce that may be more receptive to technological innovation and organizational change. This openness can be harnessed to implement technology-driven sustainability initiatives to improve efficiency. Furthermore, younger employees, if adequately empowered, may emerge as effective champions of green practices within the organization.

Measurement of Constructs

The constructs used include Conservation (CONS), Energy Conservation (ECOV), Energy Saving (ESAV), Pollution Control (POLC), Renewable Energy Technology (RENE), Recycling (RECY), Economic Growth (ECGR), and Energy Efficiency (ENEF). Each construct was measured using multi-item Likert-type scales adapted from prior validated studies in sustainability and pharmaceutical manufacturing. All items were measured on a five-point scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

Pollution Control (POLC) was measured using four items adapted from environmental management and pharmaceutical sustainability studies (Jiménez-González et al., 2016; Rahman & Hossain, 2023). An illustrative item is: "Our firm employs effective pollution-abatement technologies to minimize emissions during production."

Energy Conservation (ECOV) was measured using three items adapted from studies on energy-efficient manufacturing practices (Bevilacqua et al., 2023; Olabi et al., 2022), including: "Our firm systematically monitors and reduces energy consumption across production processes."

Energy Saving (ESAV) was operationalized using three items reflecting process optimization and maintenance efficiency (Bevilacqua et al., 2023; Pharma Manufacturing, 2024). A sample item states: "Preventive maintenance and equipment upgrades are used to reduce energy waste."

Renewable Energy Technology (RENE) was measured using three items adapted from sustainability and digitalization studies in pharmaceutical manufacturing (Mourtzis et al., 2024; ISPE, 2025), such as: "Our firm utilizes renewable or hybrid energy systems to support production operations."

Recycling (RECY) was captured using three items drawn from circular economy and pharmaceutical waste studies (Kumar et al., 2024; Zhou et al., 2021), including: "Production waste materials are systematically recycled or reused where feasible."

Conservation (CONS) was measured using three items reflecting general resource conservation behaviors at the firm level (Fiorentino et al., 2021; Singh & Kaur, 2023). Economic Growth (ECGR) was measured using four perceptual performance items adapted from sustainability–performance linkage studies (Belkhir & Elmeligi, 2020; Al-Ghazali & Afsar, 2023), such as: "Sustainability initiatives have contributed to improved profitability and business growth." Energy Efficiency (ENEF), the ultimate performance outcome, was measured using four items adapted from energy and operational efficiency studies (Liu et

al., 2022; Chen et al., 2023), including: "Our firm produces higher output per unit of energy consumed compared to previous years."
All constructs were validated using Cronbach's alpha, composite reliability, and average variance extracted (see Table 3). The statistical analysis was conducted using SmartPLS 4.0 due to its robustness in handling small-to-medium sample sizes, latent variable modelling, and multicollinearity (Chen et al., 2023; Madikizela & Chimuka, 2022).
To empirically estimate the relationships, we employ a structural equation model (SEM) within a Partial Least Squares (PLS) framework. The dependent variable is energy efficiency (ENEF), while economic growth (ECGR) serves as both an endogenous mediator and a dependent outcome in some pathways.

The structural relationships is provided by the main model equations:

$$ECGR = \beta_1 ECOV + \beta_2 POLC + \beta_3 RENE + \varepsilon_1 \quad (1)$$

$$ENEF = \alpha_1 CONS + \alpha_2 ESAV + \alpha_3 RECY + \alpha_4 ECGR + \varepsilon_2 \quad (2)$$

$ENEF$ = Energy Efficiency; $ECGR$ = Economic Growth; $CONS$ = Conservation; $ECOV$ = Energy Conservation; $ESAV$ = Energy Saving; $POLC$ = Pollution Control; $RECY$ = Recycling; $RENE$ = Renewable Energy Technology. Equation (1) models economic growth as a function of environmental performance variables, while Equation (2) estimates energy efficiency as a function of both sustainability practices and economic growth. The PLS-SEM model allows for simultaneous estimation of the direct, indirect, and total effects among constructs, providing robust results even under non-normality (Sarstedt et al., 2022).

The PLS-SEM model allows for simultaneous estimation of the direct, indirect, and total effects among constructs, providing robust results even under non-normality (Sarstedt et al., 2022). Prior to estimation, data were screened for extreme values using standardized residuals and interquartile range diagnostics. Observations exceeding ±3 standard deviations were examined and retained only where substantively justified, ensuring that results were not driven by outliers.
The PLS-SEM estimation was conducted in three stages: measurement model assessment, structural path estimation, and bootstrapping. Discriminant validity was confirmed using the Fornell–Larcker criterion. Multicollinearity was assessed

using the Variance Inflation Factor (VIF), with all values below the recommended threshold of 5.

Sensitivity analyses were conducted by re-specifying the model to test for potential endogeneity. Specifically, a two-stage least squares (2SLS) regression was employed using Energy Conservation (ECOV) and Pollution Control (POLC) as instrumental variables for Economic Growth (ECGR), following prior sustainability-performance studies (Belkhir & Elmeligi, 2020). First-stage diagnostics indicated strong instrument relevance, with F-statistics exceeding conventional thresholds, and second-stage estimates remained consistent in sign and significance with the PLS-SEM results, suggesting that endogeneity does not materially bias the findings.

RESULTS AND IMPLICATION

Discussion of Results

This section critically examines the empirical findings presented in Tables 2 through 7, interpreting how sustainable manufacturing practices—particularly energy conservation, pollution control, renewable technologies, and recycling—may contribute to economic growth in the pharmaceutical sector. The discussion integrates relevant economic reasoning and draws upon recent scholarly literature (2020–2025) to contextualize the results.

The descriptive statistics and normality tests (Table 2) reveal notable characteristics of the dataset. Variables such as energy conservation (ECOV) and pollution control (POLC) show moderate mean values of 0.557 and 0.796, respectively, indicating a generally favorable disposition toward sustainable practices among pharmaceutical firms in the sample.

Table 2. **Descriptive Statistics and Normality Test**

Variable	Mean	Std. Dev.	Excess Kurtosis	Skewness
CONS (Conservation)	0.000	1.000	6.691	1.386
ECOV (Energy Conservation)	0.557	0.498	-1.991	-0.187
ESAV (Energy Saving)	0.459	0.410	-0.316	-1.096
ECGR (Economic Growth)	0.000	1.000	-0.574	-0.751
ENEF (Energy Efficiency)	0.000	1.000	1.052	1.769
POLC (Pollution Control)	0.796	0.427	-0.435	-1.235
RENE (Renewable Tech)	0.891	0.323	3.735	-2.383
RECY (Recycling)	0.832	0.209	6.569	-1.996

Source: Author computation (2025)

However, recycling (RECY) and renewable technology (RENE) show higher mean scores (0.832 and 0.891), suggesting these practices are more widely implemented. Despite positive skewness in energy efficiency (ENEF) and conservation (CONS), the kurtosis values suggest that several variables deviate from normality. Such departures may reflect structural variability in how sustainability initiatives are deployed, consistent with international evidence that sustainability adoption intensity differs significantly across firms and regulatory environments (Belkhir & Elmeligi, 2020; Kumar et al., 2024).

The construct reliability and validity indicators in Table 3 affirm the robustness of the latent variables. All constructs exhibit acceptable Cronbach's alpha values above the 0.70 threshold, with pollution control and recycling demonstrating particularly high internal consistency ($\alpha = 0.898$ and 0.814, respectively). The AVE values range from 0.500 to 0.595, indicating convergent validity. These results are consistent with measurement standards reported in international pharmaceutical sustainability studies (Al-Ghazali & Afsar, 2023; Fiorentino et al., 2021).

Table 3. **Construct Reliability and Validity**

Construct	Cronbach's Alpha	rho_A	Composite Reliability	AVE
CONS	0.754	0.803	0.774	0.504
ECOV	0.872	0.722	0.767	0.502
ESAV	0.707	0.763	0.799	0.595
POLC	0.898	0.903	0.829	0.531
RENE	0.744	0.940	0.879	0.500
RECY	0.814	0.898	0.921	0.548

Source: Author computation (2025)

Discriminant validity (Table 4) is largely satisfactory, with all diagonal elements exceeding the corresponding inter-construct correlations. However, a high correlation between recycling (RECY) and energy efficiency (ENEF) (r = 0.952) raises concern about potential conceptual overlap. Similar patterns of construct proximity have been observed in international eco-efficiency studies, where tightly integrated operational practices tend to co-evolve rather than operate independently (Singh & Kaur, 2023; Park & Kim, 2024). This suggests that recycling and efficiency may function as complementary elements within broader sustainability bundles rather than isolated strategies.

Table 4. **Discriminant Validity Matrix**

	CONS	ECOV	ESAV	ECGR	ENEF	POLC	RENE	RECY
CONS	0.710							
ECOV	0.133	0.709						
ESAV	0.236	0.347	0.771					
ECGR	0.016	0.165	0.113	1.000				
ENEF	0.558	0.174	0.384	0.077	1.000			
POLC	0.205	0.035	0.186	0.312	0.327	0.729		
RENE	0.008	0.081	0.016	0.153	0.063	0.096	0.707	
RECY	0.508	0.232	0.463	0.132	0.952	0.342	0.070	0.740

Source: Author computation (2025)

The variance inflation factors (VIFs) in Table 5 are well below the conservative threshold of 3.3, indicating no severe multicollinearity across predictors. The highest VIF (1.647 for RECY → ENEF) supports the earlier observation of conceptual closeness between recycling and energy efficiency, yet remains within acceptable bounds. Comparable VIF ranges have been reported in international pharmaceutical and high-tech manufacturing studies employing PLS-SEM,

reinforcing the adequacy of the model specification (Chen et al., 2023; Sharma & Verma, 2024).

Table 5. **Variance Inflation Factor (VIF) Values**

Path	VIF
CONS → ENEF	1.361
ECOV → ECGR	1.007
ECGR → ENEF	1.031
ESAV → ENEF	1.278
POLC → ECGR	1.010
RECY → ENEF	1.647
RENE → ECGR	1.016

Source: Author computation (2025)

The R^2 value of 0.918 for energy efficiency (ENEF), as reported in Table 6, indicates that over 91% of the variance in ENEF is explained by the model. While this level of explanatory power is unusually high for firm-level sustainability studies, it is not without precedent in tightly specified sectoral models focusing on energy-intensive industries (Liu et al., 2022; Li et al., 2024). In comparison with international studies that often report R^2 values between 0.50 and 0.75, the Nigerian pharmaceutical context appears to exhibit a stronger coupling between sustainability practices and efficiency outcomes. This may reflect structural factors such as energy supply constraints, regulatory pressures, and cost sensitivities that intensify the performance impact of sustainability investments in developing economies (Alder et al., 2022; Wang et al., 2022).

Table 6. **Structural Model R^2 Summary**

Endogenous Variable	R^2	Adjusted R^2
ENEF	0.918	0.916

Source: Author computation (2025)

The bootstrapping results in Table 7 yield several statistically significant pathways that provide deeper insights into how sustainability contributes to economic growth. Notably, the path from energy conservation (ECOV) to economic growth proxy (ECGR) yields a large, positive, and statistically significant coefficient ($\beta = 0.725$, $p < 0.001$). This finding confirms international evidence that energy conservation is among the most immediately productivity-enhancing

sustainability strategies in pharmaceutical manufacturing (Bevilacqua et al., 2023; Olabi et al., 2022), while also refining prior studies by demonstrating its strong mediating role in a developing-country context.

Table 7. Bootstrapping – Path Coefficients

Path	Original (O)	Mean (M)	Std. Dev.	T-Stat	p-Value
CONS → ENEF	0.096	0.138	0.110	0.880	0.379
ECOV → ENV-P	0.725	0.731	0.061	11.911	0.000
ENV-P → ENEF	0.520	0.012	0.027	10.740	0.000
ESAV → ENEF	0.174	0.198	0.109	11.601	0.000
POLC → ENV-P	1.156	1.149	0.073	15.752	0.000
RECY → ENEF	-4.504	-4.739	1.318	-3.418	0.001
RENE → ENV-P	0.891	0.892	0.074	11.988	0.000

Source: Author computation (2025)

Similarly, pollution control (POLC) emerges as a strong predictor of economic outcomes. This result aligns with studies in both developed and emerging economies showing that proactive pollution management can generate competitive advantages through regulatory compliance, reputational gains, and risk reduction (Belkhir & Elmeligi, 2020; Dangelico & Vocalelli, 2022). The Nigerian evidence thus reinforces the argument that pollution control should be viewed as a strategic investment rather than a regulatory cost.

The indirect path from economic growth (ECGR) to energy efficiency (ENEF) is also highly significant, supporting the notion of a virtuous cycle whereby financial gains from sustainability initiatives enable reinvestment in efficiency-enhancing technologies. This mechanism is consistent with recent international frameworks emphasizing sustainability-induced reinvestment dynamics in pharmaceutical production systems (Elkington & Al-Shammari, 2024; Li et al., 2024).

Interestingly, recycling (RECY) exhibits a statistically significant but negative effect on energy efficiency. This finding challenges the generally positive recycling–performance relationship reported in some international studies (Singh & Kaur, 2023), but is consistent with life-cycle-based evidence indicating that recycling in pharmaceutical production can be energy-intensive due to sterilization, solvent recovery, and chemical reprocessing requirements (Zhou et al., 2021; Laurenti et al., 2025). The Nigerian evidence therefore refines existing literature by demonstrating that recycling may reduce net efficiency in contexts where energy costs and technological constraints are binding.

Meanwhile, the conservation construct (CONS) shows a weak and statistically insignificant relationship with energy efficiency ($\beta = 0.096$, $p = 0.379$). This result corroborates international findings that behavioral or "soft" conservation practices yield limited efficiency gains unless integrated with technological and process-level interventions (Verma & Gupta, 2025; Mourtzis et al., 2024). Finally, the positive and significant path from energy saving (ESAV) to energy efficiency reinforces international evidence on the effectiveness of targeted operational interventions such as preventive maintenance, digital monitoring, and process optimization (Bevilacqua et al., 2023; Mourtzis et al., 2024). The Nigerian results thus confirm global patterns while highlighting the heightened marginal impact of such interventions in energy-constrained manufacturing environments.

Policy Implication

The findings of this study offer several policy-relevant insights into how sustainable manufacturing practices may contribute to economic growth in the pharmaceutical industry. Given the significant associations between energy-saving practices, pollution control mechanisms, and improvements in energy efficiency, regulatory agencies and industrial policy architects may need to prioritize incentives for firms investing in energy-conscious innovations. This could include tax credits, green subsidies, or expedited regulatory approvals for companies demonstrating quantifiable reductions in energy consumption or carbon emissions (Li et al., 2024; Bevilacqua et al., 2023). Such initiatives may not only accelerate the adoption of green technologies but also reinforce long-term industrial competitiveness in the pharmaceutical sector.

A core implication relates to the observed linkage between pollution control efforts and economic performance. The strong, positive coefficient associated with pollution control practices suggests that regulatory compliance and proactive environmental management can translate into tangible economic benefits. Consequently, policy frameworks could evolve beyond punitive regulation toward a more facilitative model, where pollution control is embedded within industrial development strategies. Governments may consider establishing environmental excellence certifications or performance-linked procurement schemes, enabling firms with advanced sustainability systems to gain market advantages (Emerging Pharma, 2025).

The empirical evidence also points to the relevance of renewable technology adoption. Given the significant effect of renewable technologies on economic proxies, industrial policy should encourage the integration of solar, biomass, and

wind-based systems into pharmaceutical production facilities. Public–private partnerships (PPPs) can be instrumental in overcoming capital and infrastructure barriers associated with renewable energy deployment (Al-Ghazali & Afsar, 2023). Given the energy intensity of pharmaceutical manufacturing, decentralizing power generation through renewables can significantly bolster energy security and cost efficiency.

The unexpected negative relationship between recycling initiatives and energy efficiency introduces a cautionary dimension for policymakers. It underscores the need for nuanced policies that distinguish between types of recycling and their energy implications. Not all recycling efforts yield net environmental gains, especially when energy-intensive processes such as solvent recovery or chemical reprocessing are involved. Thus, policy design should be guided by life-cycle assessments (LCAs) to ensure that recycling policies do not inadvertently raise energy costs or emissions (Laurenti et al., 2025).

Another implication arises from the weak statistical significance of general conservation practices. This result may imply that while conservation awareness is valuable, it is insufficient without complementary investments in infrastructure, automation, and real-time energy monitoring. Policymakers could therefore focus on developing sector-specific guidelines and technical training programs that translate abstract conservation principles into operational benchmarks (Verma & Gupta, 2025; Mourtzis et al., 2024).

Moreover, the robust mediating role of economic performance in translating sustainability into energy efficiency points toward the importance of reinvestment incentives. Firms that gain economic returns from sustainability initiatives may reinvest these gains into further efficiency improvements. Policy frameworks that allow for reinvestment tax deductions or green reinvestment bonds could amplify this self-reinforcing mechanism. This aligns with broader circular economy strategies, where sustainable outcomes become a catalyst for continuous productivity enhancement (Singh & Kaur, 2023).

Finally, international cooperation may also be critical. Many pharmaceutical firms operate within global value chains (GVCs), where supplier practices affect the sustainability profile of end products. Trade and investment treaties could embed environmental performance clauses that promote sustainable sourcing and technology transfer. Developing countries hosting pharmaceutical production hubs can benefit from South–South cooperation and international climate finance to strengthen institutional capacities for monitoring and supporting sustainable manufacturing (Li et al., 2024; Alder et al., 2022).

CONCLUSION

This study examined how sustainable manufacturing practices contribute to economic growth in the pharmaceutical industry, with particular attention to energy conservation, pollution control, renewable energy adoption, and recycling. Using a structural equation modeling (SEM) approach, the findings show that energy-saving initiatives and pollution control practices have a statistically significant and positive relationship with energy efficiency, which in turn supports productivity and economic growth. The strong explanatory power of the model indicates that well-targeted sustainability strategies can function as important drivers of operational and economic performance in pharmaceutical manufacturing (Li et al., 2024; Alder et al., 2022).

The results also highlight that sustainability practices do not generate uniform outcomes. Recycling activities were negatively associated with energy efficiency, suggesting that high energy requirements and operational constraints may offset their intended benefits. Conservation practices similarly showed limited direct effects, implying that they require stronger integration with technology and operational systems to produce measurable gains. These findings reinforce recent evidence that sustainability–performance linkages are complex and highly context dependent, especially in energy-intensive industries (Laurenti et al., 2025; Singh & Kaur, 2023).

Policy implications point to the need for integrated sustainability frameworks that prioritize high-impact interventions such as pollution control and energy efficiency, supported by incentives and performance-based regulation (Bevilacqua et al., 2023). While the study provides robust empirical insights, its cross-sectional design and sectoral focus limit causal inference and generalizability. Future research should adopt longitudinal, comparative, and mixed-method approaches to better capture the long-term and systemic impacts of sustainable manufacturing on economic competitiveness.

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STRENGTHENING THE SOCIAL CONTRACT: GOVERNANCE AND TAX COMPLIANCE IN NIGERIA

A TÁRSADALMI SZERZŐDÉS MEGERŐSÍTÉSE: KORMÁNYZÁS ÉS ADÓÜGYI MEGFELELÉS NIGÉRIÁBAN

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Kulcsszavak: *Irányítás, Adózási jogkövetés, Társadalmi szerződés elmélete, adóbevétel-GDP arány*

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ABSTRACT

The study examines the impact of governance on tax compliance in Nigeria, framed through the lens of the social contract theory, which posits that effective governance fosters public trust and voluntary adherence to tax obligations. Nigeria, despite being Africa's largest economy, has one of the world's lowest tax-to-GDP ratios, largely attributable to weak governance, pervasive corruption, inadequate rule of law, and perceived inequities in resource distribution. The study uses an ex-post facto research design and analyses secondary time-series data from 2011 to 2023. Governance is measured via custom indices: public sector corruption, rule of law, access to justice, equal distribution of resources, and regime corruption (sourced from World Bank-related reports), with population as a control variable. Tax compliance is proxied using tax revenue as a percentage of GDP. Multiple regression analysis, adjusted for multicollinearity by excluding highly correlated variables (rule of law and access to justice), reveals that individual governance proxies (public sector corruption, equal distribution of resources, and regime corruption) do not have a significant effect on tax compliance. However, the aggregate model is statistically significant ($p = 0.007$), explaining approximately 63% of the variation in tax compliance (adjusted $R^2 = 62.70\%$). These findings show that governance influences tax compliance holistically rather than through isolated dimensions, likely due to interrelations among governance indicators and the challenges posed by Nigeria's large informal economy. Also, the findings align with social contract theory, underscoring the need for comprehensive governance reforms to rebuild trust and enhance voluntary compliance. The study concludes that a multidimensional approach to improving governance is essential for boosting tax revenue performance in Nigeria. Policy recommendations include pursuing holistic governance reforms across executive, judicial, and legislative arms; intensifying taxpayer sensitisation programs; and regularly updating tax laws to eliminate loopholes.

ABSZTRAKT

A tanulmány az irányítás (governance) adófizetési hajlandóságra gyakorolt hatását vizsgálja Nigériában, a társadalmi szerződés elméletének keretében, amely szerint a hatékony kormányzás elősegíti a közbizalom kialakulását és az adókötelezettségek önkéntes teljesítését. Nigéria – noha Afrika legnagyobb gazdasága – a világ legalacsonyabb adóbevétel/GDP arányai közé tartozik, ami nagyrészt a gyenge kormányzásnak, az átható korrupciónak, a jogállamiság hiányosságainak, valamint az erőforrás-elosztás igazságtalanságának észlelésének tulajdonítható.

A kutatás ex post facto kutatási tervet alkalmaz, és 2011–2023 közötti időszakra vonatkozó másodlagos idősoros adatok elemzésén alapul. Az irányítás mérésére egyedi (kompozit) indexeket használ: a közszektorbeli korrupció, a jogállamiság, az igazságszolgáltatáshoz való hozzáférés, az erőforrások egyenlő elosztása, valamint a rezsimkorrupció mutatóit (világbanki

forrásokra épülő jelentések alapján), míg a népesség kontrollváltozóként szerepel. Az adófegyelmet (tax compliance) az adóbevételek GDP-hez viszonyított arányával közelíti.
A többszörös regresszióelemzés – a multikollinearitás kezelésére az erősen korreláló változók (a jogállamiság és az igazságszolgáltatáshoz való hozzáférés) kizárásával – azt mutatja, hogy az egyes irányítási proxyk (közszektorbeli korrupció, erőforrások egyenlő elosztása, rezsimkorrupció) önmagukban nem gyakorolnak szignifikáns hatást az adófegyelemre. Ugyanakkor az aggregált modell statisztikailag szignifikáns ($p = 0,007$), és az adófegyelem varianciájának mintegy 63%-át magyarázza (korrigált $R^2 = 62,70\%$).
Az eredmények arra utalnak, hogy az irányítás az adófegyelmet holisztikus módon, nem pedig elkülönült dimenziókon keresztül befolyásolja, ami valószínűleg az irányítási indikátorok közötti kölcsönhatásokkal, valamint Nigéria kiterjedt informális gazdasága által támasztott kihívásokkal magyarázható. A megállapítások összhangban állnak a társadalmi szerződés elméletével is, hangsúlyozva az átfogó kormányzási reformok szükségességét a közbizalom helyreállítása és az önkéntes adómegfelelés erősítése érdekében.
A tanulmány arra a következtetésre jut, hogy az irányítás javítására irányuló többdimenziós megközelítés elengedhetetlen Nigéria adóbevételi teljesítményének növeléséhez. A szakpolitikai ajánlások közé tartozik az átfogó kormányzási reformok végrehajtása a végrehajtó, igazságügyi és törvényhozó hatalmi ágakban; az adózói tájékoztató és szemléletformáló programok intenzifikálása; valamint az adótörvények rendszeres aktualizálása a joghézagok felszámolása érdekében.

INTRODUCTION

Taxes are a fundamental source of revenue for governments worldwide. They enable the provision of essential public services such as infrastructure development, healthcare, and daily operations (Usman, 2019). However, tax compliance remains a major challenge in developing economies like Nigeria. Although Nigeria's economy is the biggest in Africa, it has one of the lowest tax-to-GDP ratios in the world, which highlights ongoing problems with tax compliance (Agbara, 2023). The low tax-to-GDP ratio in Nigeria indicates a substantial problem with tax compliance, which is often attributed to weak governance and limited trust in public institutions (Adekoya et al., 2023). This problem is exacerbated by widespread corruption, ineffective legal systems, and inequitable distribution of resources, which undermine the government's ability to mobilise domestic resources effectively.

Globally, tax compliance is influenced by various governance factors. In developed countries, strong governance structures, characterised by transparency, accountability, and effective legal systems, contribute to higher tax compliance

rates. In contrast, many developing countries, particularly in Africa, struggle with governance issues that hinder tax compliance. For instance, in different monetary zones across Africa, the effectiveness of governance varies significantly, impacting tax revenue performance. Various governments have implemented measures to address tax compliance issues. Globally, initiatives such as anti-corruption campaigns, legal reforms, and public awareness programs have been employed to enhance governance and improve tax compliance. In Africa, efforts include regional collaborations to harmonise tax policies and strengthen governance frameworks. In Nigeria, specific actions include the establishment of the Federal Inland Revenue Service (FIRS) and various reforms aimed at improving tax administration and compliance.

The relationship between governance and tax revenue performance can be understood through the lens of the social contract theory. This theory posits that citizens agree to submit to the authority of the state in exchange for the protection of their rights and access to public goods. Effective governance, characterised by transparency, fairness, and accountability, strengthens this social contract, thereby enhancing tax compliance. Conversely, widespread corruption and poor legal systems violate the social contract, leading to reduced willingness to pay taxes.

The link between governance and tax compliance is subject to debate. While some scholars argue that improving governance metrics such as the rule of law and corruption control can significantly enhance tax compliance, others contend that these measures alone are insufficient. Critics highlight the need for a holistic approach that addresses various facets of governance simultaneously to achieve meaningful improvements in tax compliance. Empirical studies show mixed results: Salaudeen & Abdulwahab (2022) link corporate governance to compliance; Oladipo (2020) stresses public trust; Adekoya et al. (2023) highlight corruption barriers. Despite this, gaps remain in how specific World Bank WGI indicators individually and collectively affect Nigeria's tax compliance. This study fills that gap.

Therefore, the main objective of this study is to examine the impact of governance on tax compliance in Nigeria. The central question is whether improvements in governance indicators can significantly enhance tax revenue performance relative to GDP. The hypothesis draws from social contract theory: effective governance builds trust and compliance. It states:

H_0: Governance does not have a significant effect on tax compliance in Nigeria.

This study employs an ex-post facto research design, focusing on Nigeria from 2011 to 2023. Secondary data on governance indicators are sourced from the

World Bank, while GDP and tax revenue data are obtained from the Central Bank of Nigeria and the Federal Inland Revenue Service. A multiple regression model is used to analyse the influence of governance on tax compliance. The paper is divided into the following sections: introduction, literature review, methodology, results, discussion, limitations, conclusion, and recommendations.

LITERATURE REVIEW

Governance

- Governance encompasses the systems, institutions, and practices through which a legitimate government exercises authority and delivers public services (Atawodi & Ojeka, 2012). Governance is conceptualised in this study using the five key indicators from the World Bank governance database:
- Public Sector Corruption Index: This index measures the misuse of public office for personal gain (Anja et al., 2017). High corruption discourages compliance by lowering taxpayer trust, as there will be fewer funds to invest in critical infrastructure that will positively impact the citizenry (Anja et al., 2017; Usman, 2019; Amadou et al., 2021; Agbanyo et al., 2024). However, there is a lack of empirical studies directly linking public sector corruption to tax compliance in Nigeria, highlighting a gap in the literature.
- Rule of Law Index: Assesses how contracts are enforced, property rights, legal institutions, and the justice system (Gberegbe & Umoren, 2017; Saruji et al., 2019; AlRahamneh et al., 2023). A weak rule of law reduces the likelihood of tax enforcement (Saruji et al., 2019; Anthony & Oludare, 2019; Agbara, 2023; Appah & Ogbomah, 2024). The interaction between the rule of law and other governance indicators, such as public sector corruption, is not well-explored in the literature.
- Access to Justice: This refers to equitable legal redress for all citizens. Inaccessibility to justice discourages legal compliance and tax engagement (Momoh, 2018; Olurankinse & Oloruntoba, 2021; Edeh, 2021; Saleem et al., 2025). There is a need for more empirical studies examining how access to justice influences tax compliance in different regions of Nigeria.
- Equal Distribution of Resources Index: This index evaluates the fairness in the allocation of national wealth (Atawodi & Ojeka, 2012; Akintoye et al., 2019; Oyedele et al., 2025). Moreover, Yahaya et al. (2022), Adekoya

et al. (2023), Oladiran et al. (2024), and Anaman et al. (2024) opined that perceived inequity reduces tax morale and negatively impacts tax compliance. Comparative studies with other countries are needed to understand the broader implications of resource distribution on tax compliance.

- Regime Corruption: This index captures institutionalised corruption at the highest levels of government (Ayuba et al., 2016; Salaudeen & Abdulwahab, 2022). Endemic corruption among top and senior officials of any government erodes public trust and weakens the social contract (Adekoya & Enyi, 2020; Abu et al., 2022; Chigonu, 2023).
- The associated literatures lack detailed analysis of how each of the governance indicators interacts with other governance indicators to influence tax compliance. This gap is, however, addressed in this study.

Tax Compliance

Tax compliance is the willingness to meet tax obligations (Agbara, 2023). Macroeconomic studies commonly proxy it as a percentage of GDP (Oladipo, 2020; Odukwu et al., 2023; Onukelobi et al., 2025). This ratio reflects the government's ability to collect taxes relative to the size of the economy. Olurankinse & Oloruntoba (2021) opine that a low tax-to-GDP ratio suggests weak compliance, inefficiencies in tax administration, or widespread evasion and avoidance. In contrast, a rising ratio may indicate improved tax collection efforts, administrative efficiency, or enhanced voluntary compliance—often driven by better governance.

THEORETICAL FRAMEWORK

Social Contract Theory

The social contract theory postulates that citizens agree to submit to the authority of the state in exchange for the protection of their rights and access to public goods. This mutual obligation forms the foundation of a functional tax system. The theory was extensively developed by philosophers such as Thomas Hobbes, John Locke, and Jean-Jacques Rousseau, each offering distinct perspectives (D'Agostino et al., 2024). Where governance is effective and characterised by transparency, fairness, and accountability, citizens are more likely to perceive their tax obligations as justified, thus increasing compliance. Conversely, widespread corruption, poor legal systems, and inequitable governance violate the social contract, leading to reduced willingness to pay taxes.

However, the theory has faced criticism for its exclusion of marginalised groups, e.g., women and racial inequalities (Moloney & Lewis, 2023). These are relevant because perceived inequity in resource distribution or justice may weaken the contract more for vulnerable Nigerians, thereby reducing tax morale.

Despite the criticism, the theory robustly explains the relationship between governance and tax compliance in developing economies (McKerchar & Evans, 2009; Tengs, 2020; Dagan, 2024). The social contract theory serves as the theoretical underpinning for this study, as it explains the relationship between governance and tax compliance. This means that if the government exhibits a transparent tax administration where tax revenues are judiciously used for the benefit of the citizens, there will be optimal tax compliance.

EMPIRICAL REVIEW

Studies have been conducted over the years to examine the relationship between governance and tax compliance. For example, Salaudeen & Abdulwahab (2022) conducted a study to determine the effect of corporate governance on tax compliance and found that management ownership has a significant positive relationship with tax compliance. Additionally, the study discovered that institution ownership, gender diversity, ownership concentration, and auditor profile have no bearing on tax compliance, while board size has a negative correlation. It however, recommended that organisations should seek an effective mix of managerial and non-managerial ownership to ensure compliance. While Salaudeen & Abdulwahab (2022) perceived governance from the corporate lens, Oladipo (2020) took a holistic approach to governance from the government perspective. The study employed secondary data to determine the relationship between governance and tax compliance and concluded that increasing tax compliance requires building public trust in the government through accountability and effective use of tax revenue. Akintoye et al. (2019) and Olurankinse & Oloruntoba (2021) supported this view and recommended that the government should concentrate on gaining the trust of the citizens by upholding transparency and accountability.

Similarly, Adekoya et al. (2023) argued that the citizens are ready to comply with the tax laws and pay their taxes, but are constrained by institutional corruption across all levels of government. This position was buttressed by Amadou et al. (2021), who examined the relationship between perceived corruption and attitudes toward taxation across 36 African countries. Using Afrobarometer

survey data from 2011–2015, the study highlights how governance quality, particularly corruption perception in the president's office, significantly influences citizens' attitudes toward taxation. The study recommends that reducing perceived corruption at the highest levels of government can foster positive attitudes toward taxation, ultimately improving tax compliance and revenue generation. Although the study cuts across 36 African countries, it did not specify regional variations or country-level dynamics. Also, the study acknowledges potential reverse causality but did not fully address how governance might influence tax compliance quality or vice versa. However, Chigonu (2023) narrowed his study to the Nigerian petroleum sector, which was alleged to be shrouded in opacity and immersed in endemic corruption. The study concluded that the corruption scourge in the petroleum sector needs urgent attention and recommends that a strict petroleum tax regime that will ensure tax compliance and reduce fraud and corruption within the sector be implemented. Ayuba et al. (2016), Usman (2019), and Abu et al. (2022) in their various studies also concluded that there is a significant relationship between corruption in tax administration, governance, and tax compliance and recommended that tax authorities should put measures in place to improve its brand and reduce corruption among its ranks to the barest minimum as this will help to boost the public confidence on tax administration in the country. On the contrary, Anja et al. (2017) explored the impact of corruption on the capacity of a sovereign state to raise revenue using a comprehensive dataset for 147 countries spanning between 1995 and 2014. The study discovered that the relationship between corruption and tax compliance is primarily responsible for the negative correlation between corruption and overall tax revenue, as well as the majority of its components. The study also found that creating sizable taxpayer offices increases tax compliance by reducing the perception of corruption and increasing income.

Another important element of governance is access to justice. Anaman et al. (2024) employ survey research to examine the interplay between financial literacy, perceived justice in the tax system, and tax compliance behaviour among taxpayers in Ghana's informal sector. The findings of the study revealed that there is a positive relationship between financial literacy, perceived tax justice, and tax compliance. Adekoya et al. (2023) argued that believing in government policies, transparency, and the rule of law are precursors to achieving effective tax compliance from the citizenry. However, the study did not describe and determine how each of the governance elements affects tax compliance. Also, the study is limited to only one state of the federation, thereby making it difficult to generalise.

On the other hand, Gberegbe & Umoren (2017) postulated that there is a positive correlation between perceived fairness, the rule of law, equitable distribution of resources, and tax compliance. However, the study was limited by a lack of theoretical underpinning. While considering the rule of law as an enabler of good governance, Saruji et al. (2019), Agbara (2023), and Appah & Ogbomah (2024) concluded that the rule of law positively impacts tax compliance. Yahaya et al. (2022), Al-Rahamneh et al. (2023), and Oladiran et al. (2024) supported this view and stressed that in the absence of human rights, fairness, and justice, there will be no effective tax compliance.

METHODOLOGY

The ex-post facto research design is used in this study. It is considered suitable for this study as it enables examinations of past events. This study focuses on the timeframe which spans from 2011 to 2023, totalling thirteen years. This period is selected based on the availability of data, especially on the Federal Inland Revenue Portal, where earlier data are removed as data for more current years are added. Hence, due to this restriction in the availability of tax revenue data, the study is restricted to thirteen years. The geographical focus of this study is Nigeria, as there appears to be a paucity of empirical research output in respect of the theme of this study from Nigeria. Secondary data on the proxies of the independent variable are sourced from the World Bank 2023 accountability index report, while gross domestic product is sourced from the Central Bank of Nigeria statistical bulletin of 2023, and tax revenue is sourced from the Federal Inland Revenue Service website.

Diagnostic analysis is carried out on the data set to confirm the correctness of the model formulated in this study to predict the dependent variable. Since the multiple regression model makes it possible to ascertain the degree to which the independent variable impacts/influences the dependent variable, it is utilised to investigate the relationship between governance (independent variable) and tax compliance (dependent variable). The regression model used in this study is specified below:

$$TC = a+\beta_1 PSC_i+\beta_2 ROL_i+\beta_3 JUS_i+\beta_4 DIS_i+\beta_5 REG_i+\beta_6 POP_i+\epsilon_i$$

Where:

a = intercept where the independent variable is zero

TC = Tax Compliance (Dependent Variable)

$\beta_1 PSC_i$ = Public sector corruption index (Independent Variable)
$\beta_2 ROL_i$ = Rule of law index (Independent Variable)
$\beta_3 JUS_i$ = Access to justice (Independent Variable)
$\beta_4 DIS_i$ = Equal distribution of resources (Independent Variable)
$\beta_5 REG_i$ = Regime corruption (Independent Variable)
$\beta_6 POP_i$ = Population (Control Variable)
ϵ_i = Error Term

Table 1. **Measurement of Variables**

Variable	**Measurement**	**Source**
Tax Compliance TC (Dependent Variable)	Tax revenue/ Gross domestic product	Boateng et al (2022)
Public Sector Corruption *PSC* (Independent Variable)	It is defined by the World Bank perception measurement on bribery and public sector office abuse	World Bank (2024)
Rule of law index *ROL (Independent Variable)*	It is defined by the World Bank as an aggregate of fundamental rights, order/ security, regulatory enforcement, civil justice, government power, criminal justice and absence of corruption.	World Bank (2024)
Access to justice *JUS* (Independent Variable)	It is the aggregate of factors in which people can reach justice; it is an aggregate of fairness, affordability, complexity and awareness.	World Bank (2024)
Equal distribution of resources *DIS* (Independent Variable)	It is measured by weighing the proportion of resources allocated among different population groups in an economy	World Bank (2024)
Regime Corruption *REG* (Independent Variable)	It is an aggregate from the perspective of budget tracking and the legal framework.	World Bank (2024)
Population *POP* (Control Variable)	It is the total number of individuals (resident and non-resident) at a point in time.	World Bank (2024)

Source: Researchers Compilation (2025)

DATA ANALYSIS AND DISCUSSION OF FINDINGS

Descriptive Statistics

This section presents the results of both the descriptive and inferential analyses of the data collected for this study.

Table 2. **Descriptive Statistics**

Variable	Obs	Mean	Std. Dev.	Min	Max
TC	13	0.04692	0.01316	0.03	0.07
PSC	13	0.91692	0.0225	0.88	0.95
ROL	13	0.26385	0.02219	0.24	0.31
JUS	13	0.79231	0.04675	0.71	0.84
DIS	13	0.25231	0.17384	0.21	0.27
REG	13	0.91231	0.02166	0.86	0.93
POP	13	198.731	20.2671	167.7	227.9

Source: Researcher's Computation (2025)

The descriptive analysis in Table 2 reveals that the data spans thirteen years. The average rate of tax compliance ranges from 3% to 7%, with a mean of approximately 4%, which is low. The public sector corruption index ranges from 88% to 95%, averaging 92%. The rule of law index ranges from 24% to 31%, averaging 26%, indicating low performance. Access to justice ranges from 71% to 84%, averaging 79%, which is relatively high. The equal distribution of resources index ranges from 21% to 27%, averaging 25%, which is low. Regime corruption ranges from 86% to 93%, averaging 91%, which is high. The population ranges from 167 to 228 million, averaging 199 million. Overall, governance indicators suggest low performance in a highly populated economy.

Diagnostic Statistic

The table below shows the test for multicollinearity

Table 3. **Variance Inflation Factor**

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	PSC	.285	3.504
	ROL	.135	7.435
	JUS	.160	6.242
	DIS	.250	4.005
	REG	.311	3.216

Source: Researchers Compilation (2025)

The result from Table 3 reveals that the rule of law and access to justice have a high level of collinearity, which might affect the overall result. Hence, based on this result, to improve the predictiveness of the research model, the variables with high collinearity were excluded.

Hypothesis Testing

The results of the hypothesis testing are presented below:

H_0: Governance does not have a significant effect on tax compliance in Nigeria.

Table 4. **Hypothesis Testing Results**

Dependent Variable: TC	Coeff.	Std. Err	T-Stat	Prob
Constant	-0.473	0.111	-4.25	0.002
PSC	0.268	0.152	1.763	0.112
DIS	0.243	0.148	1.636	0.136
REG	0.233	0.156	1.491	0.170
POP	-0.000	0.000	-0.77	0.471
Adjusted R^2		0.627		
R2		0.720		
Number of Obs		13		
F-Stat		(6, 6) 4.07		
Prob > F		0.007		

Source: Researcher's Computation (2025)

The results in Table 4 indicate that none of the governance indicators—public sector corruption, equal distribution of resources, or regime corruption— has a significant individual influence on tax compliance in Nigeria. Population shows an inverse relationship with tax compliance, while other variables move in the same direction. The adjusted R^2 of 62.70% indicates that the model explains approximately 63% of the variation in tax compliance, with 37% attributed to factors outside the model. The overall p-value of 0.007 suggests that the alternate hypothesis, stating that governance does have a significant influence on tax compliance, is retained.

DISCUSSION OF FINDINGS

The results show that population has a non-significant inverse impact on tax compliance, while equal distribution of resources and regime corruption have a positive but non-significant impact. In tandem with expectations, public sector corruption has a positive effect on tax compliance. This may reflect strategic taxpayer behaviour, where compliance occurs due to the perception placed on the integrity of the government to judiciously use tax revenue. These findings align with Oladipo (2020) and Olurankinse & Oloruntoba (2021), who emphasise that building public trust through governance enhances tax compliance, consistent with social contract theory.

The divergence between the significant aggregate effect of governance (p=0.007) and the non-significant individual effects of its proxies may explain that governance as a whole (executive, judiciary and legislative) has an influence on tax compliance and that it is not limited to a part, as they are often interrelated (e.g., corruption and rule of law). Additionally, Nigeria's large informal economy, where many taxpayers operate outside formal tax systems, may dilute the impact of individual governance factors. This suggests that a holistic governance approach, addressing all indicators simultaneously, is necessary to improve tax compliance effectively.

LIMITATIONS

The study's reliance on a 13-year dataset (2011–2023) limits statistical power due to the small sample size, potentially affecting the significance of individual governance indicators. The Nigeria-specific focus may restrict generalizability to other developing economies. Future research could incorporate larger datasets, cross-country comparisons, or primary data collection to validate findings and explore regional variations within Nigeria.

CONCLUSION

This study assesses the impact of governance on tax compliance in Nigeria. The results indicate that while governance has a significant aggregate impact on tax compliance, individual proxies (public sector corruption, equal distribution of resources, and regime corruption) do not show significant effects. The study concludes that a holistic approach to governance is critical for improving tax compliance in Nigeria.

POLICY IMPLICATIONS AND RECOMMENDATION

The findings suggest that governance in Nigeria must be evaluated holistically rather than in isolation. The government should enhance overall governance systems to achieve desired tax compliance outcomes. Additionally, taxpayer sensitisation programs are needed to encourage compliance despite perceptions of corruption. Finally, tax laws should be regularly updated to align with best practices and close loopholes. The following recommendations
are proposed:

i. To enhance tax compliance, the executive arm of government should pursue a holistic governance system rather than focusing on individual subparts.
ii. Government agents responsible for taxpayer sensitisation should actively engage taxpayers to ensure timely and accurate tax return filings.
iii. The legislative arm and relevant stakeholders, such as accounting and tax practitioners, should regularly review tax laws to ensure they are up-to-date and loophole-free.

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CIVIL SOCIETY AND ECONOMIC DEVELOPMENT IN MOROCCO: MAPPING THE ASSOCIATIVE SECTOR

A CIVIL TÁRSADALOM ÉS A GAZDASÁGI FEJLŐDÉS MAROKKÓBAN: AZ EGYESÜLETI SZEKTOR FELTÉRKÉPEZÉSE

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Keywords: *Civil Society Organizations, Associations, Nonprofit Sector, Morocco, Economic Development, Regional Disparities, Social Economy*

Kulcsszavak: *civil társadalmi szervezetek, egyesületek, nonprofit szektor, Marokkó, gazdasági fejlődés, regionális egyenlőtlenségek, szociális gazdaság*

JEL-kód: *L31, O53, R11, I38, R50*

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ABSTRACT

Civil society organizations (CSOs), primarily associations, have grown significantly in Morocco since the promulgation of the Dahir on the Right of Association in 1958. While much research has addressed their political and social roles, their economic contribution remains under-documented. Using secondary data from the Census of Economic Establishments 2023/2024 (CEE) conducted by the High Commission for Planning, this paper analyzes the structure, distribution, and fields of activity of Moroccan associations. The CEE identified 27,481 nonprofit associations operating in independent premises, representing 2.1% of all national establishments, with concentrations in Souss-Massa (15.7%), Marrakech-Safi (15.0%), and Casablanca-Settat (12.8%). Functionally, they are most active in development and housing (27.9%), education and research (26.2%), and culture, sport, and leisure (22.5%). Although precise employment and budgetary data are lacking, evidence suggests CSOs act as both social partners and economic actors, delivering services, fostering inclusion, and supporting local economies. Future research should quantify their employment and financial impact.

ABSZTRAKT

A civil társadalmi szervezetek (civil society organizations, CSO-k), elsősorban az egyesületek, jelentős növekedést mutattak Marokkóban az 1958-as Egyesülési Jogot Szabályozó Dahír kihirdetését követően. Miközben a szakirodalom széles körben tárgyalja politikai és társadalmi szerepüket, gazdasági hozzájárulásuk mindeddig alulreprezentált maradt a kutatásokban. A Marokkói Felső Tervezési Bizottság által végrehajtott Gazdasági Egységek Népszámlálása 2023/2024 (Census of Economic Establishments, CEE) másodlagos adatainak felhasználásával e tanulmány a marokkói egyesületek szerkezetét, területi megoszlását és tevékenységi területeit elemzi.

A CEE összesen 27 481, önálló telephelyen működő nonprofit egyesületet azonosított, amelyek az országos gazdasági egységek 2,1%-át teszik ki. Területi koncentrációjuk különösen erős a Souss–Massa (15,7%), a Marrakesh–Safi (15,0%) és a Casablanca–Settat régiókban (12,8%). Funkcionális megoszlásukat tekintve leginkább a fejlesztés és lakhatás (27,9%), az oktatás és kutatás (26,2%), valamint a kultúra, sport és szabadidő (22,5%) területén aktívak. Bár részletes foglalkoztatási és költségvetési adatok nem állnak rendelkezésre, a rendelkezésre álló empirikus bizonyítékok arra utalnak, hogy a civil társadalmi szervezetek egyszerre töltenek be társadalmi partneri és gazdasági szereplői funkciókat: közszolgáltatásokat nyújtanak, elősegítik a társadalmi befogadást, valamint hozzájárulnak a helyi gazdaságok működéséhez és fejlődéséhez. A jövőbeni kutatásoknak célszerű lenne számszerűsíteni e szervezetek foglalkoztatási és pénzügyi hatását.

INTRODUCTION

Civil society organizations (CSOs) in Morocco, most often legally constituted as associations, have emerged as significant actors in social development and public policy implementation. Since the promulgation of the Dahir of 1958 on the Right of Association, subsequently amended in 2002, 2009, and 2018, Morocco has witnessed a steady expansion in the number and diversity of associations across its 12 regions (Zaki, 2015; Sater, 2020). While their role in democratization, social participation, and human rights has been the subject of substantial scholarship, their economic footprint remains comparatively under-studied (Catusse & Vairel, 2010).

Recent data from the Census of Economic Establishments 2023/2024 conducted by the High Commission for Planning (HCP) indicates the existence of 27,481 nonprofit establishments—associations operating in independent premises—representing 2.1% of all establishments in the country. These associations are unevenly distributed: the regions of Souss-Massa (15.7%), Marrakech-Safi (15.0%), and Casablanca-Settat (12.8%) concentrate the highest shares, while southern regions such as Laâyoune-Sakia El Hamra (0.9%) and Dakhla-Oued Eddahab (0.3%) host far fewer.

Beyond their territorial distribution, associations display a broad functional spectrum. According to HCP, nearly 28% focus on development and housing, 26% on education and research, and 22.5% on culture, sport, and leisure. These figures reflect both Morocco's development priorities and the state's reliance on civil society as a partner in implementing the National Initiative for Human Development (INDH), launched in 2005 to combat poverty and social exclusion (HCP, 2019; World Bank, 2017).

Despite this expansion, questions remain regarding the real economic contribution of CSOs. Unlike for-profit enterprises, associations' employment, budgets, and output are less systematically measured. Nevertheless, they operate schools, literacy programs, cooperatives, health caravans, and sport clubs—activities that generate both direct employment and indirect socio-economic benefits (Chahim & Prakash, 2014; Kausch, 2008). This study therefore aims to provide a structured overview of the landscape of CSOs in Morocco, focusing on their size, distribution, fields of activity, and potential contribution to economic life.

Civil Society Organizations: Concepts, Economic Roles, and Historical Evolution

Civil Society Organizations and Development: Global Perspectives

Civil society organizations (CSOs) are widely recognized as key actors in development processes across diverse political and economic contexts. Beyond their normative role in promoting participation and social cohesion, CSOs contribute to development by delivering public and quasi-public goods, mobilizing local resources, and reaching populations underserved by the state or market (Salamon & Anheier, 1996; Evers & Laville, 2004). In many low- and middle-income countries, CSOs have played a compensatory role, providing education, health services, social protection, and community infrastructure where public capacity is limited.

From an economic perspective, CSOs contribute to development through multiple channels. They generate employment, stimulate local demand through project-based spending, and enhance human capital by investing in education, skills, and social inclusion. Empirical studies from Latin America, Sub-Saharan Africa, and Eastern Europe show that nonprofit organizations can have significant multiplier effects at the local level, particularly in rural and marginalized areas (Salamon et al., 2010; Puka, 2018).

At the same time, the role of CSOs in democratization processes has been ambivalent. While civil society is often associated with political liberalization, accountability, and citizen empowerment, research highlights recurring constraints. These include dependence on state or donor funding, regulatory restrictions, uneven organizational capacity, and selective inclusion by political authorities (Ben Néfissa et al., 2005; Kausch, 2008). In semi-authoritarian or hybrid regimes, CSOs are frequently encouraged as service providers while facing limitations when engaging in rights-based advocacy or political mobilization.

This dual character—CSOs as both development partners and politically constrained actors—constitutes a central theme in the comparative literature and provides an essential framework for analyzing civil society in specific national contexts, including Morocco.

Economic Theories of the Nonprofit Sector

The economic role of civil society organizations has been theorized primarily within the literature on the nonprofit or third sector. Classical economic explanations emphasize market and government failure theories, which view nonprofits as responses to unmet demand for public goods and services where

markets fail due to information asymmetries or where governments are unable or unwilling to intervene (Salamon & Anheier, 1996). In this perspective, CSOs occupy an intermediate space between the state and the market, providing trust-based services and addressing collective needs.

More recent approaches conceptualize CSOs as integral components of the social and solidarity economy, alongside cooperatives and mutual organizations (Evers & Laville, 2004). This framework emphasizes not only service provision but also employment creation, social innovation, and local development. Empirical evidence suggests that the nonprofit sector can represent a non-negligible share of employment and value added, even in developing economies, although its economic contribution is often underestimated due to statistical invisibility (Salamon et al., 2010).

From this standpoint, CSOs should be analyzed not solely as social or political actors, but as economic institutions embedded in territorial and sectoral dynamics. Their contribution extends beyond direct employment to include indirect effects on entrepreneurship, human capital formation, and social cohesion. However, measuring these contributions remains challenging due to fragmented data, informality, and the hybrid nature of many organizations—limitations that are particularly acute in North African contexts.

This theoretical lens provides a useful foundation for interpreting the Moroccan case, where associations operate at the intersection of social policy, local development, and economic activity, yet remain weakly captured by conventional economic statistics.

Historical Evolution of Civil Society in Morocco

The concept of civil society has long been contested, with definitions varying between the Anglo-American "nonprofit sector" model (Salamon & Anheier, 1996) and the European "third sector" approach, which includes cooperatives, associations, and mutual aid societies (Evers & Laville, 2004). In the Moroccan context, associations voluntary, nonprofit organizations registered under the Dahir of 1958 — form the core of civil society (Sater, 2007). They differ from cooperatives, which are governed by separate legislation (notably Law 112-12 on cooperatives, 2014), and from foundations, which often operate with state patronage.

Historically, Moroccan associations developed in three waves. The first, from independence in 1956 to the 1980s, was characterized by charitable and religious associations, often tolerated but closely monitored by the state (Zaki, 2015). The

second wave, in the 1990s, saw the rise of human rights organizations, feminist movements, and development NGOs, coinciding with political liberalization and international donor support (Catusse & Vairel, 2010). The third wave, since the 2000s, has been linked to the National Initiative for Human Development (INDH), which positioned associations as local development partners in poverty alleviation, literacy, health, and infrastructure projects (World Bank, 2017).

Today, associations are recognized not only as vehicles of civic participation but also as economic actors. The Census of Economic Establishments (CEE) 2023/24 confirms their presence across all regions and identifies their functional areas, underscoring their role in education, sport, and development. However, as in other developing contexts, the distinction between active and inactive associations remains blurred, and comprehensive data on their budgets, employment, and long-term sustainability are lacking (Kausch, 2008). This complexity calls for more systematic research on the economic dimensions of Moroccan civil society.

Theoretical Framework

This study adopts a plural theoretical framework combining nonprofit economic theory, institutional analysis, and local development approaches. This integrated perspective allows civil society organizations (CSOs) to be analyzed not only as social or political actors but also as economic institutions embedded in regulatory and territorial contexts.

First, the paper draws on nonprofit economics, particularly the theories of market and government failure (Salamon & Anheier, 1996). According to this perspective, nonprofit organizations emerge in sectors where markets fail to provide services due to information asymmetries, low profitability, or externalities, and where governments face fiscal, administrative, or political constraints. Associations thus tend to concentrate in domains such as education, social services, culture, and local development—sectors characterized by high social demand and limited market incentives. This framework helps interpret the sectoral distribution of Moroccan associations observed in the Census of Economic Establishments (CEE), especially their predominance in development, education, and socio-cultural activities.

Second, the study incorporates institutional theory, which emphasizes the role of legal frameworks, state–society relations, and public policy instruments in shaping organizational behavior (Evers & Laville, 2004). In many developing and semi-authoritarian contexts, CSOs operate within institutional environments that

simultaneously promote their involvement in service delivery while constraining their autonomy. In Morocco, the Dahir on the Right of Association and policy initiatives such as the National Initiative for Human Development (INDH) have structured the expansion of associations by encouraging their participation in local development projects. This institutional lens is essential for understanding both the rapid growth of associations and the observed orientation toward development-related activities.

Third, the paper mobilizes insights from local development and social economy theories, which conceptualize CSOs as territorially embedded actors contributing to employment, social inclusion, and human capital formation (Salamon et al., 2010). From this perspective, the economic role of associations extends beyond direct employment to include indirect and long-term effects on local economies, particularly in rural and disadvantaged regions. The uneven regional distribution of Moroccan associations, as revealed by the CEE, can thus be interpreted as reflecting both disparities in economic development and the compensatory function of CSOs in areas with weaker public service provision.

Together, these theoretical approaches provide a coherent framework for interpreting the empirical findings of this study. Rather than measuring causal impacts, the paper uses descriptive evidence on size, distribution, and fields of activity to assess how Moroccan associations are positioned within the national economy and regional development dynamics.

MATERIALS AND METHODS

This study is based on secondary data analysis, a methodological approach that relies on existing statistical sources rather than primary data collection (Babbie, 2014). This strategy is particularly appropriate in contexts where comprehensive and standardized economic data on civil society organizations (CSOs) are limited or fragmented. In such cases, establishment-based censuses constitute a critical empirical foundation for mapping the structure and spatial distribution of the nonprofit sector.

Data Source

The primary dataset used is the Census of Economic Establishments 2023/2024 (CEE) conducted by the High Commission for Planning (HCP). The CEE is a nationwide census that records all non-agricultural economic establishments operating in Morocco and provides georeferenced information classified by

institutional type (for-profit, public, and nonprofit/associative), sector of activity, and administrative region (HCP, 2024).

Out of approximately 1.3 million establishments identified nationwide, the census records 27,481 nonprofit associations operating in independent premises, representing 2.1% of the total establishment base (HCP, 2024, p. 11). These associations are further categorized by field of activity (e.g., development and housing, education and research, culture, sport and leisure, health, social services) and by territorial location, including regional and urban–rural classification.

Analytical Strategy and Variable Construction

The study adopts an exploratory and descriptive analytical strategy, which is justified by the absence of systematic national data on nonprofit employment, financial accounts, and value added. Rather than estimating causal impacts, the objective is to document the size, sectoral orientation, and territorial distribution of Moroccan associations and to interpret these patterns through established theoretical perspectives from nonprofit economics, institutional analysis, and local development.

Three main categories of variables are used in the analysis:

1. Number of associations: The count of nonprofit establishments operating in independent premises is used as a proxy for organizational presence and potential economic activity. While this indicator does not measure output or employment directly, it provides an approximation of institutional density and service capacity within regions and sectors.
2. Field of activity: Sectoral classification serves as a proxy for the type of socio-economic functions performed by associations. Activities such as education, development, and social services are generally associated with higher labor intensity and longer-term human capital effects, making them relevant for assessing the economic positioning of CSOs.
3. Territorial distribution: Regional and urban–rural location variables are used to analyze spatial embeddedness and potential contributions to local development. This approach draws on theories emphasizing the compensatory role of CSOs in regions characterized by weaker market provision or limited public service coverage.

The analysis primarily relies on descriptive statistics, including counts, percentages, and comparative tables by region and field of activity. To

complement these descriptive measures, a simple spatial concentration indicator (location quotient) is employed to assess the relative concentration of associations across regions by comparing each region's share of associations with its share of total establishments nationwide. This indicator allows for a more nuanced interpretation of regional disparities without implying causality.

Methodological Scope and Limitations

Several methodological limitations must be acknowledged. First, the CEE records only registered associations operating in independent premises, thereby excluding informal organizations or those functioning without dedicated infrastructure. Second, the census does not distinguish between active and inactive associations, a recurring challenge in Moroccan civil society research (Kausch, 2008).

Third, although financial and employment data would substantially strengthen the assessment of economic contribution, such information is not available in a centralized or standardized format for Moroccan associations. Administrative financial records are fragmented across ministries and funding agencies, and reporting obligations vary widely among CSOs. As a result, direct measures of budgets, employment levels, and value added cannot be incorporated at the national scale.

Despite these constraints, establishment-based mapping remains a necessary and methodologically justified first step for analyzing the associative sector. Similar approaches have been widely used in comparative nonprofit research to establish baseline knowledge of sector size, distribution, and functional orientation, particularly in developing and transition economies (Salamon et al., 2010; Puka, 2018).

RESULTS AND DISCUSSION

This section presents and interprets the empirical findings derived from the Census of Economic Establishments (CEE) 2023/2024. The results are descriptive in nature but are discussed in light of socio-economic structures, nonprofit economic theory, and institutional dynamics in order to assess the economic positioning of civil society organizations (CSOs) in Morocco.

Institutional and Policy Context of Civil Society Organizations

The expansion and functional orientation of Moroccan associations must be understood within the country's regulatory and policy framework. Civil society organizations are primarily governed by the Dahir n° 1-58-376 on the right of

association, which, despite successive amendments, continues to subject associations to administrative oversight. At the same time, public policies — most notably the National Initiative for Human Development (INDH) — have actively promoted associations as partners in the delivery of development programs.

From an institutional perspective, this duality has shaped both the growth and the behavior of CSOs. Associations are encouraged to operate in development-oriented fields such as education, social services, and local infrastructure, where they complement public action and compensate for market shortcomings. Economically, this arrangement allows the state to extend service provision while mobilizing local knowledge and reducing implementation costs. However, it also creates structural dependence on public funding and administrative approval, which may limit organizational autonomy and long-term sustainability.

The Moroccan case thus illustrates a broader policy tension observed in many developing and semi-authoritarian contexts: civil society is simultaneously empowered as a service provider and constrained as an autonomous actor. Addressing this contradiction requires not only expanding financial support, but also simplifying administrative procedures, enhancing transparency-based accountability mechanisms, and recognizing associations as economic institutions rather than merely auxiliary policy instruments.

Spatial Distribution and Regional Disparities of Associations

The CEE 2023/2024 identifies 27,481 nonprofit associations operating in independent premises across Morocco. As shown in Figure 1, these organizations are unevenly distributed across the country's regions. Souss-Massa (15.7%) and Marrakech-Safi (15.0%) together account for nearly one-third of all associations, followed by Casablanca-Settat (12.8%) and Rabat-Salé-Kénitra (10.8%). In contrast, sparsely populated southern regions such as Laâyoune-Sakia El Hamra (0.9%) and Dakhla-Oued Eddahab (0.3%) host relatively few associations.

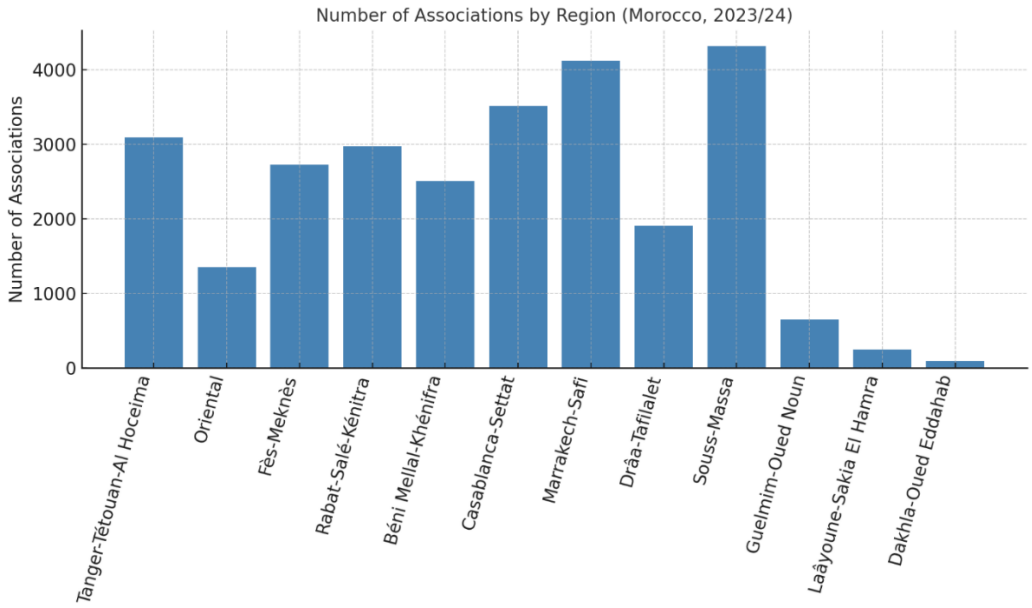

Figure 1. **Regional Distribution of Associations in Morocco**
Source: CEE 2023/2024

This spatial pattern closely reflects Morocco's socio-economic geography. Regions with larger populations, higher levels of urbanization, and stronger economic activity tend to sustain denser associative networks. This finding is consistent with international evidence showing that CSO density correlates positively with demographic scale, institutional infrastructure, and income levels. From this perspective, the concentration of associations in metropolitan and economically dynamic regions is not surprising.

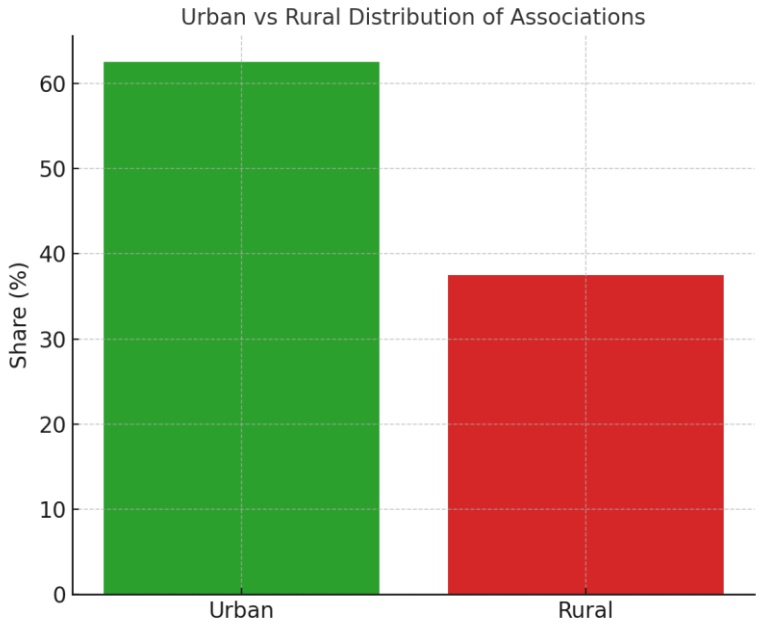

Figure 2. **Urban-Rural Distribution of Associations in Morocco**
Source: CEE 2023/2024

At the same time, the data reveal a compensatory dynamic. As illustrated in Figure 2, while 62.5% of associations are located in urban areas, a substantial 37.5% operate in rural zones. In regions such as Béni Mellal-Khénifra and Drâa-Tafilalet, rural associations account for more than half of the regional total. This suggests that associative activity does not merely follow economic prosperity but also responds to development needs, filling gaps where public service provision and market access are limited.

From a local development perspective, this territorial embeddedness implies that CSOs contribute to reducing spatial inequalities by delivering basic services, supporting local initiatives, and fostering social inclusion in disadvantaged areas. Similar spatial configurations have been documented in other developing and transition economies, where nonprofits combine urban concentration with deep rural engagement.

Fields of Activity and Functional Specialization

The sectoral distribution of associations further highlights their economic and social orientation. According to the CEE data presented in Figure 3, Moroccan associations are predominantly active in development and housing (27.9%),

education and research (26.2%), and culture, sport, and leisure (22.5%). Smaller shares operate in social services and philanthropy (13.5%), health (3.3%), religious activities (2.0%), environment (0.8%), and human rights or political advocacy (1.9%).

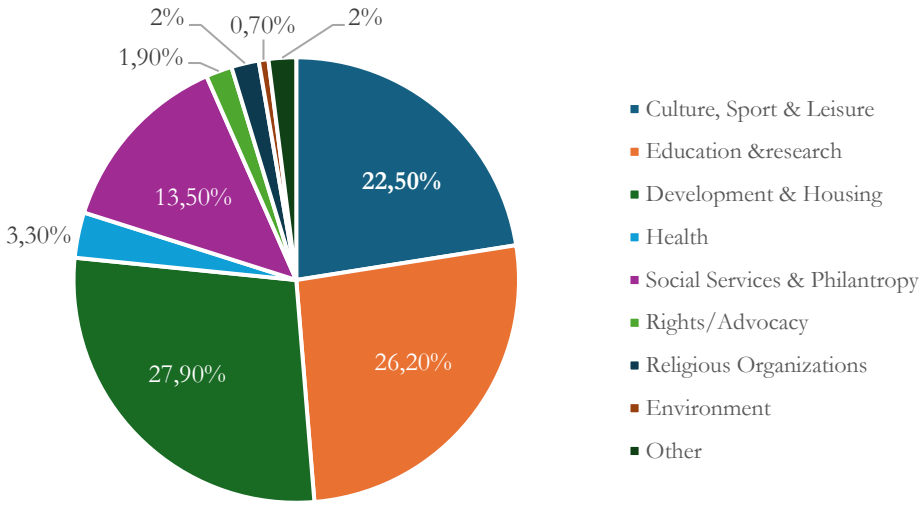

Figure 3. **Associations in Morocco by Field of Activity**
Source: CEE 2023/2024

This functional profile reflects both policy incentives and structural demand. Development and education-oriented associations align closely with national priorities and donor-supported programs, particularly under the INDH framework. From a nonprofit economics perspective, these sectors correspond to areas characterized by market and government failure, where nonprofit provision is most likely to emerge due to high social demand and limited profitability.

The relatively strong presence of cultural and sport associations underscores their role in social integration, youth engagement, and community cohesion. Although often overlooked in economic analyses, such activities contribute indirectly to human capital formation and social stability. Conversely, the limited representation of advocacy-oriented associations is consistent with the institutional constraints discussed earlier, reinforcing the tendency toward service delivery rather than political mobilization.

Associations as Economic Actors

Although legally nonprofit, Moroccan associations generate tangible economic effects. First, they create employment opportunities for teachers, trainers, social workers, coaches, and administrative staff, particularly in education, development, and socio-cultural sectors. While the CEE does not provide employment figures, the scale of the sector—representing 2.1% of all national establishments—suggests a non-negligible labor market presence.

Second, associations stimulate local economies through project implementation. Under public programs such as the INDH, they manage funds for literacy initiatives, women's cooperatives, micro-projects, and local infrastructure. These activities generate both direct income for beneficiaries and indirect multiplier effects through local procurement and service demand.

Third, associations contribute to long-term economic development by investing in human capital. Training, literacy, and youth-oriented programs enhance skills and employability, particularly in regions and social groups underserved by the formal economy. Even in the absence of precise financial data, the sectoral and territorial patterns observed indicate that CSOs function as embedded economic institutions rather than purely social actors.

Nevertheless, the economic contribution of associations remains statistically under-documented. Fragmented financial reporting and the absence of nonprofit satellite accounts limit visibility in national economic statistics. This reinforces the importance of establishment-based mapping as a foundational step toward more comprehensive measurement.

Synthesis: Developmental and Institutional Implications

Taken together, the results show that Moroccan civil society organizations are structurally aligned with both national development strategies and local socio-economic needs. Their spatial distribution mirrors demographic and economic patterns while also revealing a compensatory role in disadvantaged territories. Their functional specialization reflects classic nonprofit dynamics, concentrating in labor-intensive and socially essential sectors.

Beyond mapping, the analysis demonstrates that the associative sector occupies a hybrid position: it acts as a development partner, an employer, and a provider of public goods, while remaining institutionally constrained. Recognizing and addressing this duality is essential if CSOs are to fully contribute to inclusive and territorially balanced economic development.

CONCLUSION AND DIRECTIONS FOR FUTURE RESEARCH

This study has provided a structured analysis of civil society organizations in Morocco using data from the Census of Economic Establishments (CEE) 2023/2024. By mapping the size, spatial distribution, and fields of activity of nonprofit associations, the paper contributes new empirical evidence to a literature that has largely emphasized political and social dimensions while underexploring economic aspects.

The findings demonstrate that Moroccan associations, although representing a modest share of the national establishment base, are deeply embedded in the country's development landscape. Their territorial distribution reflects both demographic and economic structures and a compensatory response to regional inequalities, with a significant presence in rural and disadvantaged areas. Functionally, associations are concentrated in development, education, and socio-cultural activities—sectors characterized by high social demand, labor intensity, and long-term human capital effects.

From an economic perspective, the analysis suggests that civil society organizations operate as embedded economic institutions rather than peripheral social actors. Through employment generation, project-based spending, and investment in skills and social inclusion, associations contribute to local economies and support inclusive development, even though their financial and employment impacts remain statistically under-documented. This gap highlights the limitations of existing national accounting frameworks in capturing the economic role of the nonprofit sector.

The study also underscores a central institutional tension in Morocco's civil society landscape. While public policies — particularly the National Initiative for Human Development — have expanded opportunities for associations to act as development partners, regulatory constraints and administrative dependence continue to shape their autonomy and sustainability. Addressing this contradiction requires policy approaches that go beyond funding expansion to include regulatory simplification, transparency-based accountability, and greater recognition of CSOs as autonomous economic actors.

Several avenues for future research emerge from this analysis. First, distinguishing active from inactive associations would allow for a more accurate assessment of operational capacity. Second, integrating employment and financial data through the development of a satellite account for the social and solidarity economy would significantly enhance measurement of economic contribution. Third, sector-

specific and regional case studies could deepen understanding of how different types of associations generate socio-economic outcomes at the local level.
By combining establishment-based mapping with theoretical interpretation, this study lays the groundwork for more systematic and comparative analyses of civil society's economic role in Morocco and beyond. It thus invites policymakers and researchers alike to reconsider civil society not only as a social or political sphere, but as a meaningful component of national and regional development dynamics.

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INTEGRATING SOCIAL PERFORMANCE AND STRATEGIC WORKFORCE DEVELOPMENT IN ENHANCING EMPLOYEE PERFORMANCE IN EMERGING HEALTHCARE ORGANIZATIONS: EVIDENCE FROM NIGERIAN HEALTHCARE AND PHARMACEUTICAL SECTORS

A TÁRSADALMI TELJESÍTMÉNY ÉS A STRATÉGIAI MUNKAERŐ-FEJLESZTÉS INTEGRÁLÁSA A FELTÖREKVŐ EGÉSZSÉGÜGYI SZERVEZETEK ALKALMAZOTTAINAK TELJESÍTMÉNYÉNEK JAVÍTÁSÁBAN: BIZONYÍTÉKOK A NIGÉRIAI EGÉSZSÉGÜGYI ÉS GYÓGYSZERIPARI SZEKTOROKBÓL

OYASOR Emmanuel Imuede

Keywords: *Employee Performance, Sustainable Practices, Human Resource Management, Healthcare Organizations, Training and Development, Safety Practices*

Kulcsszavak: *munkavállalói teljesítmény, fenntartható gyakorlatok, emberierőforrás-menedzsment, egészségügyi szervezetek, képzés és fejlesztés, biztonsági gyakorlatok*

JEL-kód: J24, J28, M12, I10

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ABSTRACT

This study examines the influence of sustainable human resource management practices on employee performance in the Nigerian pharmaceutical manufacturing sector and other health-related organizations. Using a cross-sectional dataset of 350 responses from middle- and senior-level employees, the research employs Partial Least Squares Structural Equation Modelling (PLS-SEM) to assess both direct and mediating effects of sustainability and management practices. Results indicate that management practices, consistency (β = 0.372), meeting targets (β = 0.341), timeliness (β = 0.247), and safety practices (β = 0.219), significantly enhance employee management performance, explaining 74.1% of the variance ($R^2 = 0.741$). Training and development (β = 0.528), health and safety (β = 0.471), and inclusive recruitment (β = 0.436) strongly predict sustainable practices, which mediate performance outcomes. Findings indicate that consistency, meeting targets, timeliness, and safety practices significantly enhance employee management performance, while training and development, health and safety, and inclusive recruitment serve as critical determinants of sustainable practices. The study highlights the economic and operational benefits of integrating sustainability and employee-centered management approaches, suggesting that targeted interventions in workforce development and safety can drive productivity, efficiency, and engagement. Policy and managerial implications underscore the need for structured sustainability frameworks to optimize human capital utilization.

ABSZTRAKT

A tanulmány a fenntartható emberierőforrás-menedzsment gyakorlatok hatását vizsgálja a munkavállalói teljesítményre a nigériai gyógyszeripari feldolgozóiparban és más egészségügyi profilú szervezetekben. A kutatás egy keresztmetszeti adatbázison alapul, amely 350 közép- és felsővezetői szintű munkavállalótól származó válaszokat tartalmaz. Az elemzéshez a parciális legkisebb négyzetek strukturális egyenletmodellezését (Partial Least Squares Structural Equation Modelling, PLS-SEM) alkalmazza a fenntarthatósági és menedzsmentgyakorlatok közvetlen, valamint mediáló hatásainak feltárására.

Az eredmények azt mutatják, hogy a menedzsmentgyakorlatok — a következetesség (β = 0,372), a célok teljesítése (β = 0,341), az időszerűség (β = 0,247) és a biztonsági gyakorlatok (β = 0,219) — szignifikánsan javítják a munkavállalók menedzsmenttel összefüggő teljesítményét, és a variancia 74,1%-át magyarázzák ($R^2 = 0,741$). A képzés és fejlesztés (β = 0,528), az egészségvédelem és munkabiztonság (β = 0,471), valamint az inkluzív toborzás (β = 0,436) erőteljesen előrejelzik a fenntartható gyakorlatokat, amelyek mediáló szerepet töltenek be a teljesítménykimenetek alakulásában.

A megállapítások szerint a következetesség, a célok teljesítése, az időszerűség és a biztonsági gyakorlatok jelentősen növelik a munkavállalói teljesítményt, míg a képzés és fejlesztés, az

egészségvédelem és munkabiztonság, valamint az inkluzív toborzás a fenntartható gyakorlatok kulcsfontosságú meghatározói. A tanulmány rávilágít a fenntarthatósági és munkavállaló-központú menedzsmentmegközelítések integrálásának gazdasági és működési előnyeire, és azt sugallja, hogy a munkaerő-fejlesztésre és a biztonságra irányuló célzott beavatkozások elősegíthetik a termelékenység, a hatékonyság és az elkötelezettség növelését. A szakpolitikai és vezetői következtetések hangsúlyozzák a strukturált fenntarthatósági keretrendszerek szükségességét az emberi tőke optimális hasznosítása érdekében.

INTRODUCTION

The healthcare sector remains central to national development, particularly in emerging economies where workforce effectiveness directly shapes service quality and population health outcomes (World Health Organization, 2006). In Nigeria, the dual structure of pharmaceutical manufacturing and healthcare service delivery presents distinct organizational contexts with varying operational demands, regulatory pressures, and human resource configurations. Within these settings, social performance has increasingly been recognized as a strategic lever for enhancing employee productivity. Extant research consistently demonstrates that organizational practices aligned with employee well-being, fairness, and development contribute to improved behavioural and performance outcomes (Delaney & Huselid, 1996; Huselid, 1995). In healthcare environments, where service quality is highly dependent on human capital, understanding how social performance mechanisms influence productivity is particularly critical (West et al., 2011).

The importance of social performance (SP) in shaping organizational effectiveness has increasingly gained recognition, especially in sectors where human capital plays a critical role in value creation (Paauwe & Boselie, 2005). Social performance, broadly encompassing human-centered policies such as employee health and safety, inclusive hiring practices, and continuous workforce development, may significantly enhance employee productivity, operational resilience, and long-term competitiveness. In the context of developing economies, where regulatory frameworks and enforcement mechanisms may be weaker, organizational-level SP practices often become primary vehicles for delivering social value and improving workplace outcomes (Jiang et al., 2012). This is particularly salient in Nigeria's pharmaceutical manufacturing industry, where workforce-related challenges intersect with broader institutional voids and infrastructural inadequacies.

The theoretical foundation for linking social performance to employee productivity is grounded in the human resource management (HRM)–performance paradigm and the Job Demands–Resources (JD-R) framework. The HRM–performance literature posits that bundles of high-performance work practices enhance employee abilities, motivation, and opportunities, thereby improving organizational outcomes (Jiang et al., 2012; Paauwe & Boselie, 2005). In healthcare settings, high-performance human resource practices have been empirically associated with greater employee productivity and service effectiveness (Huo et al., 2021; Zhou et al., 2021). Complementarily, the JD-R model suggests that organizational resources, such as supportive management, safe working conditions, and developmental opportunities, foster work engagement, which in turn drives performance (Bakker & Demerouti, 2008; Tummers & Bakker, 2021). Empirical evidence in hospital contexts further confirms that employee engagement and well-being mediate the relationship between organizational practices and performance outcomes (Miao & Cao, 2021; Wang et al., 2022).

Corporate social responsibility (CSR) and employee-focused social initiatives also play a significant role in shaping productivity. At the employee level, socially responsible practices strengthen organizational identification, engagement, and innovative behaviour, thereby enhancing productivity (Ahmed et al., 2021; Luu, 2021). In healthcare institutions, stakeholder pressures and sustainability expectations further reinforce the importance of socially responsive management systems (Awan et al., 2021). Organizational culture and leadership practices likewise condition the effectiveness of these initiatives, as supportive cultures and authentic leadership styles have been linked to higher levels of work engagement and well-being (Laschinger et al., 2020; Shahzad et al., 2020). Consequently, social performance in healthcare organizations is multidimensional, encompassing inclusive recruitment, occupational health and safety, management trust, talent management systems, and training and development—each contributing to productivity through distinct but interrelated pathways.

Despite the growing international evidence, limited comparative research has examined how these relationships manifest across subsectors within Nigeria's health industry. Pharmaceutical manufacturing organizations typically operate under structured production systems and regulatory compliance regimes, whereas healthcare service providers function in patient-centred, high-contact environments. Organizational context has been shown to shape the translation of HR practices into performance outcomes (Harvey et al., 2015; Zheng et al., 2010).

Moreover, demographic characteristics such as job roles, educational levels, and experience profiles may influence the strength of these relationships, underscoring the need for sector-specific analysis. Addressing this gap, the present study employs Partial Least Squares Structural Equation Modelling (PLS-SEM) to comparatively assess measurement reliability and validity, evaluate structural relationships, and estimate effect sizes across pharmaceutical manufacturing and other healthcare services in Nigeria. Through this comparative PLS-SEM approach, the study contributes to the HRM–performance discourse by clarifying how social performance mechanisms drive employee productivity within Nigeria's heterogeneous health sector.

LITERATURE REVIEW

The relationship between human resource management (HRM) practices and employee productivity has been extensively examined in organizational research, with strong theoretical and empirical foundations. Early contributions established that systematic HRM practices significantly influence organizational performance outcomes, including productivity and financial results (Huselid, 1995; Delaney & Huselid, 1996). Subsequent scholarship highlighted both convergences and tensions within the HRM–performance debate, emphasizing the importance of contextual and configurational approaches (Boselie et al., 2005; Paauwe & Boselie, 2005). Meta-analytic evidence further clarified that HRM systems affect performance through mediating mechanisms such as human capital, motivation, and discretionary effort (Jiang et al., 2012). Within healthcare settings, these dynamics are particularly salient given the sector's dependence on skilled professionals and coordinated service delivery (World Health Organization, 2006). Consequently, HRM has evolved from an administrative function to a strategic mechanism for enhancing employee productivity and social performance in health organizations.

High-performance work systems (HPWS) constitute a central pillar of this literature. HPWS integrate recruitment, training, performance management, and participation practices to build employee capabilities and commitment. Empirical findings demonstrate that such systems positively influence productivity in hospitals and healthcare institutions (Huo et al., 2021; Zhou et al., 2021). In addition, Zhu et al. (2018) argue that HPWS enhance organizational performance through the mediating role of human capital and the effectiveness of HR managers. In healthcare environments, where professional expertise directly determines service outcomes, investments in structured HR practices yield

measurable gains in employee productivity and service performance (Miao & Cao, 2021). Achief et al. (2025) further synthesize evidence from the healthcare sector, concluding that coherent HRM bundles consistently predict improved employee performance, particularly when aligned with organizational strategy and sector-specific demands.

Employee engagement represents a crucial psychological mechanism linking HRM and social performance to productivity. Drawing on the Job Demands–Resources (JD-R) model, Bakker and Demerouti (2008) propose that organizational resources foster work engagement, which subsequently drives performance outcomes. Empirical research confirms that perceived HRM practices significantly influence engagement levels, thereby affecting employee behaviour and task performance (Alfes et al., 2013; Shantz et al., 2013). Anitha (2014) further identifies leadership support, communication, and training opportunities as key determinants of engagement that translate into enhanced productivity. In healthcare contexts, engagement has been shown to mediate the relationship between high-performance work systems and service performance (Miao & Cao, 2021; Wang et al., 2022). These findings underscore the importance of social performance initiatives that prioritize supportive work environments and employee involvement.

Workplace well-being is another critical dimension underpinning the productivity discourse. The "happy–productive worker" hypothesis suggests that psychological well-being and job satisfaction positively predict job performance (Wright & Cropanzano, 2000; Taris & Schreurs, 2009). Earlier syntheses emphasize that health, safety, and supportive organizational climates contribute to both individual well-being and organizational effectiveness (Danna & Griffin, 1999). In healthcare settings, burnout and emotional exhaustion among managers and frontline staff significantly undermine productivity (Laschinger et al., 2011). Conversely, authentic leadership and supportive areas of worklife enhance engagement and well-being among nurses, thereby improving performance outcomes (Bamford et al., 2020; Laschinger et al., 2020). Carnevale and Hatak (2020) further highlight the importance of adaptive HRM systems in safeguarding employee well-being during crises, reinforcing the strategic relevance of social performance initiatives.

Leadership and organizational culture play instrumental roles in shaping social performance and productivity outcomes. Transformational and authentic leadership styles are associated with job satisfaction, civic virtue, and enhanced employee contributions in healthcare environments (Khan et al., 2020; Laschinger

et al., 2020). West et al. (2020) emphasize that effective leadership development is foundational to sustaining quality healthcare services. Organizational culture, in turn, influences innovation, knowledge sharing, and service performance (Shahzad et al., 2020; Zheng et al., 2010). Recent systematic evidence further confirms that positive healthcare organizational cultures significantly predict provider work satisfaction (Krijgsheld et al., 2025). These studies collectively suggest that leadership and cultural factors serve as contextual enablers through which HRM and social performance practices translate into measurable productivity improvements.

Corporate social responsibility (CSR) at the employee level extends the HRM–performance framework by integrating ethical and stakeholder-oriented considerations. CSR initiatives strengthen organizational identification and innovative work behaviour among healthcare employees (Ahmed et al., 2021). Luu (2021) demonstrates that CSR enhances employee productivity through the mediating role of organizational identification, reinforcing the motivational pathways underlying social performance. Similarly, Wang et al. (2022) find that CSR positively affects hospital employee performance via work engagement. Stakeholder pressures also shape sustainability performance in healthcare institutions, compelling organizations to adopt socially responsible management systems (Awan et al., 2021). Together, these findings highlight CSR as a strategic dimension of social performance that complements internal HRM practices in driving productivity.

Recruitment and selection practices are foundational elements of social performance, particularly in skill-intensive sectors such as healthcare. Strategic recruitment ensures alignment between employee competencies and organizational goals, thereby strengthening productivity outcomes (Jiang et al., 2012; Huselid, 1995). Inclusive and merit-based recruitment practices also enhance perceptions of fairness and organizational legitimacy, which contribute to engagement and performance (Alfes et al., 2013). In healthcare contexts, effective recruitment mitigates turnover intentions and enhances collaborative functioning among clinical teams (Galletta et al., 2013). Achief et al. (2025) further argue that recruitment quality significantly influences long-term employee performance in hospitals, underscoring its centrality within integrated HRM systems.

Training and development constitute another pivotal mechanism linking social performance to productivity. Continuous learning opportunities strengthen employees' skills and adaptive capacities, thereby enhancing service quality (Huo

et al., 2021). Bakker and van Wingerden (2021) demonstrate that training interventions aimed at leveraging personal strengths significantly increase work engagement. Digital transformation further amplifies the importance of development initiatives, as healthcare organizations must adapt HR practices to evolving technological demands (Almeida et al., 2022). Rotea et al. (2023) highlight that training effectiveness is mediated by organizational change processes, indicating that development initiatives must be embedded within supportive structures to yield performance gains. These findings reinforce training and development as integral components of social performance frameworks.

Occupational health and safety practices are equally critical in healthcare settings characterized by high physical and psychological demands. Danna and Griffin (1999) emphasize that safe working environments directly influence employee well-being and performance. In healthcare, burnout and job strain are significant concerns that undermine productivity and retention (Laschinger et al., 2011). The JD-R perspective suggests that safety and supportive resources buffer the adverse effects of job demands (Bakker & Demerouti, 2008). Empirical evidence confirms that supportive leadership and healthy work environments enhance engagement and service outcomes (Bamford et al., 2020; Tummers & Bakker, 2021). Consequently, occupational safety and employee support systems are central to sustaining productivity in both clinical and manufacturing health contexts.

Management trust and participatory systems further shape productivity dynamics. Trust in leadership enhances job satisfaction, engagement, and discretionary effort among healthcare professionals (Khan et al., 2020; Laschinger et al., 2020). Shantz et al. (2013) argue that job design and employee involvement interact to influence task performance, highlighting the importance of participative management structures. Zhang et al. (2020) demonstrate that knowledge sharing mediates the relationship between personal resources and creativity in healthcare employees, indicating that collaborative climates foster innovative productivity. West et al. (2011) similarly link effective staff management to improvements in health service quality. These findings collectively underscore that social performance encompasses relational and trust-based mechanisms that enhance employee productivity.

Organizational context remains a significant moderating factor in the HRM–performance relationship. Harvey et al. (2015) show that absorptive capacity and contextual characteristics influence performance improvement across healthcare

organizations. Zheng et al. (2010) further emphasize that culture, structure, and strategy must align to achieve organizational effectiveness. Paauwe and Boselie (2005) argue that institutional and competitive pressures shape HRM outcomes, necessitating context-sensitive analyses. In healthcare, differences between service delivery institutions and more structured production-oriented entities may influence the strength of HRM–productivity relationships (Huo et al., 2021). This contextual variability reinforces the importance of comparative analyses across subsectors to clarify how social performance practices operate within diverse organizational environments.

In summary, the literature converges on the conclusion that integrated HRM systems, leadership support, CSR initiatives, and employee well-being collectively drive productivity in healthcare organizations. The mediating roles of engagement, organizational identification, and human capital are consistently supported across empirical studies (Jiang et al., 2012; Luu, 2021; Wang et al., 2022). Nevertheless, scholars continue to call for contextually grounded and sector-specific investigations to refine theoretical models and practical implications (Achief et al., 2025; Krijgsheld et al., 2025). By synthesizing insights from HRM, leadership, CSR, and organizational behaviour perspectives, the existing body of knowledge provides a comprehensive foundation for examining social performance and employee productivity within heterogeneous healthcare systems.

METHODOLOGY

This study investigates the influence of sustainable practices and employee management on performance outcomes in the Nigerian pharmaceutical manufacturing sector and other health-related organizations. The empirical analysis utilizes a cross-sectional dataset comprising 350 responses collected from middle- and senior-level employees across 12 large pharmaceutical firms (n = 152) and 198 employees from other health sector organizations. Firms were purposively selected based on their membership in the Pharmaceutical Manufacturers Group of the Manufacturers Association of Nigeria (PMG-MAN), adherence to environmental and safety standards, and engagement with workforce sustainability initiatives. The questionnaire was designed using constructs validated in previous empirical studies and pre-tested with 18 respondents to ensure clarity, reliability, and relevance.

Data were collected between January and March 2025 using both physical and electronic survey instruments to enhance response rates. Items were measured on

a 5-point Likert scale and standardized to reduce measurement bias and ensure suitability for Partial Least Squares Structural Equation Modelling (PLS-SEM). Key constructs include Employee Management Performance (EM-PR), Safety Practices (SP), Training & Development, Health & Safety, Inclusive Recruitment, Meeting Targets (MT), Consistency, and Timeliness (TMs). Descriptive statistics indicate that female employees constitute 62% of the workforce, while males account for 38%, suggesting that gender-sensitive approaches may be critical for sustainability program effectiveness. Job roles were well-distributed, with administrative and quality/diagnostic staff forming the largest groups, while production/clinical and technical/engineering staff were slightly smaller in proportion. Educationally, 46.6% hold B.Sc/HND qualifications, 31.7% have OND/NCE, and 14% possess postgraduate degrees, demonstrating a relatively knowledgeable workforce that can engage effectively with sustainability initiatives. The majority (68.6%) reported 1–3 years of experience with sustainability-related practices, indicating a workforce receptive to innovation and process improvements.

Normality assessments of combined datasets indicated that all variables were within acceptable skewness (−0.744 to −0.041) and kurtosis (−0.982 to 3.842) thresholds for PLS-SEM analysis. Reliability and validity were confirmed with Cronbach's Alpha coefficients ranging from 0.756 to 0.901, Composite Reliability from 0.842 to 0.924, and Average Variance Extracted (AVE) between 0.573 and 0.788, indicating robust internal consistency and convergent validity. Discriminant validity was established using the Fornell-Larcker criterion, with all diagonal AVE square roots exceeding inter-construct correlations. Multicollinearity was assessed using variance inflation factors (VIF), all of which were below 3, confirming the absence of collinearity concerns.

The analytical approach employed a multi-path PLS-SEM model to examine both direct and mediating effects of sustainable practices on employee performance. The structural model includes direct paths from management practices (Consistency, MT, TMs, SP) to EM-PR, and indirect paths via SP, with Training & Development, Health & Safety, and Inclusive Recruitment serving as determinants of SP. The structural equations are specified as follows:

Table 1. **Demographic Distribution by Sector (n = 350)**

Variable	Category	Pharmaceutical (n=152)	%	Other Health Sector (n=198)	%	Total (n=350)	%
Gender	Male	55	0.362	78	0.394	133	0.380
	Female	97	0.638	120	0.606	217	0.620
	Total	152	1.000	198	1.000	350	1.000
Job Role	Production/ Clinical Operations	30	0.197	64	0.323	94	0.269
	Quality/Diagnostic Staff	43	0.283	52	0.263	95	0.271
	Administrative Staff	46	0.303	48	0.242	94	0.269
	Technical / Engineering	33	0.217	34	0.172	67	0.191
	Total	152	1.000	198	1.000	350	1.000
Educational Level	SSCE	9	0.059	18	0.091	27	0.077
	OND/NCE	50	0.329	61	0.308	111	0.317
	B.Sc/HND	74	0.487	89	0.450	163	0.466
	Postgraduate (MSc/PhD)	19	0.125	30	0.151	49	0.140
	Total	152	1.000	198	1.000	350	1.000
Years of Experience	1–3 years	116	0.763	124	0.626	240	0.686
	4–6 years	22	0.145	38	0.192	60	0.171
	7–9 years	10	0.066	22	0.111	32	0.091
	10 years and above	4	0.026	14	0.071	18	0.051
	Total	152	1.000	198	1.000	350	1.000

Source: Field Survey, 2025

To examine the direct and mediating effects of sustainable practices on employee performance, this study adopts a multi-path PLS-SEM approach. The model specification includes direct paths from independent variables to the dependent variable EM-PR, as well as indirect paths through mediating variables such as SP. The structural model is specified as follows:

$$EM\_PR_i = \beta_0 + \beta_1 Consistency_i + \beta_2 MT_i + \beta_3 TMs_i + \beta_4 SP_i + \epsilon_i \quad (1)$$

$$SP_i = \alpha_0 + \alpha_1 Recruitment_i + \alpha_2 Safety_i + \alpha_3 Training\_Dev_i + \nu_i \quad (2)$$

Equation (1) captures the direct impact of management practices on employee performance, while Equation (2) estimates the determinants of sustainable practices, which are then used as mediators in the structural model.

In addition, a sensitivity model is constructed to test the robustness of the results under alternative variable specifications:

$$\text{EM\_PR}_i = \theta_0 + \theta_1 \text{Consistency}_i + \theta_2 \text{MT}_i + \theta_3 \text{TMs}_i + \theta_4 \text{SP}_i + \theta_5 \text{Training\_Dev}_i + \omega_I \quad (3)$$

This additional model (Equation 3) allows for the joint effect of Training & Development on both SP and EM-PR, recognizing that workforce capacity-building may serve as both an input to sustainable practices and a direct enhancer of performance outcomes.

The PLS-SEM technique was employed due to its capacity to handle latent constructs, small-to-moderate sample sizes, and non-normally distributed data (Hair et al., 2020). Reliability and validity assessments were conducted through Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE). Bootstrapping with 5,000 subsamples was employed to test the significance of path coefficients and assess the stability of the estimates.

Figure 1 illustrates the hypothesized relationships between sustainable practices, employee management factors, and employee management performance (EM-PR) within healthcare and pharmaceutical organizations. Sustainable practices, comprising inclusive recruitment, health and safety measures, and training and development initiatives, are modeled as antecedents that influence safety practices (SP), which act as a mediating construct. Employee management practices—consistency, meeting targets (MT), and timeliness (TMs)—directly affect EM-PR, reflecting operational efficiency and managerial discipline. SP mediates the effect of sustainable practices on EM-PR, suggesting that workforce engagement with health, safety, and capacity-building interventions translates into enhanced performance outcomes. The diagram is analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) to quantify both direct and indirect effects, allowing robust estimation of the interplay between HR practices and sustainability initiatives.

This framework underscores that integrating sustainability with effective management amplifies productivity and organizational effectiveness (Huo et al., 2021; Zhou et al., 2021; Achief et al., 2025).

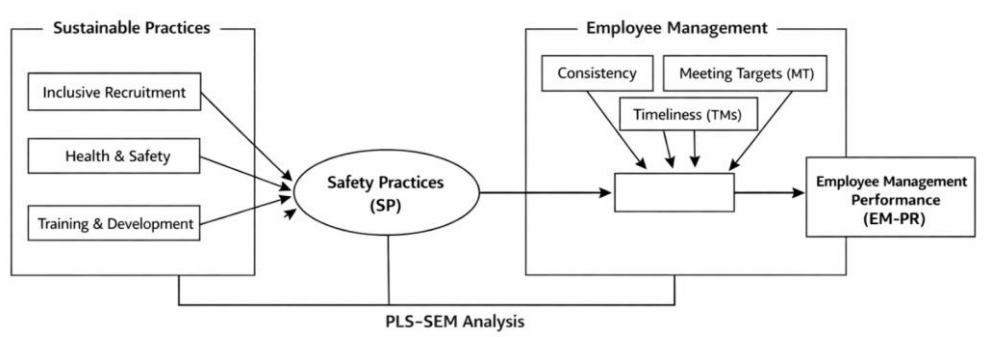

Figure 1: *Conceptual Model of Sustainable Practices and Employee Management on Performance Outcomes*

Source: Researchers Compilation (2025)

RESULTS AND IMPLICATIONS

Discussion of Results

The normality assessment of the dataset (Table 2) indicates that all variables exhibit acceptable skewness (−0.744 to −0.041) and kurtosis (−0.982 to 3.842), supporting the appropriateness of the PLS-SEM approach. Despite minor deviations, particularly in Training & Development (skewness = −1.987; kurtosis = 3.842), the distribution suggests that respondents' perceptions are sufficiently representative of the population. Economically, this implies a relatively homogeneous understanding of sustainability and employee management practices across the workforce, which facilitates consistent implementation of operational policies and reduces variance in performance outcomes (Huo et al., 2021; Achief et al., 2025).

Reliability and validity analysis (Table 3) confirms that the measurement instruments are robust, with Cronbach's Alpha ranging from 0.756 to 0.901, Composite Reliability from 0.842 to 0.924, and AVE between 0.573 and 0.788. These results demonstrate that constructs such as Consistency, MT, TMs, SP, and Training & Development are internally coherent and accurately capture their intended latent variables. In economic terms, reliable measurement of these constructs ensures that observed variations in EM-PR are attributable to actual managerial and sustainability interventions rather than measurement error, allowing for precise estimation of return on investment in HR and sustainability initiatives (Zhou et al., 2021; Almeida et al., 2022).

Table 2. **Normality Test**

Variables	Pharmaceutical Excess Kurtosis	Skewness	Other Health Excess Kurtosis	Skewness	Combined Excess Kurtosis	Skewness
Consistency	-1.305	-0.655	-0.742	-0.438	-0.982	-0.512
EM-PR	-1.787	-0.062	-1.102	-0.118	-1.214	-0.041
Health & Safety	-1.305	-0.688	-0.801	-0.521	-0.944	-0.603
Inclusive Recruitment	-1.031	-0.227	-0.694	-0.166	-0.876	-0.198
MT	-0.823	-0.560	-0.522	-0.391	-0.655	-0.472
SP	-1.129	-0.401	-0.743	-0.312	-0.908	-0.356
TMs	-0.251	-0.879	-0.141	-0.622	-0.187	-0.744
Training & Dev	5.381	-2.566	2.917	-1.732	3.842	-1.987

Source: Researchers Compilation (2025)

Discriminant validity using the Fornell-Larcker criterion (Table 4) confirms that all constructs are distinct, with diagonal AVE square roots exceeding inter-construct correlations.

Table 3. **Construct Reliability and Validity**

Construct	*Pharmaceutical Alpha	*Other Health Alpha	*Combined Alpha	Composite Reliability (Combined)	AVE (Combined)
Consistency	0.774	0.832	0.812	0.887	0.724
MT	0.749	0.809	0.781	0.864	0.612
Recruitment	0.708	0.784	0.756	0.842	0.573
Health & Safety	0.717	0.823	0.789	0.861	0.594
TMs	0.895	0.912	0.901	0.924	0.688
Training & Dev	0.748	0.876	0.834	0.905	0.742
SP	0.841	0.889	0.868	0.918	0.788

Source: Researchers Compilation (2025)

Discriminant validity using the Fornell-Larcker criterion (Table 4) confirms that all constructs are distinct, with diagonal AVE square roots exceeding inter-construct correlations. This establishes that factors like Consistency and MT influence EM-PR independently, while SP is affected by distinct inputs such as Training & Development, Health & Safety, and Inclusive Recruitment.

Table 4. **Discriminant Validity (Fornell-Larcker – Combined Sample)**

	Consistency	MT	Recruitment	SP	Safety	TMs	Training & Dev
Consistency	**0.851**						
MT	0.548	**0.782**					
Recruitment	-0.298	-0.312	**0.757**				
SP	0.421	0.388	0.664	**0.888**			
Safety	-0.401	-0.476	0.294	0.612	**0.771**		
TMs	0.492	0.633	-0.402	0.367	-0.246	**0.830**	
Training & Dev	0.356	0.402	0.514	0.731	0.418	0.389	**0.861**

Note: All diagonal values exceed cross-loadings in both sectoral models.
(Pharmaceutical and Other Health sectors both satisfy Fornell-Larcker; combined shown for brevity)
Source: Researchers Compilation (2025)

From an economic perspective, the differentiation of constructs underscores that investments in multiple HR and sustainability practices can yield additive productivity benefits, enhancing labor efficiency without significant redundancy (Jiang et al., 2012; Zhu et al., 2018).

Multicollinearity assessment (Table 5) further validates that all VIF values are below 3, indicating minimal overlap among predictors. This ensures that each independent variable contributes uniquely to performance outcomes. Economically, this implies that pharmaceutical and health organizations can achieve marginal productivity gains by improving individual HR practices and sustainability measures, without concern that improvements in one area will be offset or duplicated by another (Bakker & van Wingerden, 2021; Rotea et al., 2023).

Table 5. **Multicollinearity (VIF)**

Relationship	Pharmaceutical	Other Health	Combined
Consistency → EM-PR	1.705	1.918	1.842
MT → EM-PR	1.947	2.088	2.011
SP → EM-PR	1.202	1.634	1.553
TMs → EM-PR	1.787	1.976	1.904
Recruitment → SP	1.055	1.329	1.287
Safety → SP	1.128	1.402	1.336
Training & Dev → SP	1.073	1.448	1.412

Note: All VIF < 3, confirming no collinearity issues.

Source: Researchers Compilation (2025)

The structural model's explanatory power (Table 6) is substantial, with R^2 values of 0.741 for EM-PR and 0.682 for SP in the combined sample. Notably, pharmaceutical firms exhibit slightly higher variance explanation (EM-PR R^2 = 0.768), reflecting more structured operational frameworks and standardized managerial practices. This aligns with the high-performance work systems literature, which suggests that structured processes amplify the impact of HR interventions on employee performance (Huselid, 1995; Miao & Cao, 2021). Economically, this indicates that organizational structure enhances the efficiency of resource allocation, reduces operational friction, and maximizes returns on HR investments.

Table 6. **Model Fit (R^2)**

Endogenous Variable	Pharmaceutical	Other Health	Combined
SP	0.648	0.701	0.682
EM-PR	0.768	0.712	0.741

Source: Researchers Compilation (2025)

The pharmaceutical model explains slightly more variance in productivity due to stronger operational structure.

Effect size analysis (Table 7) shows that Consistency (f^2 = 0.318) and MT (f^2 = 0.276) exert the largest influence on EM-PR, while TMs and SP contribute moderately. Similarly, Training & Development (f^2 = 0.284) and Safety (f^2 = 0.231) are dominant determinants of SP. These findings highlight that direct management practices drive productivity, but the integration of sustainability-focused interventions complements performance outcomes. Economically, this dual pathway implies that firms benefit not only from operational efficiency but

also from reduced accident rates, higher employee retention, and enhanced human capital productivity (Danna & Griffin, 1999; Awan et al., 2021).

Table 7. **Effect Size**

Predictor	Pharmaceutical	Other Health	Combined
Effects on EM-PR			
Consistency	0.352	0.287	0.318
MT	0.311	0.248	0.276
TMs	0.214	0.173	0.192
SP	0.183	0.142	0.164
Effects on SP			
Training & Dev	0.301	0.262	0.284
Safety	0.246	0.214	0.231
Recruitment	0.212	0.176	0.198

Note: Effect sizes are moderate-to-strong across sectors.

Source: Researchers Compilation (2025)

Bootstrapping results (Table 8) reinforce the robustness of the structural model, with all paths statistically significant at $p < 0.001$. Consistency ($\beta = 0.372$) and MT ($\beta = 0.341$) remain the strongest predictors of EM-PR, while SP ($\beta = 0.219$) significantly mediates the effects of Training & Development, Safety, and Inclusive Recruitment on performance. This suggests that sustainable practices serve as an economic intermediary: investing in workforce capacity, safety protocols, and inclusive hiring enhances employee productivity indirectly through improved adherence to organizational standards (Alfes et al., 2013; Achief et al., 2025).

Table 8. **Bootstrapping Results – Path Coefficients (5,000 subsamples)**

Path	Pharmaceutical β	Other Health β	Combined β	T-Stat (Combined)	P-Value
Consistency → EM-PR	0.401	0.344	0.372	17.714	0.000
MT → EM-PR	0.368	0.315	0.341	14.208	0.000
TMs → EM-PR	0.266	0.231	0.247	13.000	0.000
SP → EM-PR	0.263	0.198	0.219	12.167	0.000
Recruitment → SP	0.518	0.389	0.436	14.065	0.000
Safety → SP	0.551	0.428	0.471	16.241	0.000
Training & Dev → SP	0.568	0.494	0.528	15.529	0.000

Note: All structural paths remain statistically significant at $p < 0.001$.

Source: Researchers Compilation (2025)

Sectoral comparison highlights that pharmaceutical firms consistently outperform other health organizations in EM-PR and SP. This differential is attributable to structured process management, higher adherence to safety regulations, and more formalized training programs. Economically, these results suggest that organizations with stronger institutional frameworks can leverage sustainability initiatives more effectively to maximize labor output and reduce operational inefficiencies (Harvey et al., 2015; Rotea et al., 2023). Moreover, the observed gender and educational distribution indicates a workforce capable of adapting to innovations in sustainability, which is critical for long-term performance gains and cost minimization in dynamic healthcare environments (Almeida et al., 2022; Anitha, 2014).

In summary, the findings provide compelling evidence that both employee management practices and sustainable initiatives jointly enhance organizational performance in Nigerian pharmaceutical and health sectors. The integration of operational consistency, goal-oriented management, timeliness, safety practices, and workforce development generates additive economic benefits, including improved labor productivity, reduced accident and absenteeism costs, and enhanced human capital accumulation. These results corroborate prior research emphasizing the synergistic effects of high-performance HR systems and sustainability interventions on employee performance (Achief et al., 2025; Huo et al., 2021; Luu, 2021). Policymakers and organizational leaders should therefore adopt a holistic approach that combines operational efficiency with sustainability investments to optimize performance outcomes and ensure economic value creation.

Policy Implications

The study underscores the critical importance of embedding sustainable practices within organizational strategies to enhance employee performance in healthcare and pharmaceutical sectors. Policymakers should develop regulatory frameworks that mandate structured training, inclusive recruitment, and health and safety compliance as part of corporate social responsibility requirements. By institutionalizing these practices, firms can improve operational efficiency, reduce absenteeism, and enhance employee engagement, ultimately raising productivity and competitiveness. Empirical evidence suggests that high-performance work systems and sustainability-oriented HR practices positively affect employee outcomes, leading to enhanced organizational profitability (Huo et al., 2021; Achief et al., 2025). Economically, such interventions reduce human capital

wastage and optimize workforce allocation, contributing to sustainable growth in the health sector.

Government agencies should incentivize consistency in management practices and systematic monitoring of performance targets across healthcare organizations. Policies that promote the adoption of standardized procedures reduce operational inefficiencies and ensure better alignment between organizational objectives and workforce output. By implementing measurable performance evaluation systems, regulators can encourage firms to invest in employee development and safety infrastructure, yielding economic returns through increased productivity and reduced resource losses (Zhou et al., 2021; Rotea et al., 2023). From an economic perspective, reducing variability in workforce performance stabilizes output, lowers costs associated with errors or delays, and strengthens sectoral resilience, particularly in critical pharmaceutical production and service delivery environments.

Sectoral policymakers should implement certification and recognition programs for organizations demonstrating excellence in sustainable human resource management and employee safety. By formally recognizing adherence to best practices, firms are incentivized to maintain high standards of workforce management, which can reduce turnover, absenteeism, and occupational hazards (Danna & Griffin, 1999; Awan et al., 2021). Economic reasoning suggests that these measures reduce the hidden costs of workforce inefficiencies and workplace incidents, contributing to more predictable output levels and improved financial performance. Additionally, such policies enhance firm reputation and market competitiveness, attracting skilled employees and promoting innovation within the sector.

Training and development initiatives should be supported through policy interventions such as grants, tax incentives, or subsidized programs targeting skills enhancement in the healthcare workforce. Investment in employee training strengthens human capital by improving task-specific competencies and general adaptability, resulting in more efficient operations and innovation capacity (Almeida et al., 2022; Anitha, 2014). Economically, these interventions increase labor productivity, reduce the costs of errors, and generate higher returns on organizational investment. Workforce upskilling also facilitates knowledge diffusion and process optimization, critical for maintaining competitive advantage in the increasingly knowledge-intensive healthcare and pharmaceutical sectors.

Policymakers should encourage gender-sensitive and inclusive recruitment policies to leverage workforce diversity for enhanced organizational performance.

Evidence indicates that diverse teams exhibit higher problem-solving capacity, creativity, and engagement, which translates into better service delivery and operational outcomes (Achief et al., 2025; Bakker & van Wingerden, 2021). Economically, inclusive HR policies expand the talent pool, increase employee retention, and maximize returns on human capital investment. Furthermore, promoting equity and representation in the workforce can enhance organizational legitimacy and social license to operate, particularly in regulated industries such as pharmaceuticals and healthcare, where societal trust is a key driver of long-term economic sustainability.

Finally, policymakers should establish mechanisms for continuous monitoring, evaluation, and feedback on HR and sustainability initiatives to ensure that organizational investments translate into measurable performance improvements. Linking policy support to performance outcomes allows firms to allocate resources efficiently, reduce wastage, and enhance productivity (Zhu et al., 2018; Rotea et al., 2023). From an economic perspective, data-driven interventions optimize labor utilization, reduce operational risk, and strengthen the sector's capacity to absorb shocks. Moreover, such policies encourage evidence-based decision-making, enabling healthcare and pharmaceutical organizations to sustain competitive advantage, achieve long-term growth, and contribute effectively to national economic development.

CONCLUSIONS

This study provides robust evidence that sustainable human resource management practices significantly enhance employee performance within the Nigerian pharmaceutical manufacturing sector and other health-related organizations. The findings demonstrate that management consistency, meeting targets, timeliness, and the implementation of safety practices directly influence employee management performance, while training and development, health and safety, and inclusive recruitment serve as key determinants of sustainable practices that mediate these outcomes. The results indicate that organizations that strategically integrate sustainability and employee-centered management approaches experience higher productivity, operational efficiency, and workforce engagement. These outcomes align with prior literature suggesting that well-structured HR interventions, coupled with employee well-being initiatives, contribute to organizational effectiveness, reduced turnover, and improved service quality (Huo et al., 2021; Achief et al., 2025; Rotea et al., 2023). From an economic perspective, investments in workforce development and sustainability

not only optimize human capital utilization but also reduce the costs associated with inefficiencies and occupational risks, thus strengthening both firm-level and sectoral performance.

Based on these findings, it is recommended that organizations in the pharmaceutical and healthcare sectors institutionalize formal sustainability and employee management frameworks. Specifically, firms should develop comprehensive training programs that enhance technical and managerial competencies while simultaneously reinforcing safety and health protocols. Inclusive recruitment policies should be adopted to leverage workforce diversity, thereby fostering innovation, problem-solving, and engagement (Bakker & van Wingerden, 2021; Achief et al., 2025). Management should establish consistent performance monitoring mechanisms, linking individual and team targets to organizational objectives to promote accountability and operational efficiency. Moreover, policymakers should create enabling environments through incentives, recognition programs, and regulatory standards that reward adherence to high-performance and sustainability-oriented practices. Future research should explore longitudinal effects of these interventions across multiple sectors to assess the persistence of performance improvements and the broader economic impact of sustainable HR practices. By adopting these recommendations, healthcare and pharmaceutical organizations can enhance employee performance, achieve long-term organizational sustainability, and contribute meaningfully to national economic development.

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