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SPIS TREŚCI

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Zespół Redakcyjny wyraża przekonanie, że aktualny numer „Zeszytów Naukowych Politechniki Częstochowskiej. Zarządzanie" wzbudzi zainteresowanie szerokiego grona odbiorców oraz stanie się impulsem do dalszych, pogłębionych badań w przedstawionych obszarach tematycznych.

Redakcja

Preface

We present to our Readers the 58th issue of "Research Reviews of Czestochowa University of Technology. Management", containing six articles in the field of management sciences, whose authors address current and important issues concerning the functioning of contemporary enterprises. The presented scientific studies are the result of independent empirical research in addition to theoretical reflections, and their common denominator is the pursuit of deepening knowledge about the mechanisms as well as conditions of management in a dynamically changing socio-economic environment. The topics of the studies cover a wide range of issues, such as: tacit knowledge in increasing the innovativeness of enterprises, smell as an element of managing intellectual property rights of modern enterprises, the impact of the closed-loop economy on entrepreneurship, Agile in a public sector unit in Poland on the example of a state information processing institute, the development and future of the affiliate marketing market in Poland, and the bifurcation of exponential growth of reference models. In terms of content, each of the published articles brings significant value to the scientific community, students and management practitioners. The issues presented by the authors are characterized by a high level of topicality and relevance, while the conducted analysis in addition to the formulated conclusions take on particular significance in the context of the contemporary challenges of a political as well as economic nature, which additionally emphasizes the significance of the discussed topics.

The Editorial Team is convinced that the current issue of "Research Reviews of Czestochowa University of Technology. Management" will arouse the interest of a wide range of recipients and will become an impulse for further, in-depth research in the presented thematic areas

Editorial Board

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DEVELOPMENT AND FUTURE OF THE AFFILIATE MARKETING MARKET IN POLAND

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Abstract: With the widespread availability of the Internet and advances in digital technologies, digital marketing and affiliate marketing have experienced significant growth. Affiliate marketing, as an effective form of sales support, has gained popularity along with the proliferation of e-commerce. Most well-known Polish e-commerce brands either manage affiliate programs independently or collaborate with affiliate platforms, and affiliate marketing is increasingly becoming an integral element of marketing strategies in Polish enterprises. This article analyzes selected aspects of the affiliate marketing market in Poland in relation to leading international markets, considering the latest trends, technologies, and practices. The aim of the study is to review applications, assess the significance and examine the development dynamics of this marketing model in Polish business practice, as well as to identify key variables that influence the profitability and competitiveness of affiliate marketing activities. The article employs research methods based on a critical literature analysis, including a review of industry and academic publications. Industry reports and market analyses were also utilized. A desk research analysis was conducted, including financial results reported by selected companies (which integrate affiliate marketing into their strategies) and their case studies. Additionally, a review of the websites of selected affiliate platforms was conducted.

Keywords: affiliate marketing, digital marketing, marketing market, marketing strategies

JEL Classification: M30, M31, M37

Introduction

The history of the Polish affiliate market dates back to the early 20th century. Affiliate marketing has evolved from an online advertising model to a key component of corporate marketing strategies.

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This model provides businesses with an additional communication channel to reach potential customers, enabling improved sales performance at lower costs, which are closely tied to achieved results, thereby enhancing competitiveness.

The development of e-commerce, advancements in technology, the growing importance of social media in shaping public opinion, and increasing consumer awareness, particularly among digitally native generations (Gen Z, Alpha), have contributed to the rising attractiveness of affiliate marketing. This approach supports brand positioning and building relationships with customers. The 21st century has charted corporate development pathways grounded in the paradigms of Industry 4.0 and 5.0, characterized by full process digitalization and the implementation of artificial intelligence – thereby positioning affiliate marketing, built upon these technologies, as a model that significantly enhances potential through advanced offer personalization and the optimization of communication and sales channels. Polish enterprises, particularly in the e-commerce sector, should incorporate affiliate marketing into their strategies while simultaneously analyzing its benefits and the barriers encountered.

Literature review

Research gap in affiliate marketing

Despite the widespread use of affiliate marketing by Polish businesses, this topic remains marginalized in academic literature. Online sources predominantly contain practical content from affiliate platforms and industry portals. Independent studies based on robust empirical data are scarce, leading to discrepancies in industry-reported findings. Data acquisition challenges – particularly from small publishers (micro and nano influencers) and numerous small-scale advertisers – further hinder comprehensive analysis. Digital market data do not explicitly reflect the affiliate market. Therefore, systematizing knowledge through an analysis of both industry data and digital marketing and e-commerce statistics is essential.

Definition and evolution of affiliate marketing

Affiliate marketing is defined as a partnership between advertisers and publishers (affiliates), in which affiliates promote products or services online using affiliate links. This model, also referred to as performance-based marketing, ensures that affiliates receive compensation only when their activities generate the expected results for advertisers, such as product purchases, newsletter sign-ups, or content downloads (Laudon & Traver, 2021; Dwivedi et al., 2017). There are two primary methods of acquiring affiliates: leveraging affiliate networks and establishing in-house partner programs (Olbrich et al., 2019).

The origins of affiliate marketing go back to the 1980s and 1990s. In 1994, Lou Montulli developed cookie technology to track affiliate links, while Dan Kohn executed the first e-commerce sale via an encrypted credit card transaction (Lankiewicz, 2022). The affiliate model was first implemented by PC Flowers Inc., founded in

1989 by William Tobin, connecting 25,000 florists and generating over USD 6 million in sales by 1991 with more than 2,700 partners (Aff 44, 2020). Subsequent innovations, including PizzaNet, Amazon Associates, eBay, and PayPal, initiated the global e-commerce era, fostering the growth of affiliate marketing (Lankiewicz, 2022).

In 2000, the U.S. Federal Trade Commission introduced the first affiliate marketing regulations, followed by the inaugural Affiliate Summit conference in 2003, dedicated to education and knowledge exchange (Telesh, 2023). Between 1996 and 2000, major affiliate platforms such as CJ Affiliate, ShareASale, and Rakuten Marketing emerged, offering complex affiliate campaigns.

Development of affiliate marketing in Poland

Affiliate marketing in Poland gained traction in e-commerce around the year 2000. In 2005, platforms such as Adkontekst, which aggregated popular publishing websites (Wirtualna Polska, Interia, Gazeta.pl), emerged (Ehandel, 2014, cited in Adkontekst). The implementation of legal regulations in online marketing in 2008 improved transparency and security in affiliate activities. Since 2010, social media has played an increasing role, and influencer marketing becoming a key component of affiliate strategy after 2015. The COVID-19 pandemic accelerated e-commerce growth, leading to the establishment of over 66,000 online stores in Poland (Mazurkiewicz, 2024), increasing interest in the affiliate model. Estimates suggest that affiliate marketing accounts for approximately 1% of the global market and is valued at around 1 billion PLN. The market exhibits industry diversification, with e-commerce, financial services, tourism, and recreation being dominant sectors. Affiliate marketing generates approximately 16% of online orders, contributing 8-10% of digital marketing revenues (WPBeginner, 2024).

The increasing interest in affiliate marketing aligns with technological advancements. In 2023, 30 million Poles used the Internet, with 79% making online purchases (Harbingers, 2024). Online shopping is also increasing among individuals over 50 years old (IAB, 2023; Gemius, 2023).

Research methodology

This study uses secondary data from industry reports, specialist portals, and academic publications. A detailed desk research analysis was conducted that included the following:

- financial performance assessments of businesses employing affiliate marketing and corresponding case studies,
- review of affiliate platform websites providing global and industry-specific market statistics,
- analysis of statistical reports, including data from Statista, Strategyand.pwc, IAB.org, and Interaktywnie.com,
- comparison of individual affiliate programs (e.g., Allegro Share, PP Ceneo, X-com, Empik, CCC) and data from affiliate networks (e.g., ceneo.pl, x-com.pl, awin.com, affiliate-program.amazon.pl, money2money.com),

– review of academic literature and industry case studies (Laudon & Traver, 2021; Dwivedi et al., 2017; WPBeginner, 2024; Harbingers, 2024).

These sources facilitated a comprehensive analysis of trends, market dynamics, and the impact of technology on affiliate marketing.

Research findings

Key market data and trends

Affiliate marketing is an integral component of e-commerce sales strategies. Industry research indicates that over 80% of digital brands implement affiliate programs (WPBeginner, 2024).

1. Global Affiliate Market: The global affiliate market is valued at approximately USD 21 billion, with an anticipated annual growth rate of 7.7% from 2024 to 2030. In 2022, US affiliate marketing expenditures reached USD 8.2 billion, accounting for roughly 40% of the global market. During the last decade, the sector has doubled in value, maintaining an average annual growth rate of 10-12% (Ławrowski, 2023, cited in Statista).
2. E-Commerce Market: In 2023, the global e-commerce market was valued at approximately USD 16 trillion, with projections indicating an increase to over USD 57 trillion by 2032 (Mirończuk, 2023). In Europe, online sales revenue is growing at an annual rate of 9-10%. In Poland, the e-commerce market is valued at approximately 140 billion PLN, a significant increase from 30 billion PLN in 2015. By 2028, this figure is expected to reach 192 billion PLN, reflecting the dynamic growth of the industry (Strategyand.pwc, 2024).
3. Impact of Social Media: Social media significantly influences purchasing decisions. Although it is not the primary sales channel, it affects brand perception: 75-80% of younger consumers rely on online reviews and recommendations when making purchase decisions (Stankowska, 2023). Consequently, social media serves as a crucial communication and promotional channel.

Analysis of affiliate platforms

Almost all marketplace platforms in Poland operate their own affiliate programs or collaborate with affiliate networks (Table 1). According to Admitad, e-commerce affiliate programs attracted 10% more publishers than in the previous year, with their earnings increasing by 49%, reflecting the growing significance of affiliate channels in marketplace strategies (PAP MediaRoom, 2024). Major Polish affiliate networks, such as Awin Polska, TradeTracker, and Convertiser, report an annual revenue growth of approximately 20%. For the largest Polish retailers, affiliate marketing revenues constitute around 15% of total e-commerce revenues[2].

[2] None of the analyzed retailers disclose affiliate revenue data in their reports; various values are presented by industry statistics (the provided value is an average derived from these sources).

Table 1. Selected Polish enterprises operating affiliate programs

Enterprise	Program	Financial Data 2023	Platform characteristics
Allegro Sp. z o.o.	Allegro Share: https://allegro.pl/programy-lojalnosciowe/allegro-share	– Total consolidated group revenue (Poland): PLN 77.951 billion, – Adjusted EBITDA (Poland): PLN 95 billion, – GMV: 54.770 billion	– Number of buyers: 19 million, – Number of sellers: more than 140,000, – Number of products: several hundred million
Ceneo.pl Sp. z o.o.	Ceneo Affiliate Program: https://pp.ceneo.pl/		– Number of products offered: 15 million, – Number of users: 17 million
x-kom Sp. z o.o.	Sales Masters: https://salesmasters.x-kom.pl/	– Total revenue: PLN 2.88 billion	– User commission value in 2023: over PLN 1 million, – Commission rates in the program: 1%, up to 20% for selected products, – Number of products: 30,000
Empik SA	https://www.empik.com/program-partnerski	– EBITDA: PLN 265 million, – Total sales value in e-commerce channels: over PLN 3 billion	– Influencer program, – Settlement models: CPS, CPC, hybrid model, – Empik.com GMV: 28% YoY, – Ranked among the top 4 e-commerce platforms in Poland (number of users), – Marketplace (EmpikPlace) GMV: 54% YoY
CCC SA	https://ui.awin.com/merchant-profile/16072	– Total net sales revenue: PLN 9.44 billion, – EBIDTA: PLN 778.4 million	– Number of e-commerce platforms within the CCC Group: approximately 90, – Collaboration platform: Awin

Source: Own elaboration based on data provided by (Bankier, 2024; BusinessInsider, 2024; Ceneo, 2024; Łuczak, 2024; WirtualnyWydawca, 2024; X-com.pl, 2024; Uryniuk, 2024)

Among the most popular affiliate programs in Poland are Leadstar, Admitad Store, Comperia Lead, Money2Money, Allegro Share, Ceneo Partner Program, My Lead, and Convertiser. The growth of affiliate marketing is driven by medium and large e-commerce enterprises. The leader of the domestic e-commerce market is Allegro, a platform and application with 19.3 million users in Q4 2023. Referral traffic accounted for 38% of online store visits, confirming the importance of traditional affiliate channels (Załęska, 2024; IAB, 2023). Polish enterprises operating affiliate programs diversify their remuneration models and leverage the synergy of

domestic reach, confirming the significant impact of these factors on program effectiveness. Financial outcomes, together with the number of users and products encompassed by these programs, underscore the dominant role of e-commerce in affiliate marketing and demonstrate that operational scale constitutes a critical determinant of competitiveness.

Foreign markets – comparative analysis

In the USA and Western Europe, global affiliate networks such as Amazon.com, Inc., CJ Affiliate, Awin AG, and Rakuten Group, Inc. dominate the market (Table 2).

Table 2. Affiliate platforms and partner programs in the USA, UK and Germany

Country	Dominant Affiliate Platforms	Largest Companies with Affiliate Programs	Dominant Industries
USA	Amazon Associates, CJ Affiliate (by Conversant), Rakuten Advertising, Awin	Shopify Inc., eBay Inc., Amazon.com, Inc., Walmart Inc., Apple Inc.	– E-commerce and retail (e.g., Walmart) – Technology and software – Finance – Lifestyle and health (including fitness, supplements)
Germany	Awin, Amazon, Vivnetworks	Zalando SE, Otto GmbH & Co KG, MediaMarktSaturn Retail Group, eBay Inc., Kaufland Ost-Europa Beteiligungs-GmbH	– E-commerce – Consumer electronics – Clothing and footwear – Finance (insurance, loans)
United Kingdom	Awin, CJ Affiliate, Rakuten Advertising	Amazon UK Services Ltd, ASOS.com Limited, John Lewis Partnership PLC	– Retail and fashion (ASOS, Next plc.) – Finance (credit cards, online banking) – Travel (Expedia Group, Inc., Booking.com)

Source: Own elaboration based on industry portal analysis

In 2023, the number of American electronic brands employing affiliate strategies increased by 11%, contributing to the revenue growth of publishers (Paszport do WS, 2023). In Western Europe, the market is dominated by the United Kingdom and Germany, with France, Italy and the Netherlands also exhibiting significant potential. The affiliate marketing model is similarly popular in Australia, Canada, Japan, and Brazil (Ławrowski, 2022). The largest affiliate networks collaborate with more than 100,000 entities, including Awin (15,000 advertisers and 100,000 publishers), CJ Affiliate (7,000 publishers), and Amazon Associates (more than 900,000 participants).

The most popular affiliate sectors include fashion (18.7% of the referral market), sports and outdoor activities (more than 14%), as well as health, travel, home furnishings, electronics, and education. Affiliate marketing accounts for approximately 16% of global e-commerce sales, reaching up to 25% for major brands (Ławrowski, 2022, citing Influencer Marketing Hub and AmNavigator). The largest platforms offer comprehensive 360-degree services, including performance-based settlements and brand awareness building (Łukianiuk, 2024). The affiliate marketing budget is estimated to constitute approximately 9% of online marketing expenditures. Global e-commerce retail sales exceeded USD 4.1 trillion in 2024, with an expected average annual growth rate of 9.5%, reaching an estimated USD 6.5 trillion by 2029 (van Gelder, 2024; Statista, 2024). The most popular global e-commerce platforms include Squarespace Online Stores, WooCommerce (6.1 million websites in 2023), and Shopify (4.1 million websites) (Builtwith, 2023a; Builtwith, 2023b; Cyrek, 2024). A comparative analysis of Poland's affiliate marketing market with leading foreign markets is presented in Table 3.

Table 3. Comparative characteristics of affiliate marketing markets

Affiliate Marketing	Poland	Western Europe and the USA
Market	Growing	Developed
	Primarily in e-commerce	A component of marketing strategies across multiple sectors
	High-level technological infrastructure and internet access. New technologies in the implementation phase	Technologically advanced. New technologies are revolutionizing affiliate campaigns
	Development of tracking technologies	Tracking technologies based on AI
	Growing competition. Small budgets	High competition. Large budgets
Dominant Compensation Models	Models based on CPA (Cost per Action) and CPC (Cost per Click). Payment method: primarily bank transfers	Compensation models vary by industry, including hybrid models like CPC, CPA, CPL, CPS. Preferred payment method: PayPal
Marketing Strategies	Personalized local campaigns	Based on automation, AI, Big Data. Using global affiliate tools (e.g., Google Ads, Amazon Associates)
Affiliate Platforms and Partner Programs	Numerous small and medium-sized affiliate networks – higher competition. Standardization of processes is difficult. Popular local platforms (e.g., webePartners,	Many global affiliate platforms, such as CJ Affiliate, Awin, or Rakuten, including industry-specific platforms

Affiliate Marketing	Poland	Western Europe and the USA
	Comperia Lead, Money2money, eBroker Partner) and affiliate programs (e.g., Allegro Share, PPCeneo, mBank). Smaller reach. Businesses often use international affiliate networks	
Legal Regulations	Growing requirements for personal data protection (RODO). E-commerce, advertising, consumer rights, and intellectual property laws apply, affecting market structure, user tracking, and content responsibility	In Western Europe, high data protection standards (GDPR). In the USA, regulations are less restrictive. CCPA (California Consumer Privacy Act) influences international marketing activities, requiring strategic adaptation
Industries and Advertising	E-commerce, fashion, beauty, sports, electronics, finance, tourism, less used in sectors like education, and insurance	E-commerce, fintech, tourism, health and beauty, education, insurance, and gaming. In Western Europe, there is a trend to recommend eco-friendly products
Costs	Lower customer acquisition costs and conversion rates	Higher conversion rates, higher customer acquisition costs
Communication	Dominated by social media communication (Facebook, Instagram)	Dominated by social media communication (TikTok, Instagram). In the USA, blogs are very popular. High participation in mobile activities
Consumer Behavior	High price sensitivity (affiliate programs utilize discounts, promo codes). High user sensitivity to recommendations. Popularity of price comparison websites. Growing role of influencer marketing	Higher level of consumerism and risk-taking tendencies, greater openness to new technologies, significant importance of brand positioning, and a major role of influencer marketing
Personalization and Sales Process Automation	More personalized recommendations and offers, implementation of AI technologies, and data-driven marketing	Data-driven marketing and artificial intelligence as the standard approach

Source: (AffNews.pl, 2024), own elaboration based on desk research of industry portals

Improvement in Poland's digital infrastructure favors the growth of affiliate marketing, although advanced technologies and their integration costs pose barriers to smaller enterprises. The adoption of hybrid remuneration models and alternative

payout systems may increase the attractiveness of affiliate programs. As the digital transformation progresses, affiliate marketing will consolidate its place within corporate strategies by refining attribution through interdisciplinary partner collaboration.

Regulatory and data security aspects

The significance of ethical considerations, social responsibility, and data security in affiliate marketing is continuously increasing:

1. National Supervision and Regulations: In Poland, the main regulatory body overseeing online commercial activities is the Office of Competition and Consumer Protection. Affiliate activities are subject to the Civil Code, the Personal Data Protection Act, and additional restrictions for specific industries. Affiliates must obtain consent for data processing and transparently inform users about cooperation principles and settlements. Affiliate agreements define collaboration terms, commissions, and brand usage regulations (Matula, 2024). Regulatory frameworks cover RODO (GDPR) compliance as well as advertising, e-commerce, consumer rights, and intellectual property laws. On 1 January 2023, amendments to the Consumer Rights Act and the Civil Code, implementing Directives 2019/2161 ("Dyrektywa Omnibus"), 2019/771, and 2019/770, came into effect (GrantThornton, 2023).
2. International Regulations: In the USA, affiliate marketing is regulated by the Federal Trade Commission (FTC), while in the European Union, in addition to national regulations, GDPR imposes strict data collection and processing rules (AffPact, 2023).
3. Data Security: With the increasing awareness of privacy and emerging abuses, affiliate entities must implement technologies that ensure data security, such as blockchain and GDPR-compliant procedures (AffPact, 2023).
4. Guidelines for Entrepreneurs: Businesses should expand their knowledge of affiliate marketing through independent reports, expert publications, and legal advisory services specializing in this sector.

Digital communication and technologies supporting affiliate marketing

Advertising in Social Media and Digital Communication: The Internet hosts more than 5 billion users, with 4.7 billion actively using social media. Global social media advertising expenditures amounted to approximately USD 207 billion in 2023, with projections reaching USD 247 billion by 2027 (Cyrek, 2024, citing Statista, 2024). Users spend an average of 2.5 hours daily on social platforms, engaging with brand-related content (49.5%) and listening to podcasts (23.4%) (Polewko, 2022; Polewko, 2023). In Poland, 88% of Internet users access the Web and 66.3% use social media, with Facebook being the most popular platform. Affiliate communication channels also include social commerce, mobile applications, email marketing, SMS, Google Ads campaigns, sponsored advertisements, webinars, and video marketing. These trends facilitate precise budget allocation within omnichannel strategies. The development of cooperation models and technologies positions Poland as an attractive

market for affiliate investments (AffNews, 2024). In 2023, digital communication accounted for 53% of the advertising budget, reaching nearly 7.8 billion PLN, underscoring the effectiveness of the Internet as an advertising medium (Kolenda, 2024; IAB, 2023).

Advanced Technologies in Affiliate Marketing: Large Polish enterprises follow global trends by implementing advanced but costly solutions, while smaller entities with limited budgets often lag behind. Technologies such as generative AI, Big Data, machine learning (ML) and blockchain are revolutionizing affiliate marketing. Advanced analytics tools enable consumer behavior tracking, precise targeting, real-time campaign automation, and optimization. Advertising platforms (e.g., Google Ads, Facebook Ads) and analytical tools (e.g., Google Analytics) support business intelligence and trend forecasting, allowing market adaptation (Kozłowski, 2023; CubeGroup, 2024).

Cookies: A significant event for the affiliate market was Google's LLC decision to halt the elimination of third-party cookies, which were used to track online user behavior. While intended to enhance user privacy, this move raised concerns in the advertising industry regarding reduced digital ad effectiveness and revenue. Privacy-centric alternatives, such as Google API Privacy Sandbox, are being developed to comply with new regulations (Sawicki, 2024).

Conclusion

An analysis of secondary data and literature suggests that affiliate marketing is a dynamically evolving and increasingly significant component of marketing strategies in Poland and globally.

1. Growth and Dynamics of the Market: The global affiliate and e-commerce markets have been experiencing long-term growth, offering small and medium-sized enterprises (SMEs) in the e-commerce sector opportunities to increase online sales with minimal investment risk. 31% of publishers consider affiliate marketing to be one of their primary sources of revenue (Interaktywnie, 2023; cited in Kinsta).
2. Affiliate Marketing in Poland: Polish affiliate platforms provide partners with a wide range of tools supporting effective marketing activities in industries such as e-commerce, finance, travel, and gaming. The increasing share of e-commerce in total retail sales outlines promising prospects for affiliate marketing.
3. Development Directions: Emerging shopping habits, including the growing popularity of mobile commerce and the expansion of influencer marketing as a key strategic component for many brands, necessitate the optimization of sales strategies (Niemczyk, 2024; IAB, 2023). Niche markets are also expanding. Conversion metrics such as registrations, downloads, and sales have demonstrated double-digit growth since 2023 (King, 2024; eMarketer, 2024). Global trends indicate increasing investments in digital channels, including social media, mobile content, and online video, which contribute to brand awareness and long-term customer relationships.

4. The Role of Technology: The implementation of AI, ML, Big Data, and blockchain significantly enhances the effectiveness and security of affiliate marketing campaigns. Process automation, precise targeting, and advanced analytics enable the optimization of marketing strategies, becoming critical competitive factors for businesses (eMarketer, 2024).
5. Regulatory and Legal Aspects: Compliance with regulations, including RODO and local legislation, is fundamental to building trust among partners and consumers. Transparency in affiliate activities, ongoing education, and continuous market monitoring are essential to mitigate the risks associated with fraudulent practices.
6. Recommendations for Businesses:
   - Expand market knowledge by utilizing independent reports and expert analyses.
   - Invest in modern technologies that support campaign automation and personalization.
   - Ensure transparency and compliance with applicable legal regulations to foster trust among customers and partners.
   - Monitor trends such as the evolution of influencer marketing, subscription-based affiliate models, new communication channels (e.g., metaverse, Web3), and B2B partnerships based on technological collaborations to quickly adapt to changing market conditions.
   - Implement innovations that enhance brand visibility and generate additional revenue streams.
7. Recommendations for Addressing Research Gaps in the Affiliate Marketing Market:
   - Standardizing data collection methodologies and secondary data analysis – developing unified procedures, tools, and terminology to facilitate the comparison of industry research results and measure the effectiveness of affiliate marketing activities.
   - Adopting an interdisciplinary research approach – combining quantitative and qualitative methods to comprehensively assess challenges, barriers, and benefits of affiliate marketing.
   - Conducting empirical studies on the effectiveness of the affiliate model in sectors characterized by a high degree of market fragmentation.

Rapid technological advancement, evolving consumer purchasing trends, and intensifying digital competition indicate that affiliate marketing is poised to become an indispensable component of corporate marketing strategies. Companies should integrate affiliate initiatives, leveraging low entry costs and advanced technologies to enhance brand visibility, generate incremental revenue, and build long-term customer relationships. Market saturation with personalized offers has led to user fatigue and declining engagement, necessitating the provision of more valuable, engaging content and the exploration of underexploited domains, such as social campaigns, public health, sustainability, non-profit organizations, and sponsorship to align business objectives with social responsibility. The implementation of these

initiatives requires credible messaging, transparency, and responsible partner selection to preserve the primacy of pro-social goals, as well as the effectiveness and competitiveness of the undertaken activities.

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ROZWÓJ I PRZYSZŁOŚĆ RYNKU MARKETINGU AFILIACYJNEGO W POLSCE

Streszczenie: Wraz z egalitaryzacją Internetu i postępem technologii cyfrowych nastąpił intensywny rozwój digital marketingu i powiązanego z nim marketingu afiliacyjnego. Afiliacja jako efektywna forma wspierania sprzedaży zyskała popularność towarzyszącą rozpropagowaniu handlu elektronicznego. Większość polskich rozpoznawalnych marek w e-commerce prowadzi samodzielnie programy partnerskie lub współpracuje w tym zakresie z platformami afiliacyjnymi, a marketing afiliacyjny coraz częściej staje się elementem strategii marketingowych polskich przedsiębiorstw.W artykule przeanalizowano wybrane aspekty rynku marketingu afiliacyjnego w Polsce na tle wiodących rynków zagranicznych z uwzględnieniem najnowszych trendów, technologii i praktyk. Celem pracy jest

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przegląd zastosowań, ocena znaczenia i dynamiki rozwoju tego modelu marketingu w polskiej praktyce biznesowej oraz identyfikacja kluczowych czynników wpływających na opłacalność i konkurencyjność działań. W artykule wykorzystano metody badawcze oparte na narracyjnej analizie literatury przedmiotu obejmującej przegląd publikacji branżowych i naukowych. Wykorzystano m.in. raporty branżowe i analizy rynku. Przeprowadzono analizę desk research obejmującą wyniki finansowe raportowane przez wybrane (uwzględniające w swojej strategii marketingowej działania afiliacyjne) przedsiębiorstwa oraz ich case study. Dokonano przeglądu witryn internetowych wybranych platform afiliacyjnych.

Słowa kluczowe: marketing afiliacyjny, marketing cyfrowy, rynek marketingu, strategie marketingowe

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SCENT AS AN ELEMENT OF INTELLECTUAL PROPERTY RIGHTS MANAGEMENT IN MODERN ENTERPRISES

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Abstract: Nowadays, implementing effective management strategies is a key condition for the functioning of enterprises on the market. The strategies themselves include many activities that are diverse and multidirectional. One of them is the effective management of intellectual property rights, which may also be reflected in the company's marketing activities. An example of such action is the concept of so-called sensory marketing affecting customer senses such as smell and taste. The aim of the article is to analyze the legal possibilities of protecting scents used in enterprise marketing strategies. The article is of a theoretical nature and contains a review of the literature on the subject in addition to court decisions in the discussed area. Due to the diversity of legal systems and difficulties in interpretation, criteria for the interpretation of unclear regulations have been indicated. Conclusions: currently, there are different systems for protecting intellectual property rights in the world, which are not uniform. Entrepreneurs can choose more advantageous system.
Keywords: sensory marketing, intellectual property, scent trademark

JEL Classification: K29, M31

Introduction

The observed growth in the importance of the global market combined with the simultaneous depreciation of regional and local markets is a challenge for contemporary enterprises. These entities are struggling with various challenges, among which competition is at the forefront. In connection with the above, enterprises are forced to implement actions resulting in raising the level of competitiveness in all areas of their activity from effective human resources management through the implementation of innovation strategies in marketing activities. While the marketing

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strategy itself, aimed at convincing consumers to the products or services offered by the enterprise, has been known and used for many years, the actions that make up this strategy are subject to change. In the 1970s, the appropriate location of the retail outlet and pricing policy were considered of key importance. In the 1980s, actions promoting a modern design and customer service were added to the aforementioned location. In the 1990s, loyalty programs came to the fore (Sullivan & Adcock, 2003, p. 100). Currently, new methods and actions are being sought, among which the concept of sensory marketing, understood as actions involving the engagement of consumers' senses and influencing their behavior, is becoming increasingly popular (Krishna, 2010, p. 2). Sensory marketing has garnered significant attention from researchers due to its ability to effectively influence consumer behavior at a subconscious level (Pandey & Tripathi, 2025). Sensory marketing uses external stimuli that are received by consumers through their senses: smell, sight, touch, taste, hearing.

Due to the fact that, until recently, it was not legally possible to register individual tastes and scents as separate trademarks, the issue under analysis represents a novelty in the intellectual property rights management strategies of modern enterprises. Consequently, it has not been widely described in the literature as thoroughly as traditional forms of trademark representation. This topic is also interesting because of the lack of uniformity in the legal regulations and procedures applied by different patent offices. The legal registration of scents represents a new element in intellectual property management strategies and may serve as a foundation for sensory branding. In practice, there is a lack of Polish literature in this field, and most of the available knowledge is based on American publications. The current customs policy of the United States and the reactions of individual countries do not contribute to reaching an agreement on matters related to intellectual property protection either. This may result in a deepening divergence in the systems of rights protection.

The article presents the legal possibilities of protecting and managing scent as an element of intellectual property rights of modern enterprises. The aim of the article is to analyze the legal possibilities of protecting scents used in the marketing strategies of enterprises. Owing to the diversity of legal systems and interpretation difficulties, the criteria for interpreting unclear regulations are indicated.

Methods

Scientific problem: can scent be an element of intellectual property law in the light of current legal regulations? In connection with the above, is it possible to protect scent as an element of intellectual property law under the current legal regulations?

The article is theoretical in nature, containing a review of the literature on the subject and court decisions in the analyzed scope. The legal analysis included national regulations, including the Polish Act of 30 June 2000 – Industrial Property Law (Ustawa z dnia 30 czerwca 2000 r.) and acts of Community and international law. Because of the fact that selected areas of economic life were regulated by the provisions of Community and international law, interpretational doubts arose on the basis of the application of these provisions and national regulations. The above

doubts are very often resolved as a result of court proceedings, the case law of which is also not uniform. As a result, the protection and effective management of intellectual property rights is hindered, and in consequence, the competitiveness of enterprises on the market decreases.

Literature review on the legal possibilities of protecting scent as an element of intellectual property rights

Innovative marketing strategies allow an increase in the sales results of products and services only until competitive companies implement similar marketing activities. Therefore, the issue of protecting one's own strategies from unauthorized imitation is crucial. In the case of the idea of sensory marketing, including aroma marketing, it is possible to use the tools provided by legal regulations on trademarks.

Scent marketing, also known as aroma marketing, is based on the use of smell as the most reliable human sense and using it in the consumer's decision-making process. An abundance of research, observations and studies around the world have shown that various smells have an impact on people's changing moods, preferences, and emotions (Berčík et al., 2021). As indicated by Michalska-Dudek (2009), "aroma marketing helps to create an atmosphere of freedom and trust, make a lasting impression on the customer (marking the existence of a given company in their consciousness), encourage the customer to stay longer, and even influence an increase in the willingness to buy, and thus increase the company's revenues". In turn, Rudzewicz (2010) points out the fact that "smell affects the customer's emotions often without their conscious participation. This is so important, because according to specialists' estimates, up to 75% of purchasing decisions are made under the influence of emotions. Companies that use scent marketing are perceived as more prestigious and exclusive". Hultén et al. (2011, p. 17) speak in a similar vein, claiming that sensory marketing enables the creation of a company image associated with the identity, lifestyle or personality of the customer.

Scent as an element of a company's identity is increasingly used in various industries, initially in establishments offering cosmetic products, then in restaurants, and currently even on board airlines. It is associated and remembered by consumers, evoking positive emotions and satisfaction with the service provided (Wan Yun & Yazdanifard, 2013).

According to art. 120 section 1 of the Industrial Property Law, "a trademark may be any marking that allows the goods of one company to be distinguished from the goods of another company and that can be presented in the register of trademarks in a way that allows for the determination of an unambiguous and precise subject of the granted protection". It is known that trademarks play an important role in the process of creating a positive image of a company and building its own brand. The most popular forms of trademarks are verbal, graphic, verbal-graphic, spatial, verbal-graphic-spatial and sound markings. However, increasingly more often all over the world, the subject of applications to patent offices are unconventional trademarks occurring in the form of scents, tastes or gestures (Konopka, 2016). This gives rise to interpretative and procedural disputes, the resolution of which is of significant

importance for businesses and the amendment of the aforementioned regulations. Unconventional trademarks have not been specified in any normative act, hence it can be assumed that there is no closed catalogue of these marks. This means that there is a legal possibility of filing a trademark that does not belong to the above categories. Furthermore, it is worth noting the existence of certain marks in economic turnover that have distinctiveness, but cannot necessarily be presented graphically. Wojcieszko-Głuszko (2013) even indicates a classification of the above-mentioned marks. According to the aforementioned author, based on the criterion of the way the mark is perceived, visible and invisible marks can be distinguished. Among the former, the following can be distinguished: holograms, moving marks, positional marks and gestures. Invisible marks, on the other hand, can occur in the form of scent marks, taste marks and tactile marks.

Scent marks are indicated in the literature on the subject as unconventional invisible marks (Wojcieszko-Głuszko, 2013). As a rule, they are perceived by the sense of smell and can be registered, provided they are presented in graphic form. In practice, however, this is difficult to achieve, because current court decisions do not recognize the recording of the chemical composition of a specific compound or a verbal description or sample of the scent. The so-called 7 Sieckmann criteria stand in the way. In case no. C-273/00 Ralph Sieckmann vs. Deutsches Patent – und Markenamt, the European Court of Justice (ECJ) ruled that every trademark must be capable of being presented graphically, taking into account 7 requirements, i.e. it must be: clear, precise, complete, easily accessible, understandable, durable and objective. In the case of scent marks, in practice the greatest problem occurs in relation to the criterion of scent durability. This is therefore an obstacle to the registration of scent marks in European patent offices.

The President of the Patent Office of the Republic of Poland expressed a similar opinion, citing the aforementioned ECJ ruling no. C-273/00, stating that it is currently not possible to register olfactory marks "because it is not possible to define their subject of protection in a clear and precise manner using generally available technology" (UPRP, 2023). Examples of olfactory trademark applications are presented in Table 1.

Table 1. Sample applications for fragrance marks

The scent of lily of the valley flower	Z. 220307 proceedings discontinued by the Patent Office of the Republic of Poland
The smell of freshly cut grass	EUTM 000428870 application registered (currently the registration right has expired)
Graphic representation of a special fragrance: grassy green note, citrus (bergamot, lemon), floral rose (orange, hyacinth scent), musk	EUTM 000521914 application rejected

Source: (UPRP, 2023)

In practice, the Office for Harmonization in the Internal Market (OHIM) has registered only one olfactory trademark. It is the scent of freshly cut grass for a manufacturer of tennis balls, interestingly – the protection period has already expired and has not been extended by the manufacturer (UPRP, 2015).

While in Europe there is no legal possibility of registering olfactory marks, it is possible in the United States or China (Fu, 2021). In the United States, there is no requirement for a graphic representation of the trademark, which is why an olfactory trademark was registered in 1990 – the scent of the Plumeria flower for Celi Clarke embroidery thread (US 758429) (Przytuła & Basałaj, 2019).

In 1995, Manhattan Oil obtained protection for three fragrance trademarks: "Super Charged Strawberry", "Cherry Bomb", and "Groovy Grape" for automotive engine lubricants (US Trademark Registration 2568512, 2596156, 2463044). When mixed with fuel during combustion, the product produces the scent of strawberries, cherries, and grapes, respectively (Burton Ong, 2008). The above-mentioned products are presented in Figure 1.

Figure 1. Manhattan Oil Scented Fuel Additives

Source: (Manhattan Oil, 2023)

Another well-known example of a fragrance mark registration is the fragrance of Hasbro's "Play-Doh" mixture obtained on May 15, 2018 in the United States. The registration certificate for this mark is shown in Figure 2.

"Sweet, slightly musky. Vanilla-like. Slight overtones of cherry. Natural smell of a salted, wheat-based dough". This is how the globally recognized scent of Play-Doh modeling compound is described. It is recognized not only by children but also by their parents, who fondly recall the carefree days of childhood. R. Polk Wagner, an expert on intellectual property law at the University of Pennsylvania Law School, said, "Not everybody can say they have the world's most distinctive scent" (Siegel, 2018, p. 1). Defined, protected, and used in marketing strategies, this scent undoubtedly constitutes a competitive intangible asset for the Hasbro company. It provides an advantage over the competition by offering a sense of product originality and simultaneously appeals to customer loyalty. The scent itself is an integral part of the product, which also includes the color and chemical composition of the compound.

The original Play-Doh scent has also been used in another Hasbro product – a unisex cologne (The Library of Fragrance Play-Doh, 2025). This example demonstrates the real potential of using a registered scent to promote other products.

United States of America
United States Patent and Trademark Office

NON-VISUAL PLAY-DOH SCENT MARK

Reg. No. 5,467,089
Registered May 15, 2018
Int. Cl.: 28
Trademark
Principal Register

Hasbro, Inc. (RHODE ISLAND CORPORATION)
1027 Newport Avenue
Pawtucket, RHODE ISLAND 02862

CLASS 28: Toy modeling compounds

FIRST USE 9-12-1955; IN COMMERCE 9-12-1955

The mark is a scent of a sweet, slightly musky, vanilla fragrance, with slight overtones of cherry, combined with the smell of a salted, wheat-based dough

SEC.2(F)

SER. NO. 87-335,817, FILED 02-14-2017

Figure 2. Hasbro fragrance trademark registration certificate for Play-Doh mixture

Source: (Samuels, 2023)

The examples provided are clear evidence of the need to regulate scents as an element of intellectual property rights. Scents are currently used in many industries. In some cases, entrepreneurs register scent trademarks in intellectual property protection systems that allow such procedures. Other entrepreneurs use national regulations on unfair competition or, to a limited extent, copyright law to protect scents. There is no doubt that the lack of action on the part of the European Union in the field of the liberalization of regulations on the registration of scent trademarks will result in an outflow of entrepreneurs to other protection systems (the United States or China).

Conclusion

Implementing new marketing strategies is a necessity today. So-called sensory marketing, which affects human senses, in particular smell and taste, is becoming increasingly popular. As a consequence of the constantly growing level of competitiveness on the global market, it is not only the implementation of the idea of sensory marketing by modern companies that is important, but also the protection of specific

scents and flavors against unauthorized use by third parties. The condition for achieving the above goal is to obtain the right to register a specific scent or flavor in the form of a trademark in patent offices.

Unconventional trademarks, including scent trademarks, are becoming an increasingly common tool for building one's own competitive strategy. The previously unfamiliar concept of sensory branding is part of a broader approach to intellectual property management. Taking action in this area has become a necessity in an increasingly competitive environment. In this context, scent trademarks and their role in aroma marketing are of key importance. Currently, in the era of a global economy based largely on knowledge and modern technologies, the management of intellectual property rights is a necessity. Among the commonly known resources of companies, it is intellectual property rights that are slowly becoming the most valuable asset, pushing the others to the sidelines. Unconventional trademarks are increasingly the subject of applications in patent offices around the world. To date, only a few of the applications have obtained rights for registration, but there is no doubt that it is only a matter of time before the regulations are amended to allow new forms of trademarks. On the other hand, under the current regulations, it is also possible to register unconventional trademarks, but it is necessary to meet the so-called 7 Sieckmann criteria (Konopka, 2021). Therefore, there is great interest in registering scents, flavors or gestures, which until now were available to all interested parties. In this aspect, aroma marketing can be an element of managing intellectual property rights. Due to the ongoing processes of economic globalization and the growth in competitiveness not only between individual enterprises, but also between entire economies, it is important to adapt the legal order to the constantly changing reality. Currently, there is a possibility of choosing a trademark protection system. As a result, entrepreneurs will choose the more favorable protection systems and ignore the less favorable ones. Hence, the lack of amendment to the European regulations on the protection of scent trademarks will result in the outflow of enterprises to other intellectual property protection systems (Chinese or the United States). The above effects are already visible today in the sphere of production owing to the assumptions of the so-called Green Deal and the resulting very high costs of electricity in Europe. The solution to the problem is to amend the Community law in the field of trademark protection by liberalizing the regulations and enabling the registration of scent trademarks.

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ZAPACH JAKO ELEMENT ZARZĄDZANIA PRAWAMI WŁASNOŚCI INTELEKTUALNEJ WSPÓŁCZESNYCH PRZEDSIĘBIORSTW

Streszczenie: Wdrażanie efektywnych strategii zarządzania stanowi współcześnie kluczowy warunek funkcjonowania przedsiębiorstw na rynku. Same strategie obejmują wiele działań, które są zróżnicowane i wielokierunkowe. Jednym z nich jest efektywne zarządzanie prawami własności intelektualnej, które może się przejawiać także w działalności marketingowej przedsiębiorstwa. Przykładem takiego działania jest koncepcja tzw. marketingu sensorycznego oddziałującego na zmysły klientów, takie jak węch czy smak. Celem artykułu jest analiza prawnych możliwości ochrony zapachów stosowanych w strategiach marketingowych przedsiębiorstw. Artykuł ma charakter teoretyczny i zawiera przegląd literatury przedmiotu oraz orzecznictwa sądowego w omawianym zakresie. Z uwagi na różnorodność systemów prawnych i trudności interpretacyjnych wskazano kryteria interpretacji niejasnych uregulowań. Wnioski: obecnie na świecie istnieją różne systemy ochrony praw własności intelektualnej. Nie są one jednolite. Przedsiębiorcy mogą dokonywać wyboru korzystniejszych systemów.

Słowa kluczowe: marketing sensoryczny, własność intelektualna, znak zapachowy

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BIFURCATIONS OF EXPONENTIAL GROWTH OF REFERENCE MODELS

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Abstract: The article discusses the determinants of taking power, its formula and effects on the social structure, and the perception of value. The analyses were conducted in the ontological trend using field interpolation in game theory. The nature of the work has the characteristics of intuitionist polemics. The main aim of the paper is the issue of a broadly understood reference model in the aspect of options for its creation and redesign. The analyses were conducted by identifying topologically uniform structures and cluster structures in relation to the typing of business model forms. The presented content may be helpful in design analyses of spatial order, as well as infrastructural and management projects. Initiating a mathematical and visualization perspective and a design research methodology formulated on this basis may constitute a new research perspective using the topological measure of exponential growth. The article is a theoretical discussion based on a literature review that covers the issues of cost management with the use of reference models.

Keywords: bifurcation, exponential growth, functional, game theory, multiple reality, reference model

JEL Classification: A12, A13

Introduction

The principle of the reason for existence (ultimate reason), as a general expression of causality, is the "embedding" of our knowledge in a contingent, variable, and pluralistic reality (Krąpiec, 2000, p. 107). In this sense, the logic of ruling has no

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translation into a rational system of values, and its main exponent is the desire to dominate and take over space from the weaker. According to social structures, only a few can enjoy unprecedented wealth at the expense of the vast majority of those who work for this existence, and the larger the zone of poverty or slavery, the greater the scale of wealth for the chosen ones. Everything in the world around us evolves, the invariant, i.e., functional nature of human behavior remains the ambivalence of power, money, and pleasure at all costs, regardless of the costs of the human and natural systems subordinate to us, to which we usurp the right by creating our own rules of social order (Grygiel, 2021, pp. 160-180).

Historians, political scientists, and philosophers deal with man in the context of his social class affiliation, when they talk about the agricultural, intelligentsia, or the so-called middle class. Analogously to European thought, references to zones, classes, castes, and the general affiliation of an individual to social groups can be found in secular and religious totalitarian ideologies. Why? Because prosperity, as it sounds, is a commodity. To have it, you either have to work hard in a democratic system or take over the potential of others in totalitarian systems. According to the assumptions of Fermi zones, you have to have a specific spin to get out of your location. The question is: where do you really want to be, where with whom, when, in what place, and in what place according to what rules? In the case of an infinite time horizon, the optimal strategy is sought among stationary strategies. The optimal stationary strategy is defined as the strategy with the largest value of q, i.e. with the largest increase in the expected payoff in the next step after achieving stationarity (Decewicz, 2011, s. 74), (1):

$$v_i(n) = q_i + \sum j \in S \qquad (1)$$

In each of the decisions assumed n (changes), we can obtain the expected payoff v_i increased by the options of subsequent changes (payoffs) – if we choose for each task the assignment of possible solutions of the state $j \in S$. In order to identify the options of moving to a higher stage (zone) of existence and making decisions, it is necessary to determine the environmental conditions, the category of the zone, the potential of the unit and its attachment options, and the chosen strategy that is to serve this purpose, creating a reference model of correlation and assignment in a given zone.

The article was prepared using the method of critical review of the existing scientific literature. The selection and analysis of the literature were based on data obtained from the Scopus database and from secondary sources.

The aim of the study is to make the presented content useful in design analyses of spatial order, infrastructure, and management projects.

Field interpolation in game theory

In order to get out of the lower zone, the particle must have a specific spin, or a specific energy of getting out of a given space at a given speed of this change, momentum. In the real world, we are talking about relational systems, the possibility

of connecting to someone stronger from a higher zone, or taking over power and displacing status. Nevertheless, it is precisely the aforementioned rituals of behavior anointed by the superior power (secular or ecclesiastical), caste, regime, and tyranny that limit the individual's drive to achieve happiness and satisfaction with the quality of life. The mutation operator marginalizes the loss options by marginalizing the gain p (payout) in the inverse of the max function operator j - condition, x_i player (2):

$$\prod_{i=\infty}^{n} \prod_{j=1}^{n} p_i(x_i) \rightarrow \min \forall f_i \qquad (2)$$

Each player has a set limit on decision-making strategies and a winning condition p_j. relative to their adaptation j. The value of the probability of winning (while minimizing losses) depends on the behavior of other players, assuming that they will play:

1. Against each other, making the most probable equilibrium the antagonistic equilibrium in a tautological distribution.
2. Against each other in dissimilar, multiple groups, where uncertainty equilibrium will be most likely. P
3. In agreement with the group (both single and multiple) in opposition to the antagonistic option.

The effectiveness of strategy implementation is determined by a clearly defined goal but also by the options for changing it through a mixed strategy. As Wolny (2006, p. 70) points out, if there is no possibility of exchanging payoffs between players, then, in general, it is not possible to aggregate assessments of decision variants, so the rational approach is to analyze the game from the point of view of minimizing payoffs (benefits), i.e., ensuring a guaranteed win by assuming that the other players will choose strategies in such a way as to minimize the payoff of a given player. The mapping of multivalued functions from set X to Y can be written as: γ: $X \Rightarrow Y$, therefore, the boundary conditions are established (Płatkowski, 2012, p. 28), (3, 4):

1^0 The mapping graph

$$\gamma : E \Rightarrow F,\ E,\ F \subset R^m \text{ is a formula } Gr\,\gamma := \{(x, y) \in E \times F : y \in \gamma(x)\} \qquad (3)$$

2^0 The mapping

$$\gamma : E \Rightarrow F,\ E,\ F \subset R^m \text{ is closed in x if } (x_n \rightarrow x,\ y_n \rightarrow y,\ y_n \in \gamma(x_n)) \Rightarrow y \in \gamma(x) \qquad (4)$$

An if (Kakutani 1941, p. 458):
X - a nonempty, compact, convex subset of n-dimensional Euclidean space < n, f: X $\Rightarrow$ X -mapping t., that conditions (4):
1. $\forall x \in X$ the set f(x) is nonempty and convex (we say that the mapping f is convex).
2. The graph of f is closed [i.e. for all sequences x_n, y_n such that $x_n \rightarrow x$, $y_n \rightarrow y$, $y_n \in f(x_n)$, occurs $y \in f(x)$].

Then the mapping f has a fixed point (i.e. $\exists x \in X: x \in f(x)$.) Therefore, in the topological space y_m (X, γ) interior int A of the set is the largest open set contained in A, in turn, the closure of class A of a set A is the smallest closed set (in the sense of inclusion) that contains the set A. The assignment of elements x_i to the open set and/or open int A depends on the rank of the assignment value and the payment condition. In the pyramid of belonging, the largest group is the most unconscious and poor classes, while those distinguished by themselves stand on the pedestal, those exercising superior power, or in the created sense, close to God. Since each of the zones has a similar potential shared within it, those who have the most to divide the goods in a given zone get the least. Therefore, it is in the interest of the authorities to have as many useful slaves as possible.

The lower the level of existence we are at, the harder it is for us to get out of its bottom, and the lack of internal energy (spin) makes it harder for our descendants to start. Of course, the start-up and the moment of its initiation are important. In the vicious circle of powerlessness, and lack of spin, the individual begins to be only the background of the game for other players (5):

$$\prod_{j=1}^{n} p_i(x_i) \rightarrow \min \prod_{i=\infty}^{n} \prod_{j=1}^{n} f_i(x_i) \qquad (5)$$

The winning options of the selected player tend to minimize the solutions according to the action selection criteria f_i.

In the above philosophical and historical analyses, there is no place for the individual at all, and yet every community or society consists of individuals (atomization), and this thread has escaped the attention of thinkers (Weiss, 2003, p. 49). There is a strong convergence between the functional principles of societies and individuals and the atomistic, cosmological construction, or the principles of physics. The assumption that the authors of the article want to prove is that politics is the main creator of social changes, economics is its tool, and all processes taking place in the global economy can be explained by interpolative mathematics. In the history of the development of societies, there are utopian aspirations for all kinds of equality and equal distribution of all kinds of goods; which, however, are not consistent with human nature itself, nor with the surplus of the human population itself. Since the dawn of time, homo sapiens has shown inexhaustible ingenuity in rejoicing in the suffering of others, taking over their happiness, access to nature, their rights, property, health, and the prospects of a decent life – theirs and their descendants; or limiting their ability to save their health, reproduce, and most importantly – effectively limiting their knowledge of reality, consciousness, or taking away human rights. To this end, with all possible actions and available tools of power: army, religion, administration, law, financial systems, formulas of conflict, and war – in their own imaginary self, holders of power – appointed themselves the rulers of souls, recognizing themselves as God. Analogies can be found both in royal families, when marriage contracts were established within families; or outside the monarchy – business arrangements – within the clan of family and business groups.

Value evaluation analyses can be conducted in the historical (temporal), geopolitical-spatial, cross-sectional stream: selecting the influence of politics on the economic development of the region, and the world. Subjective and objective perception of events, i.e. present truth and precision versus abstraction of mental creation of the future. Because "natures, which make up concretes, are hierarchically ordered from the concrete, narrowest nature, haecceitas (...) to the widest nature, the all-encompassing nature of being". And the truth of human cognition is one of the areas of truth, which can be discussed in the existential order – as ontic truth, in the moral order, as the truth of moral conduct in accordance with the rules of morality, and in the cognitive order, as the compliance of our cognition with reality grasped cognitively (Krąpiec, 2000, p. 115). Innovative strategies for taking advantage of opportunities are based on several important processes and simple rules that regulate them (Obłój, 2002, pp. 163-165):

- the first of them are executive rules (how-to-rules), which specify how the main processes are ordered in the organization and what the main decision-making criteria are;
- the second is boundary rules, separating opportunities worth using from those that the company should give up;
- the third category are rules that prioritize the importance of strategic goals;
- the fourth set of rules concerns decision-making in time, to synchronize the decisions and actions taken with specific opportunities occurring in the environment;
- the fifth set of rules concerns the criteria for abandoning an action.

The development path often has many starting points, often deviates and runs in the wrong direction, and depends on many accidental encounters and changes of direction (Morgan, 2001, p. 94). What seemed obvious at first ceases to have reference to real changes taking place in the network. At the same time, development and changes are characteristic of the herd growth model, and hence the system of equations with the same parameters a, b, c, d and the same initial states must take into account different parameters g and h. According to the analyses of interactions in the network and the creation of value in it, we can use assumptions based on binary tautology to present the above (Borel, 1914), (6):

$$x(\phi(x, y) \rightarrow y(\varphi(x, y) \wedge -\phi(x, y))) \qquad (6)$$

The quantifier calculus in notation (6) means that for each field of estimates φ (x, y) of optimal actions in the network, there is a possibility of its application to real conditions, when there is a decision area determined by variables x, y. Since x, y belong to the decision space in the field x, the quantifier in relation to the estimated field x, y can take a negative value. Of course, the above notation referring to the assignment of variables in a given field has a binary characteristic, and at the same time, the formula (6) referring to the variable y in the space x indicates the possibility of assigning the notation to the estimated function in the predator-prey area. The concept of risk minimization in a multi-criteria, finite decision problem is based on

the analysis of the problem on the basis of the theory of multi-person, non-cooperative games, the analysis of which is based on the rules of game theory. The basic assumption of building the model is to identify the player with the decision-maker, who in a special case may be a collective and considers the problem from the point of view of each criterion separately (Wolny, 2006, p. 69). Given that the main quantifier of the response field evaluation is power, the estimation of the response rank is reversed ("for every good deed, you will meet a deserved punishment").

In the sphere of influence, we are bound by the escalation of the domination of selected decision-making units on the fates of millions. Suffering does not ennoble, it is a tool in the hands of the oppressors. And there would be nothing groundbreaking in the above if not for the fact that the negotiation of preference systems gives profit to the chosen ones, at the expense of millions of people with no chance of changing their lost fate. While these rules of the game are common sense and the scale of influence is stable, in the heat of shaping a crisis, common sense decisions lose their value in favor of the preferences of influence of selected spheres (Jakimowicz, 2019). Management is assumed to be the proper use and allocation of resources remaining in the sphere of the decision-maker's property. In the literature on the subject, we find a number of definitions that refer to the directions and philosophies of management. Nevertheless, it becomes crucial in this respect to determine the proper allocation of resources based on the options for obtaining capital, and the speed of its transfer in the conditions of a changing environment, which in consequence should provide the possibility of creating added value. The efficiency of the chain depends on the functionality of its individual links and their location in the entire network system (Kowalska-Napora, 2018, p. 25). Cost can be expressed as any possible loss in the moral, financial, freedom, energy, material, etc. sense. Cost itself can have a philosophical aspect. A philosophical view of profit/loss allows for the ranking of costs in the form of the loss of the option to change. The alternative cost of a given good is the amount of another good that must be given up in order to be able to produce a unit of the first good (Begg et al. 2007, s. 37).

The oscillation between internationalization and nationalization touches on controversial issues of shaping the economic space (see Borowiec et al., 2016; Wydymus & Maciejewski, 2015), and is thus shaped between emotions and economic pragmatism (Kołodko, 2013; 2014), where morality arises from the calculation of one's own interest (Midgley, 1998, p. 31): the first is based on obvious human frailty. People are simply not as prudent or consistent as this approach would assume (...); the second reason is the equally well-known range of good human traits. People who openly make an effort to behave decently act in this way out of a completely different motivation, directly taking into account the claims of others. Value in economics means the net profit that can be brought by the exchange of a given thing; it is measured either by the quantity of goods received or by a certain medium of exchange, usually money. The property or quality of a thing makes it useful (Reber & Reber, 2008, p. 850). Human values are supra-situational goals, acting as principles regulating the life of an individual or a group. In the economic interpretation, value is defined as the utility attributed to an object, determining its price (...). The content

of values is subject to classification according to the motivation they express (Manstead & Hewstone, 1996, p. 701). The political realist wants to protect the autonomy of the political sphere, just as the economists, lawyers, and moralists do in their own fields. He considers benefits in terms of power, just as the economist thinks of benefits defined as wealth, the lawyer thinks of compliance of actions with the law, and the moralist of compliance with the principles of morality (Morgenthau & Thompson, 1985, pp. 13-14). The question then arises: what does "value" mean, what can be the costs of its creation, and as a consequence, can this value be a determinant of an individual's potential? Value, both in the understanding of social and humanistic sciences, but also technical, means something that is a determinant of our efforts, but also their effect, as a set of properties of the expected state. Therefore, it has the dimension of an entity, as matter, and its subjective evaluation. It is therefore difficult to define this value on such divergent planes of understanding the world as economics, sociology, law, and philosophy, which in its quantification does not always provide a measurable picture of the formation of this value. A bigger problem in managing the economic development of units (countries), or their system, is not so much the location, access to deposits, i.e. positional and resource potential, but above all the ability to efficiently and effectively transfer capital (Jakimowicz, 2017; Czekaj & Owsiak, 2014; Czekaj, 2016), where distance does not matter so much, and it is the speed of reaction that guarantees the success of the decision (Kołodko, 2010; Pach et al., 2016). Policy is the degradation of the status quo of the individual versus the actions of secret services, lobbying organizations, big business, and international capital. The ideology that dictates our lifestyle, ideas of what is healthy, good, desirable, beautiful, or fashionable, is shaped by interest groups that derive various profits from it. Thus, we ourselves must take care of our own well-being, not allow anyone to appropriate it, or simply fight for it, or through demonstrations or even war. Your actions aimed at short-term investments in current assets have a long-term impact on value-building achievements (Pluta & Michalski, 2013).

Cluster topology as a growth phenomenology

Selecting optimal solutions does not concern obtaining maximum values, and the solutions themselves do not constitute a reliable answer if they are limited only to space or time.

Until the particles interact with each other, their state seems to be undefined, as is their description. In order to report the course of events and the choice of relations, once you need to have a comparison of states in time, but also options for their changes in a given space of time-space dependence.

A decision space is comparable to another to the extent that the patterns of its evaluation and validation of consequences are invariant in a risk situation (Borel, 1963, p. 76).

Time is a dimension of space in which certain events occur. The more events, the faster it flows. In Latin, the word *decisio* means a resolution (Panc, 2003, p. 82). In general, a decision is understood as an act of choosing one option of action from

among many possible ones (Pasieczny, 1981, p. 87). A decision, through the act of choosing, is the result of a certain mental activity. This process ultimately leads to some resolution, the choice of a specific action (decision in the strict sense), or behavior related to solving a given problem (decision in the broad sense). The act of choice itself will also be included in the decision process (Drucker et al., 2005, pp. 8-9). The dimension of our life, as well as subsequent options of choice, depends on the decisions made and their implementation, both in the sense of an individual, as an entity, and as a generational entity. Who and what we are depends on the country we live in, who and what our parents were like, and consequently what our capabilities and beliefs are. What happens and the intensity of events affect the dimension of time that does not exist. In the literature on the subject, we find definitions of real-time, funnel-time or space-time, and time curvature. Time, which does not exist, is therefore a determinant of what is happening. Events determine its acceleration or deceleration, and each moment of the course of events creates a transformation of displacement in space-time. In the categorization of events and time, we have demagogy of sequences, the absence of zero, that is, the absence of everything through the absence of nothing. Therefore, the attractor of space bifurcation R takes the value $\left|\Delta 0 \equiv n\infty\right| \rightarrow \det \left| 0 \geq 1 \right|$ because the boundary of the space R can be established.

While the Brouwer degree is a definition of a topological image, it functioned as a principle of assigning an element to a set according to the typing of the criterion of compliance. A functional is an image of a relational function in the Gaussian distribution, where we type the extremum of values according to the established objective function. The objective function can be freedom or survival depending on the escalation of the conflict, or taking over power for this purpose. The principle of typing a solution through assignment is not the search for the maximum, but the optimum of the solution through compliance. The functional is a variable quantity whose values depend on one or more functions. The functional of each function (of a certain class) uniquely assigns a certain number (cf. Gelfand & Fomin, 1979, p. 9). In the theory of perspective, a functional is a certain constant, an axiom, a determinant of our action. On this basis, we establish the selection criteria. In ontological space, it will be love, freedom, and self-determination, in fractal space, it will be income, analysis of measurement deviations in a small increase in time (cf. Kowalska-Napora, 2012, p. 121), (7):

$$S_{\det}(x, y) = \arg(x, y) \qquad (7)$$

The functional S in the typing of the solution according to the criteria x,y constitutes the argument of the typing of the solution according to these variables. Theoretically, there always exists such x, as the extremum of the functional being its argument, for which S = constant. Therefore, defining the limit of the function as arg(x,y) cannot be equivalent to its inverse (8):

$$\lim \arg(x, y) \neq \partial \cdot [x, y] \qquad (8)$$

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The argument boundary in any time interval does not determine the ambivalence of the estimated function of quantifiers x and y, because it is an estimated function. Hence, the judgment of the situation and planning for the future must have the context of the economy of thought and rational premises. As Aristotle wrote, since all people choose above all that which is in accordance with their own nature (a just person will choose a just life, and a brave person a brave life, a moderate person a moderate life), so a wise person will choose above all wise thinking, which is the work of this ability. It is therefore clear that according to the most authoritative opinion, wisdom is the greatest of all goods. When you are at the bottom of existence, will anyone extract from you the meaning of being in a lie (?) For the functional (9):

$$S = \int_{t1}^{t2} L(x(t), x'(t), t)dt \qquad (9)$$

solution of the Euler-Lagrange equation (10):

$$\frac{d}{dt}\left(\frac{\partial L}{\partial x'}\right) - \left(\frac{\partial L}{\partial x}\right) = 0 \qquad (10)$$

is the function x(t) for which S is stationary. This means that for small deviations of x(t), S changes insignificantly. This is a necessary condition for S to take an extremum for x(t).

At any given moment, assuming that time can be a determinant of statics, the value of x(t) assumes a certain constant, comparing two systems at any time, the values at a given moment in individual systems have different values. The functional, which is a constant value and equal to 0, determines the growth level of x_1 and x_2 as a function of time.

The shift of points x with a minimal change in S determines the achievement of an extremum. By comparing the changes in the value of x(t), one can estimate the impact of S, the incremental value of t on the estimated quantities. The functional is the values for which we live, health, freedom, dignity, and love, but also the guarantee of maintaining them. So, the functional is a constant in time, which does not exist, because it has a timeless dimension. Let us not allow anyone to take away our happiness in the name of ideals created by those who want to take over our lives to improve their own lives and their own development.

Summary and conclusion

Security policy, especially related to the conditions of business democracy, is currently being depreciated due to its variability, subjection to the rules of the current game of political forces, instability, and connection with immediate, not long-term interests (Zalewski, 2013, p. 45). The concepts of policy and politics are different embodiments of public activity according to a specific goal of citizens' security. After all, policy is, in the simplest terms, actions according to the intended goal,

while politics is an activity for its implementation (Ryszka, 1992, p. 22). In the evolutionary model of the world of flora or fauna, all changes in the area of maintaining the continuity of species concern the adaptation of the individual's genome and the specificity of behavior to changing environmental conditions. Individuals not adapted to the environment not only cannot evolve in their development but also cannot survive and pass on their genes to future generations. Both in the sphere of species in the initial links of the food chain, but also its higher parts, the bargaining chip is the power of ennoblement and flexibility for change. It would seem, therefore, that in these cognitive categories, individuals from the lower parts of the food chain should evolve, provided they are genetically strong enough in their class, and at the same time flexible enough not to be food for the next element of the chain (Banasiak & Szymańska-Dębowska, 2023). At the level of molecular biology, called genetics by homo sapiens, through crossbreeding and selection, we obtain certain more or less random changes in the population, which can lead to the fact that we receive an answer that is a better solution to our problem. In the current constellations, homo sapiens uses normative → negative selection, and its goal is to create the greatest profit for groups privileged by discretion, regardless of the social, economic, and environmental costs.

In the literature on the subject, there are many references to the term selection, usually identified with biology and thus with negative or positive selection. At least what appears in the assessment: positive selection and negative selection raises many reservations and references, to what point can we speak generally about biological selection, and at what levels of worldview or history; finally – at what point does a discrepancy occur between the biological distinction and its constitution for the purpose of a usurpatory takeover of power.

According to the Authors, the goal of the study set at the beginning has been achieved. The presented content should be helpful in implementing design tasks related to spatial order, infrastructure projects, and broadly understood management activities.

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BIFURKACJE WZROSTÓW EKSPONENCJALNYCH MODELI REFERENCYJNYCH

Streszczenie: W artykule przeprowadzono dywagacje nad uwarunkowaniem przejmowania władzy, jego formułą oraz efektami w strukturze społecznej, postrzeganiem wartości. Analizy poprowadzono w nurcie ontologicznym z wykorzystaniem interpolacji pola w teorii gier. Charakter pracy ma znamiona polemiki intuicjonistycznej. W artykule przedstawiono zagadnienia szeroko rozumianego modelu referencji w aspekcie opcji jego tworzenia i przeprojektowania. Analizy poprowadzono poprzez identyfikację struktur jednolitych topologicznie i struktur klasterowych w odniesieniu do typowania form modelu biznesu. Prezentowane treści mogą być pomocne w analizach projektowych ładu przestrzennego, jak również projektach infrastrukturalnych, zarządczych. Zainicjowanie spojrzenia matematyczno-wizualizacyjnego i sformułowanej na tej podstawie metodyki badań projektowych może stanowić o nowym spojrzeniu badawczym z wykorzystaniem miernika topologicznego wzrostów eksponencjalnych.

Słowa kluczowe: bifurkacja, wzrost eksponencjalny, funkcjonał, teoria gier, rzeczywistość wieloraka, model referencyjny

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TACIT KNOWLEDGE IN ENHANCING ENTERPRISE INNOVATION – A LITERATURE REVIEW

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Abstract: As scholars' interest in the practical elements of knowledge management grows, so does the intensity of research on the relationship between tacit knowledge and innovations. Questions concerning how companies may create, capture, and disseminate tacit knowledge and how this process impacts their capacity to develop new goods, services, or procedures are at the heart of these assessments. This is why the main aim of this paper is to identify and summarize the main research area linked with the relationship between tacit knowledge and innovations in modern enterprises. The paper is prepared as a systematic literature review based on bibliographic maps developed using VOSviewer software. This allowed us to find the newest research topics about how tacit knowledge affects innovations and to choose four main themes based on keywords from papers in the Scopus database.

Keywords: innovations, knowledge management, tacit knowledge

JEL Classification: D83, O31

Introduction

In the era of a knowledge-based economy, the ability of organizations to create and implement innovations is becoming a key factor of competitive advantage. It is increasingly emphasized that access to information or technology alone is no longer enough – how organizations use the knowledge they already have is equally important, if not more important.

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Tacit knowledge refers to specialized knowledge, abilities, and skills that are learned via experience and are frequently challenging to create, capture, transfer, or share (Houessou et al., 2023). Tacit knowledge is grounded in organizational procedures and routines, relates to particular contexts, and is founded on personal experience (Nonaka & Takeuchi, 1995). Tacit knowledge is essential for increasing a firm's competitive advantage and supporting innovation. Unlike explicit knowledge, which is easily captured and disseminated, tacit knowledge consists of social competences, insights, and intuitive abilities that are often specific to an individual (Schmidt et al., 2021). Because tacit knowledge is inherently difficult for rivals to imitate, firms that successfully capture and incorporate it can use it to deliver creative solutions and increase performance (Jamshidi et al., 2018). Effectively managing tacit knowledge helps a firm develop the dynamic, creative and problem-solving capabilities that are essential for long-term success and also makes it more resilient in a competitive context (Huang, 2017).

Research on the relationship between tacit knowledge and innovation is gaining in intensity, reflecting the growing interest of researchers in the practical aspects of knowledge management. At the centre of these analyses are questions about how organizations can identify, support, and transfer tacit knowledge, and how this process affects their ability to create new products, services, or processes. This is why the main aim of this paper is to identify and summarize the main research area linked with the relationship between tacit knowledge and innovations of modern enterprises.

Methods

This article reviews the literature on the relationship between tacit knowledge and innovation, using bibliometric analysis based on the Scopus database due to its wide scope of disciplines and the possibility of exporting bibliographic data. The bibliometric analysis was carried out using maps generated by the VOSviewer software, which allowed for systematic recognition of the structure and dynamics of the studied area of knowledge. Thanks to the visualization of the co-occurrence network of concepts, it was possible to distinguish the main thematic clusters, identify research trends and assess the degree of interest in specific issues over time.

The Scopus database was selected for the analysis. The search in the Scopus database was conducted on 29.05.2025, using the following query: (tacit knowledge) AND (innovations OR innovativeness).

The VOSviewer program was used to analyse the data, enabling the creation of bibliometric maps. Two main forms of visualization were performed:

- Overlay visualization – a time map showing the dynamics of the development of the studied area by visualizing the average year of publication for each keyword. Thanks to this method, it was possible to identify trends and topics that have been gaining importance in recent years.
- Network visualization – a map of keyword co-occurrences, illustrating the thematic structure of the studied area. The threshold of the minimum number of keyword occurrences was set at 4. Based on the network analysis, four thematic

clusters were distinguished, indicating different approaches and research contexts related to tacit knowledge and innovation, where the basic keywords were highlighted:

- Cluster 1: explicit knowledge, HRM, innovation capability, knowledge management, knowledge sharing, management innovation, process innovation, product innovation
- Cluster 2: information management, knowledge, intellectual capital, organizational learning, tacit knowledge, innovation, knowledge
- Cluster 3: industrial engineering, industry, innovation performance
- Cluster 4: competition, explicit knowledge sharing, tacit knowledge sharing

The analysis enabled a synthetic presentation of the state of research in this area and the identification of potential gaps and future research directions.

Results

The evolution of research topics in the area of innovation and tacit knowledge, presented on the bibliographic map (Figure 1), shows dynamic changes in the interests of scientists over the years 2012-2022. Thanks to the applied colour scheme, reflecting the average year of occurrence of a given concept in the literature, it is possible to trace the development of this field – from the basic issues to the increasingly detailed and applied ones.

In the initial period (2012-2016), fundamental concepts dominated, such as tacit knowledge (tacit knowledge), innovation (innovation), knowledge management (knowledge management), organizational learning (organizational learning) and intellectual capital (intellectual capital). Their darker colour on the map indicates their earlier presence in the literature, which suggests that they were the basis for the developing theoretical framework in the field of the connections between knowledge and innovation. At that time, research focused on understanding how intangible resources affect innovation processes in organizations and what is the importance of knowledge, especially tacit knowledge, in creating competitive advantage.

In the following years (around 2016-2019), a phase of thematic deepening is noticeable. More specialized concepts began to appear in the literature, such as innovation performance, product and process innovation, knowledge sharing, and innovation capability. This shift in emphasis indicates an increase in interest in empirical research on the mechanisms of using knowledge in practice and in finding ways to measure and strengthen the innovation efficiency of an organization.

The most current phase of development, covering the years 2020-2022 (marked with lighter, yellow colours), indicates a clear shift in research interests towards practical issues, especially related to knowledge transfer and exchange. During this period, concepts such as tacit knowledge sharing, explicit knowledge sharing, competition, and human resource management are increasingly analysed. This indicates the growing importance of research on the factors that enable effective knowledge sharing in organizations and on the role of human capital and the competitive context in innovation processes.

Thus, the evolution of the subject matter in tacit knowledge and innovation research shows a logical and coherent trajectory of the development of the field – from the creation of theoretical and conceptual frameworks, through empirical examination of the relationships and mechanisms of action, to the exploration of practical solutions and strategies for implementing knowledge to support innovation. The latest trends indicate the maturation of the research area and its growing importance for management practice in organizations operating in a complex and dynamic environment.

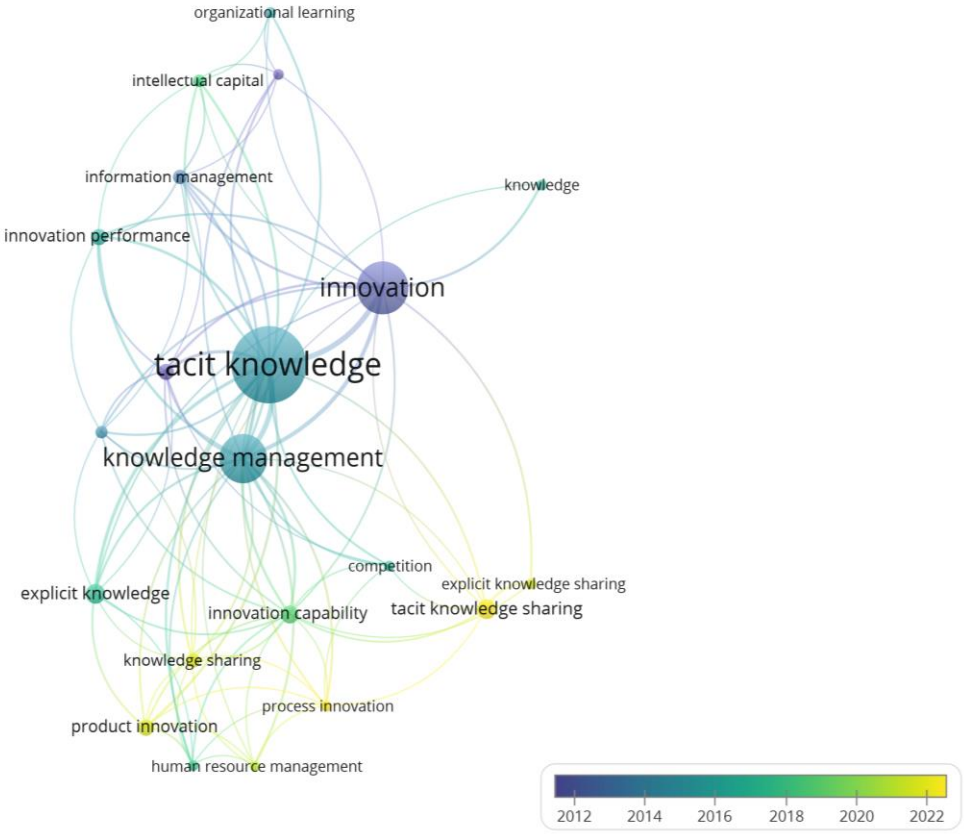

Figure 1. Overlay visualization (VOSviewer software)

Source: Own elaboration

Analysing the bibliographic map presented in Figure 2, it is visible that although the research on tacit knowledge and innovations forms one coherent scientific field, and clearly outlined thematic subdomains develop within it. They create clear thematic clusters – groups of concepts that often appear together in the literature.

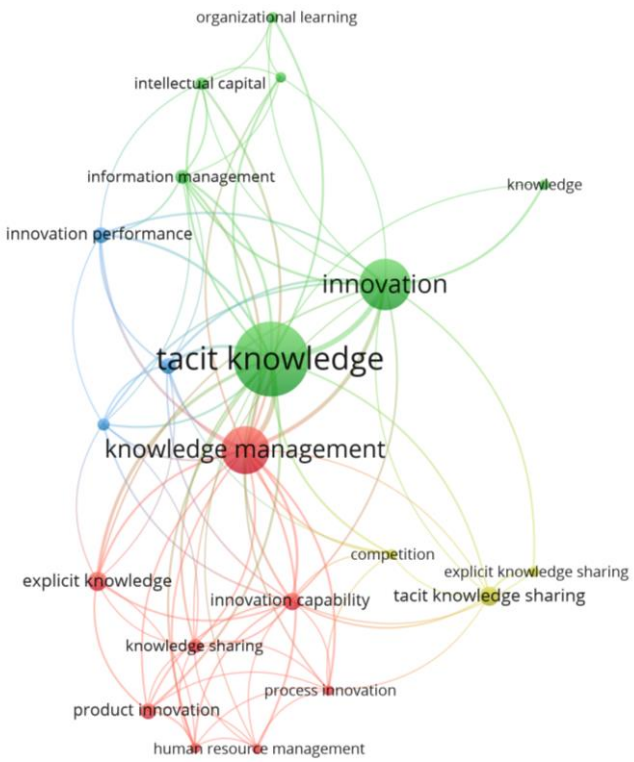

Figure 2. Network visualization (VOSviewer software)

Source: Own elaboration

In relation to cluster 1, in the centre of the map, there is the largest and most intensively connected cluster around concepts such as tacit knowledge, innovation and knowledge management. These concepts are strongly interconnected, which suggests that many scientific works address the topic of mutual relations between tacit knowledge and innovation, and shows that knowledge management is often analysed in the context of creating innovations. For example, Zhang et al. (2025) pointed out that tacit knowledge has become crucial for innovation and organizational performance. Based on a survey study of 344 Chinese firms, they confirmed that product innovation mediates the connection between managing tacit knowledge and the organization's performance. Also, Zia et al. (2024) highlighted the dependencies between tacit knowledge management and the capacity to create new products and services for enhancing organizational performance proven by a questionnaire-based study on 378 respondents from different provinces of China. Tacit knowledge, which is personal knowledge acquired from experience, can spur innovation in businesses (Berraies et al., 2020). From an employee's point of view, tacit knowledge improves daily job operations and has a substantial impact on the innovation process (Kucharska & Rebelo, 2022). Pérez-Luño et al. (2018) connect innovation to the

nature and process of knowledge. They find a nonlinear association between innovation and information interchange and combination, as well as a positive linear influence of tacit knowledge on innovation, using the data from 105 innovative enterprises. Achmad and Wiratmadja (2025) evaluated and confirmed the function of knowledge management in encouraging green innovation and its impact on organizational performance and competitive advantage based on a quantitative survey carried out with 191 SMEs.

Concerning cluster 2, above the main cluster, there is a smaller group of concepts related to organizational learning, intellectual capital, and information management. This cluster shows that there is a research stream focusing on how knowledge is created and maintained within an organization, especially through organizational culture and structures supporting learning. In relation to this topic, Han et al. (2015) pointed out that it is important to strengthen tacit knowledge management to improve enterprise innovation performance. In their research, they confirmed the positive relationship between enterprise tacit knowledge and innovation performance, as well as the positive mediating effect of intellectual capital between tacit knowledge management and innovation performance. In turn, a technique was developed by Yıldız et al. (2025) to investigate the effects of explicit and tacit knowledge on organizational innovation and a knowledge-sharing culture. The findings of the study demonstrate that tacit knowledge, as opposed to explicit knowledge, partially mediates the relationship between organizational creativity and an information-sharing culture. This is particularly true in the ICT industry. Moreover, when investigating how organizational culture types affect tacit knowledge sharing behaviour in Malaysian organizations, Suppiah and Singh Sandhu (2011) came to the conclusion that organizational culture types have an impact on tacit knowledge sharing behaviour, and that these influences can vary depending on the culture type. Therefore, managers will be able to conduct the most effective information sharing activities for a particular firm by identifying the type of organizational culture.

Referring to cluster 3, which is focused on concepts such as explicit and tacit knowledge sharing, product innovation and process innovation, it is visible that these topics are more specific and operational. There is a clear interest in how knowledge is shared between employees, and how this affects innovation in products and processes. Referring to the literature in this area, it can be indicated that organizational internal innovation is greatly aided by the sharing of tacit knowledge. Its importance is emphasized by Ganguly et al. (2019), who point out that social capital influences an organization's capacity for innovation comes before the sharing of tacit knowledge. According to Al-Zoubi et al. (2019), individuals' ability to adapt and innovate in dynamic work situations is enhanced when they share tacit knowledge. Moreover, Hu & Randel (2014) propose that the relationship between social capital and team creativity is mediated by tacit knowledge sharing, which improves teams' flexibility. In turn, in their summary of the literature review, Herlina et al. (2024) highlighted the importance of tacit knowledge sharing in promoting an innovative culture inside organizations, enhancing team interactions, and facilitating knowledge transfer.

In cluster 4, a group of entries such as competition, human resource management and innovation capability can be distinguished. This group is equally important as it indicates research that analyses factors that support or inhibit innovation, such as market competition or effective personnel management. Knowledge management is critical in improving the competitive advantage of firms by ensuring effective knowledge collection, sharing, and utilization. The potential of knowledge management to convert individual and community know-how into structured information that can be used to build new strategies and maximize operational performance emphasizes its importance (Ali et al., 2023). Companies that strategically apply knowledge management systems can leverage both explicit and tacit information, resulting in better decision-making and market responsiveness, both of which are essential aspects in gaining and maintaining competitive advantage (Otundo, 2023). Previous studies show that the ability to handle knowledge is one of the primary factors of organisational performance and competitive advantage (Chuang, 2004). Knowledge management is considered as a critical part of boosting organisational performance, which is crucial for continuous survival and competitive advantage of an organisation (Shehabat, 2020). Nguyen Tran and Ngo Thi (2025) looked into how innovation and knowledge management improve the business performance of family businesses. They also found that competitive advantage acts as a moderator in the relationship between these two factors and the business performance of family businesses. In turn, an investigation based on empirical research was carried out on 183 software companies in Pakistan and confirmed the impact of knowledge management capability on sustainable competitive advantage (Saleem et al., 2025).

Conclusion

Research on tacit knowledge and innovation is crucial to understanding how employees' intangible knowledge resources contribute to the creation and implementation of innovations in organizations. They allow us to identify the mechanisms for effective knowledge management, which helps build competitive advantage and long-term development.

Conducting such a scientific study brings a number of significant benefits, both cognitive and practical. The use of bibliometric analysis using the Scopus database and the VOSviewer tool allows for a systematic and objective recognition of the structure and dynamics of the studied area of knowledge, which is the relationship between tacit knowledge and innovation. Thanks to the visualization of the co-occurrence network of concepts, it was possible to distinguish the main thematic clusters, identify dominant and developing research trends and determine the degree of interest in individual issues over time. This approach allows not only for a synthetic presentation of the state of research but also for revealing gaps in previous analyses and indicating potential directions of future scientific investigations. As a result, this study is a valuable contribution to the development of an interdisciplinary field of knowledge, integrating issues from the field of knowledge management, innovation

and organizational sciences, which may be particularly useful for researchers, decision-makers and practitioners striving for a more effective use of tacit knowledge in innovation processes.

The study is limited by its exclusive dependence on the Scopus database, which may result in omitting important publications found in other sources, such as the Web of Science or Google Scholar. Moreover, the bibliometric analysis takes into account only quantitative data and the co-occurrence of concepts, which limits the possibility of a deep interpretation of the content of individual publications.

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Streszczenie: Wraz ze wzrostem zainteresowania naukowców praktycznymi elementami zarządzania wiedzą wzrasta również intensywność badań nad związkiem między wiedzą milczącą a innowacjami. Kwestie dotyczące tego, w jaki sposób firmy mogą tworzyć, przechwytywać i rozpowszechniać wiedzę milczącą, a także w jaki sposób ten proces wpływa na ich zdolność do opracowywania nowych dóbr, usług lub procedur, stanowią istotę tych badań. Dlatego głównym celem niniejszego artykułu jest zidentyfikowanie i podsumowanie głównych obszarów badawczych związanych ze związkiem wiedzy milczącej z innowacjami w nowoczesnych przedsiębiorstwach. Artykuł przygotowano jako systematyczny przegląd literatury w oparciu o mapy bibliograficzne opracowane przy użyciu oprogramowania VOSviewer. Pozwoliło to znaleźć najnowsze tematy badawcze dotyczące wpływu wiedzy milczącej na innowacje i wyselekcjonować cztery główne klastry tematyczne w oparciu o słowa kluczowe z artykułów w bazie danych Scopus.

Słowa kluczowe: innowacyjność, zarządzanie wiedzą, wiedza ukryta

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HOW CAN A CIRCULAR ECONOMY IMPACT ENTREPRENEURSHIP? INSIGHTS FROM A SYSTEMATIC REVIEW

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Abstract: This paper aims to provide a systematic review of the literature on entrepreneurship in the context of the circular economy concept. More specifically, the authors aim to answer the question "What characteristics and conditions of entrepreneurship emerge in connection with the transformation towards circular economy?". The research adopted the systematic literature review method, which provides the clearest possible conclusions about what is already known and what is not yet known in the selected area or topic. The review examined publications from key databases, Scopus and Web of Science, which enabled the identification of trends and gaps in existing research. Circular entrepreneurship is an emerging research area. The circular economy offers numerous entrepreneurial opportunities, emphasizing the need for further investigation to understand this topic better.

Keywords: circular economy, entrepreneurship, sustainable development

JEL Classification: M10, M20, L20, L26, Q01

Introduction and theoretical background

Entrepreneurship is related to discovering, evaluating and exploiting opportunities (Shane & Venkataraman, 2000). Long (1983) indicated three basic dimensions of entrepreneurship: firstly, uncertainty and risk, secondly, complementary managerial competence, and thirdly, creative opportunism. It can therefore be stated that entrepreneurship is manifested in the ability to take a risk, innovation, creativity and the ability to implement new ideas and concepts (Veeraraghavan, 2009). Over the

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last decade, the concept of entrepreneurial ecosystem has gained popularity among researchers and practitioners (Wurth et al., 2021). It is a systemic view of entrepreneurship (Cavallo et al., 2018), focusing on communities composed of many independent entities, including investors, service providers, government, universities, and the media among others. These communities can play a key role from the point of view of the level and development of entrepreneurship in a given region (Hechavarría & Ingram, 2019). Moreover, researchers perceive entrepreneurship in the context of various trends, such as digitalization (Baranauskas & Raišiene, 2022) and Industry 4.0. (Kruger & Steyn, 2020). The analyses focus on the possibilities resulting from the use of digital technologies, i.e., artificial intelligence (Chalmers et al., 2020), Internet-of-Things (Joshi et al., 2019), or cloud computing (Ross & Blumenstein, 2015). Research also concerns the impact of disruptive phenomena, e.g., in recent times especially of the COVID-19 pandemic (Ratten, 2021; Zahra, 2021).

Entrepreneurship is widely believed to have great potential for positive change towards sustainable development (Ashari et al., 2021; Perez-Encinas et al., 2021). Sustainable entrepreneurship consists in discovering, evaluating and exploiting opportunities in such a way as to make a positive contribution to socio-economic life and take care of environmental issues, to the benefit of both current and future generations (Lüdeke-Freund, 2020). Sustainability motivates innovation (Weidner et al., 2020; Yamoah et al., 2021) and encourages organizations to seek new business models (Lüdeke-Freund, 2020; Sinkovics et al., 2021). However, it should be indicated that in the case of sustainability-oriented initiatives, it is necessary to find a balance between creating social and environmental value and economic performance (Musona et al., 2021). Therefore, this type of entrepreneurial activity requires a holistic approach. It is not about pursuing social, economic or environmental goals independently of each other, but rather about combining them in a systemic way (Muñoz & Cohen, 2018). Due to the key role of stakeholders in creating sustainable value (Dembek et al., 2018; Vladimirova, 2019), attention is focused on sustainable entrepreneurial ecosystems (Volkmann et al., 2021).

Assuming that sustainability is an umbrella concept (Hestad et al., 2021), in this paper, entrepreneurship is examined through the prism of specific determinants, challenges and opportunities brought by the circular economy (CE). The constantly growing popularity of CE is caused by the deteriorating state of the natural environment, which brings the need to look for production and consumption methods that are less dependent on depleting natural resources (Kristensen & Mosgaard, 2020). CE is presented as a new paradigm (Geissdoerfer et al., 2017), as well as a new strategy for the development of civilization (Pikoń, 2018) that generates positive effects in each of the three main, i.e., economic, social and environmental, dimensions of sustainability (Korhonen et al., 2018).

CE is an alternative to the linear economy model based on the take-make-waste principle (Sariatli, 2017). The main goal of this concept is to make economic growth independent of resource consumption (Scheel et al., 2020) on the basis of the principles that in their basic version are referred to as 3R (reduce, reuse, recycle). With the development of CE, the set of rules was expanded to 4R, 6R, 10R. Other rules include, among others: redesign, renovate and repair (Kirchherr et al., 2017; Reike

et al., 2018). Murray et al. (2017, p. 369) propose a definition according to which CE is "an economic model wherein planning, resourcing, procurement, production and reprocessing are designed and managed, as both process and output, to maximize ecosystem functioning and human well-being".

CE proposes a new approach to the use of resources and energy, value creation and entrepreneurship (Lewandowski, 2016). Ranta et al. (2020) indicate that CE is an innovation-driven phenomenon. Innovations are among the most important factors determining resource productivity. It is widely believed that through innovations it is possible to maintain current standards of living while addressing serious environmental problems (Cainelli et al., 2020). Research conducted by Hysa et al. (2020) shows that there is a strong and positive correlation between a circular economy and economic growth. This emphasizes the fundamental importance of sustainability, innovation, and investment in resource efficiency and no-waste initiatives in responsible wealth creation.

Circular entrepreneurship is an emerging field of research (Cullen & De Angelis, 2021). Zucchella and Urban (2019, p. vii) conceptualized circular entrepreneurship as "processes of exploration and exploitation of opportunities in the circular economy domain". Undoubtedly, the transformation towards CE is associated with new opportunities, but also – like any extensive change – with a number of different challenges (Suzanne et al., 2020; Silva & Sehnem, 2022). As stated by Cullen (2023, p. 1) "circular entrepreneurship is becoming a new, promising reality, in the manner of needed radical paradigmatic change in the era of Anthropocene". Therefore, it can be seen that entrepreneurship in the face of the CE transition gains a new dimension and its own specificity. Based on this, the following research question was formulated: What characteristics and conditions of entrepreneurship emerge in connection with the transformation towards CE?

Methodology

The systematic literature review method which can be defined as "systematic, explicit, and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners" (Fink, 2020, p. 6) was adopted. A systematic literature review should provide the clearest possible conclusions about what is and what is not known in the selected area or topic (Denyer & Tranfield, 2009). Due to the multitude of determinants, perspectives and dimensions of entrepreneurship in the context of CE, systematic literature review is an appropriate method that enables a precisely defined process of identification, assessment and interpretation of available evidence (Cillo et al., 2019).

The conducted literature review included 3 stages. The first consisted in searching the Web of Science (WoS) and Scopus databases, using the criteria outlined in the review process chart (Figure 1). The search indicated 209 publications. 67 duplicates were rejected. Then, the publication titles and abstracts were analyzed, and on this basis, 54 articles that did not match the topic of the study were rejected. Having read the 88 papers that were included in the study, content related to entrepreneurship in

the context of CE was identified and coded. On this basis, the articles were assigned to 3 thematic areas: (1) circular economy transition and entrepreneurial opportunities (N = 17), (2) innovations and business models (N = 45), and (3) entrepreneurial ecosystems (N = 26).

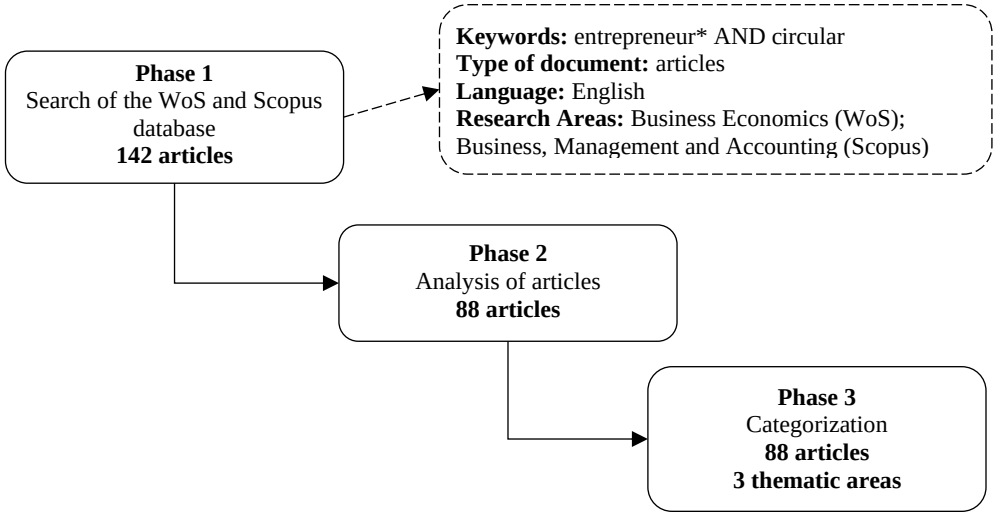

Figure 1. Systematic review process

Source: Authors' own elaboration

Results

The review covered articles published up to 2023. The data presented in Figure 2 shows that the oldest of the selected articles were published in 2017. They have the most citations. It can also be noted that since 2021 there has been a dynamic increase in the number of publications.

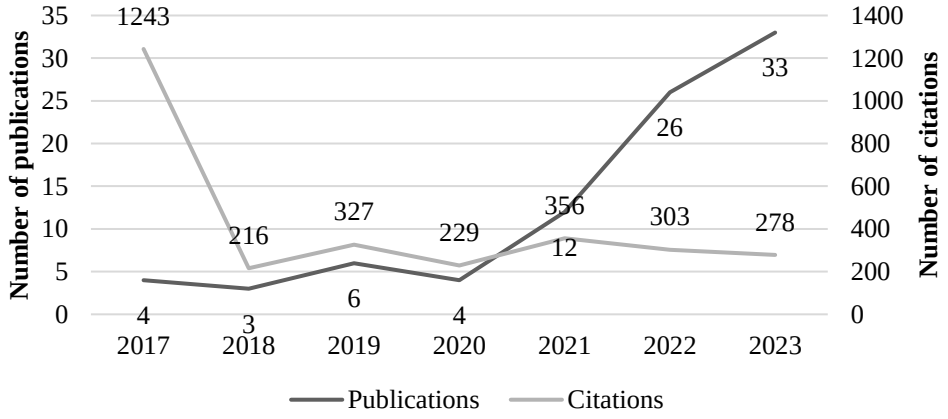

Figure 2. Temporal distribution of publications and citations

Source: Authors' own elaboration

In terms of journals, it is noticeable that few published more than one paper. Among the journals that meet this criterion, most articles were published in the "Journal of Cleaner Production" (22 articles). The next places are occupied by "Business Strategy and the Environment" (10 articles) and "Management Decisions" (7 articles).

Figure 3 shows the co-occurrence of author keywords in the identified publications.

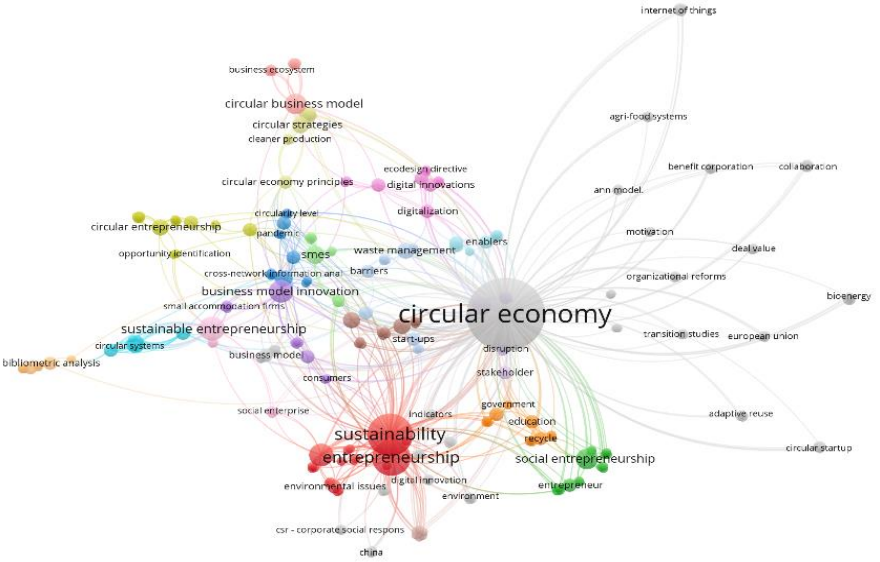

Figure 3. Co-occurrence of author keywords

Source: Authors' own elaboration

The findings resulting from the analysis of the publications included in the review for each thematic area are presented in Table 1.

Table 1. Findings from the systematic literature review

Thematic area	Key findings
Circular economy transition and entrepreneurial opportunities	The holistic nature of changes related to the CE transition creates new space for seeking opportunities that entrepreneurs can use to develop interesting and beneficial initiatives (e.g. Rawat & Singh, 2022; Zhu et al., 2022; Beheshti et al., 2023). When referring to CE, a "win-win formula" narrative in which economic and environmental benefits reinforce each other is often used. Since the effects of climate policy are visible in the long term, companies must play a leading role in this area by creating new, sustainable business models and production systems. The external effects generated by climate change become an opportunity for entrepreneurship. Many large companies do not incorporate CE principles into their business strategy, e.g. due to costs or logistical obstacles. This creates opportunities for entrepreneurial companies with innovative business models to fill the gap and provide

Thematic area	Key findings
	circular solutions to corporations, while creating new business opportunities and generating social benefits. Successfully transitioning to a circular economy requires specialized knowledge and skills (e.g. Hinderer & Kuckertz, 2022; Borms et al., 2023). Different industries need expertise in areas like transport, logistics, research, and digital technologies to implement circular solutions. The literature highlights the potential for developing circular value propositions and value capture models, offering new entities greater access to traditional markets (e.g. Despeisse et al., 2017)
Innovations and business models	Innovativeness is one of the fundamental determinants of a successful transformation towards CE. By emphasizing the multidimensional and systemic nature of CE, the literature signals the need for a holistic approach to innovation (e.g. Kostakis & Tsagarakis, 2022; Van Opstal & Borms, 2023). Methods like experimentation, open innovation, and small incremental steps help businesses foster innovation and navigate uncertain returns. Much research confirms that implementing circular innovations enhances company performance (e.g. Khodaparasti & Garabollagh, 2023). In addition, it is noted that the trend that favors circular economy is digitalization. The importance of innovations based on digital technologies, such as the Internet of Things or blockchain, is widely emphasized (e.g. Kalogiannidis et al., 2022). The literature also mentions the social dimension of innovation for CE (e.g. Costanza, 2023). Stimulating innovative entrepreneurship through integrating digital technologies into business models contributes to prosperity and social progress, which is an important element of a sustainable economy. Business model innovations are essential for sustainable development, influenced by purpose-led motivation and the desire to maximize positive impact. Entrepreneurs in CE adopt a disruptive approach, experimenting with circular business models and leveraging design thinking for collaboration. Compared to conventional business models, circular business models represent a more holistic and inclusive structure. This structure acts as a mechanism for transferring the decision-making powers of the entrepreneur to the stakeholders. Therefore, the entrepreneur's field of control, power and influence on the business may be narrowed. For entrepreneurs, circular business models are associated with significant challenges in proactive reducing of uncertainty (e.g. Linder & Williander, 2017; Cullen, 2023)
Entrepreneurial ecosystems	The ecosystem perspective is especially important in the case of circular entrepreneurship. The ecosystem concept adequately reflects the high level of coordination between different stakeholders necessary to implement CE-specific solutions. An ecosystem perspective can help resolve the problems related to complexity and coordination. Adopting this perspective is a way for a company to move beyond creating only economic value to also include social andenvironmental value and use this as a competitive advantage (e.g. Re & Magnani, 2022). It is also pointed out that institutional

Thematic area	Key findings
	frameworks, including regulations, norms, and ethical standards, play a crucial role in the circular ecosystem (e.g. Boffa et al., 2023). Institutional entrepreneurship enablers are vital for circular entrepreneurship, with a focus on strengthening the social dimension of CE through technological, organizational, and social innovations. Flexible institutional solutions that involve multiple stakeholders are necessary. Policies and action programs that drive and support innovation are key, especially in developing economies where removing regulatory barriers and fostering digital and local start-ups is crucial. While governments promote CE, entrepreneurship is essential for translating policies into sustainable business models (e.g. Nunes et al., 2022). The ecosystem perspective is also adopted when discussing CE incubators. It should be emphasized that cooperation within the ecosystem is facilitated by the knowledge of its participants (e.g. Del Vecchio et al., 2021). Therefore, the development of educational initiatives that combine issues related to entrepreneurship and CE is extremely valuable. In addition to schools and universities, non-governmental organizations and their contribution to the development of circular entrepreneurship should also be considered

Source: Authors' own elaboration

Discussion

The prospects that CE offers to entrepreneurs can be considered an indicator of how transformation in business will proceed. Opportunities are seen in CE policies implemented at the national or supranational level, among others. It seems that the associated potential is significant, especially in Europe, where opportunities for business are one of the key policy aspects (McDowall et al., 2017). The analyzed publications also show that new technologies – in particular digital technologies – are an important factor in entrepreneurial opportunities in relation to CE. It is worth noting that the dynamic development of technology forces enterprises to implement new solutions on a large scale and under time pressure. The implementation of digital technologies is seen as one of the ways to effectively adapt to a turbulent environment. Implementing this process quickly and efficiently is often necessary. Failure in this regard may widen the technological gap in relation to competitors (Priyono et al., 2020). Due to the fact that CE is a concept that includes many different solutions and many ways to achieve the goal, the specificity of the sector or industry is of great importance. The development of research related to circular entrepreneurship in specific industries, considering specific barriers and challenges, seems to be extremely necessary. Therefore, it is important for future researchers to identify what CE opportunities are emerging in specific sectors and industries.

Innovations and business models were often considered from the perspective of SMEs and start-ups. This is important due to the significance of these entities for the implementation of CE. In publications on circular innovations, attention is paid to their

social dimension. CE appears as a concept that inspires social entrepreneurs and fosters their innovation among others. These are valuable observations that can be related to the sometimes raised objection that the social aspect of CE is clearly less exposed, and that the relationship between CE and social impact is not clear (Merli et al., 2018; Padilla-Rivera et al., 2021). Entrepreneurs entering CE should have genuine passion and commitment, which can ensure their economic success as well as positive social and environmental effects. The approach to constructing business models also highlights experimentation and creativity. In addition to the articles included in this review, this aspect is often associated with circular business models in the literature (Hofmann & Jaeger-Erben, 2020; Bocken et al., 2021). It is also emphasized that the creation of circular business models must consider stakeholders who make an extremely valuable contribution to resource-efficient and waste-free business models. This is consistent with the significance of networks (Hofmann, 2019; Reim et al., 2019) and the multi-stakeholder approach (Geissdoerfer et al., 2020; Moggi & Dameri, 2021) highlighted in numerous publications. Future research in the area of circular innovations may focus on organizational innovations that seem to be overshadowed by product and process innovations. Working on tools and methods of constructing circular business models, considering the identification and use of opportunities (in relation to the broadly understood environment) and scaling possibilities, which may be particularly important for circular start-ups also seems justified.

The outlined characteristics of circular business models are naturally connected with the ecosystem perspective. The most important issues raised in considerations on circular entrepreneurship ecosystems include institutional conditions and CE incubators. The role of governments in the development of circular entrepreneurship is significant, although it is not entirely clear whether it should consist more in reducing barriers (e.g. administrative ones) or in active, direct support for entrepreneurs. Research on stakeholder involvement and cooperation indicated barriers in this regard. An important role in this context is performed by leadership, which should focus on building and cultivating lasting and trust-based relationships with various stakeholders inside and outside the organization and coordinating their activities in order to achieve common goals (Maak & Pless, 2006). The ability of an organization to collaborate with its stakeholders requires a mutual understanding of the importance of interacting and exchanging information. Due to this, both the organization and its stakeholders recognize opportunities to pursue their own interests while pursuing common interests (Kujala et al., 2019). It seems that these common interests should be emphasized, while indicating that cooperation within the ecosystem leads to a win-win situation. Potential opportunities can also be sought in this area. It may be interesting to look at the contribution that ecosystem participants make to the created value, which suggests that future research should consider the issue of value co-creation.

Conclusion

This study reviews the literature on the characteristics and determinants of entrepreneurship that emerge in connection with the transformation towards CE. 88 papers published between 2017 and 2023 that were relevant to the review were identified.

This review allowed for the determination of the key thematic areas related to the issue under consideration. Based on the conducted analysis, it can be concluded that entrepreneurship in the context of CE is becoming the subject of increased interest among researchers.

The transformation towards CE is expected to contribute to meeting global challenges and, at the same time, increasing prosperity. It is founded on the actions undertaken by entrepreneurs, including identifying and exploiting opportunities related to CE, implementing innovations and creating new business models, or creating new ways of cooperation. This requires a proactive approach and the ability to function in conditions of high volatility and uncertainty.

It should be noted that this study is not free from limitations. One of them is limiting the literature search to specific databases. An effort was made to select the most important and appropriate ones; however, not including other databases could lead to the omission of some publications. Another limitation is related to the search criteria. The review included only articles published in journals; therefore, it does not include book chapters and conference materials. Moreover, the development of CE research is extremely dynamic. Therefore, it can be assumed that the increase in the number of publications on entrepreneurship from a CE perspective, observed in 2021-2023, will continue. The results presented in this study only reflect the current state of research, and future work will bring new insights and conclusions.

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JAK GOSPODARKA OBIEGU ZAMKNIĘTEGO MOŻE ODDZIAŁYWAĆ NA PRZEDSIĘBIORCZOŚĆ? SPOSTRZEŻENIA Z SYSTEMATYCZNEGO PRZEGLĄDU LITERATURY

Streszczenie: Niniejszy artykuł ma na celu systematyczny przegląd literatury na temat przedsiębiorczości w kontekście koncepcji gospodarki o obiegu zamkniętym. Dokładniej rzecz biorąc, celem autorów jest odpowiedź na pytanie: Jakie cechy i warunki przedsiębiorczości wyłaniają się w związku z transformacją w kierunku gospodarki o obiegu zamkniętym? W badaniu zastosowano metodę systematycznego przeglądu literatury, która dostarcza jasnych wniosków na temat tego, co jest już znane, a co jeszcze nie jest znane w wybranym obszarze lub temacie. W przeglądzie przeanalizowano publikacje z kluczowych baz danych (Scopus i Web of Science), co umożliwiło identyfikację trendów i luk w istniejących badaniach. Przedsiębiorczość w gospodarce o obiegu zamkniętym to rozwijający się obszar badań. Gospodarka o obiegu zamkniętym oferuje liczne szanse przedsiębiorcze, co podkreśla potrzebę dalszych badań w celu lepszego zrozumienia tej dziedziny.

Słowa kluczowe: gospodarka o obiegu zamkniętym, przedsiębiorczość, zrównoważony rozwój

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AGILE IN PUBLIC SECTOR UNIT IN POLAND BASED ON EXAMPLE OF NATIONAL INFORMATION PROCESSING INSTITUTE (OPI PIB)

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Abstract: Agile management methods have been used since the beginning of the 21st century, with solutions available in accessible and developing organizations; their implementation is generally identified with the organization of private corporations. Currently, Agile and its variants are among the most common approaches to create software and carry out research and development work, bringing many tangible benefits in relation to traditional Waterfall management. In recent years, we have observed an increased degree of implementation of agile methodologies in the public sector, but the pace of implementation should be described as slow; this fact is also reflected in the literature, because there is relatively little research relating to the adoption of Agile methodologies in the public sector. The aim of the article is to determine the possibilities of using Agile project management by public sector entities, as well as to compare Agile management with traditional management. The results obtained from a literature review and case study analysis illustrate the possibilities, threats, barriers and specific recommendations related to the use of Agile management in the public sector. The research entity is the Information Processing Center – the National Research Institute, which is one of the leading national research institutes that carry out research and development work, as well as work related to the creation and development of software.

Keywords: Agile, Scrum framework, Waterfall methodology, project management, public sector, National Information Processing Institute

JEL Classification: M10, M15, H83

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Introduction

Technological progress and digitization are currently characterized by remarkable dynamism. The development of new technologies, especially ICT (information and communication technologies), directly influences the need to implement effective management methods. The dynamics of digitization radically affect management methods across almost all sectors of the economy, introducing new, innovative possibilities while also requiring the adjustment and redesign of traditional approaches to project management and product development. Digital technologies enable rapid data acquisition and analysis almost in real time. Tools such as artificial intelligence (AI) and big data allow quick decisions to be made based on large databases of information, which significantly shortens the time for the organization to implement changes. Modern digitization enables the automation of a wide range of routine tasks, from organizational resource management to customer and stakeholder service. This allows managers to focus their attention on strategic goals while operational costs are reduced. The dynamic development of ICT technologies also impacts remote work models and the management of distributed teams, directly translating into the need to acquire new skills, such as trust-building and adaptation to virtual work environments. Modern digital systems enable precise monitoring of performance indicators and easier access to information for stakeholders, directly contributing to a significant increase in transparency, which has become one of the key elements of management, enhancing trust in organizations. The exceptionally dynamic growth of digitization fosters innovation, which largely determines the agile approach to development.

Agile management methodologies are widely and successfully used in the implementation of IT projects in the private enterprise sector. The public sector seems to recognize the benefits of applying Agile management methods and is increasingly adopting them. Traditional management methods prove ineffective in addressing the contemporary dynamics of digital and economic changes. The implementation of Agile management in the public sector seems to be a necessity. Like private enterprises, the public sector must quickly adapt to new regulations, legal changes, and unexpected crisis situations. Agile management enables public organizations to respond more swiftly, minimizing the time required to implement new solutions. The adoption of Agile management in the public sector directly contributes to an increase in the efficiency and quality of public services. In the digital era, the public sector is forced to introduce modern technologies to keep up with extremely dynamic changes. Agile management promotes the experimentation and testing of new solutions, which favors innovation.

Literature review

The history of Agile project management dates back to the early 1990s, when managers and developers began searching for alternatives to traditional, bureaucratic project management methods such as Waterfall. In the academic community, there is no clear definition of how to categorize Agile. Some management scientists tend

to define Agile as a philosophy. According to Alistair Cockburn (2004), one of the pioneers of Agile, agility refers to being effective and ready for continuous change. The Agile process should exhibit a high level of "lightness", which is key to quickly responding to changes and adapting to them. Boehm and Turner (2003) describe Agile as a method that is an outgrowth of rapid prototyping and rapid development experience, as well as a revival of the philosophy that software development is a craft rather than an industrial endeavor. Larman (2003) believes that agility cannot be clearly defined due to the wide variety of practices used. However, the core element uniting these approaches is the time-bound, relatively short, adaptive, and evolutionary refinement of plans and objectives. Many of Agile's principles are not new to management; iterative development has been used since the 1950s by organizations such as NASA, IBM, and the Federal Systems Division in the United States (Larman & Basili, 2003). A turning point in the development of Agile management methodologies was the publication of the Agile Manifesto in 2001 – the Manifesto for Agile Software Development (Kaczor, 2016). Since then, Agile methodologies have evolved, adapting to various industries and project types, and have also become the foundation for other practices, such as DevOps. The vast majority of the creators of the Agile Manifesto were individuals with significant experience in software development and production. Moreover, they had previously implemented their well-defined methods, such as Extreme Programming (XP) and Crystal (Abbas et al., 2008). The Agile Manifesto defined the key values and principles of the agile approach to project execution. The core values represented by Agile are: individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a fixed plan (Stellman & Greene, 2015). For better understanding, the creators of the Manifesto supplemented their message with 12 principles that supplement and develop the basic assumptions of the method (Łazarz, 2023).

On the opposite side of the pole from Agile is the Waterfall model. The Waterfall approach owes its name to a diagram presenting five distinct and sequential phases. The work related to the implementation of the project, like water flowing down the rocky steps of a waterfall, "moves down" to the next phases of the process. The idea for such an approach to the software development process was taken from the organization of work in factories and construction projects. In this model, we always start the action by collecting the requirements, which is often time-consuming; the collected requirements are allocated to the given phases of project implementation, which are carried out one after the other. Each stage must be completed so that the next one can begin (Prywata, 2010). In the Agile approach, products are developed in relatively short time periods (typically two-week iterations), each resulting in a small but functional part of the product. The correctness of each iteration is verified continuously, enabling almost immediate adjustments to project assumptions and adaptations to changing business conditions. In the traditional approach, products are created within closed, typically relatively long stages, each dedicated to a single action (e.g., analysis, programming). The results of the work are verified for the first time only during the testing phase, focusing on the product as a whole rather than

allowing prior verification of its individual components. In the Agile approach to management, cooperation is continuous, permanent and ongoing. Communication often occurs ad hoc, as needed. Cooperation and communication are usually characterized by a low degree of formalism and "flattening", which allows the appropriate pace of information flow to be maintained, which translates directly into the pace of work performed. The traditional approach to management is characterized by the fact that cooperation is generally limited, highly formalized and often unsystematic. Communication usually occurs at specifically defined stages of project implementation, e.g. when discussing milestones or during the exchange of information within formal project management structures (e.g. a steering committee). Agile management accepts the occurrence of changes, even in the late stages of project implementation, as a natural environment. It is based on a systematic review of the work being done, taking into account both the quality of individual elements of the developed product and the quality of the entire production process, also taking into account the relationships prevailing in the team, the adequacy of the tools and technologies used, as well as the development of the team. The traditional management model focuses on delivering the originally planned result; change is not a natural or preferred state. The cascading nature of the performed work translates into the possibility of revealing changes only at an advanced stage of the work being carried out, often in circumstances in which the introduction of change is burdened with significant expenditures of time and money (Maruta – Kancelaria Radców Prawnych, 2017).

Modern Agile management practices go beyond software development, with which they are primarily identified (Cromley et al., 2022). Nowadays, a significant number of organizations that are not related to software development also benefit from the many advantages achieved by implementing an Agile approach to management. Compared to traditional project methodologies, the Agile approach translates primarily into an increase in the achievement of project goals, a decrease in the time needed to complete the project, better budget management, and increased effectiveness in achieving strategic initiatives (Ossowska-Nowakowska, 2023).

There is a stereotypical belief in the public sector that it tends to develop slowly and uses mainly traditional methods as well as practices of project management and product development. The vast majority of leaders of European countries, including Poland, see a new imperative: the need for a responsive, adaptive, flexible model open to innovative solutions, such as Agile (Eggers et al., 2021). Over the past few years, government agencies around the world have been implementing Agile management methods in their operations, such as procurement, policymaking, workforce deployment, financing, infrastructure construction, and R&D.

The most prominent European examples of project implementation in accordance with Agile methodology include the Harbour Master Management and Information System (HaMIS); the implementation of an IT system for managing the seaport in Rotterdam, the largest seaport in Europe (the Netherlands); the Prehospital Patient Record System: the implementation of an IT system that is a pre-hospital patient journal, as part of a comprehensive health sector computerization project (Denmark);

the Danish Business Authority: the implementation of a system that comprehensively supports the process of entrepreneur registration; the process of company registration as a fully digital process – supported by a dedicated IT system (Denmark); Heathrow Terminal No. 5: the implementation of a construction and infrastructure project in the form of Terminal No. 5 of Heathrow Airport – the project was implemented in 280 consecutive iterations (Great Britain) (Maruta – Kancelaria Radców Prawnych, 2017). In relation to Polish legal regulations, the provisions of the Act of 29 April 2004 – Public Procurement Law (Journal of Laws of 2015, item 2164, as amended), allow the implementation of projects in the public sector in the Agile model. This is possible primarily due to the amendment of Public Procurement Law, which took place on the basis of the Act of 22 June 2016 amending Public Procurement Law and certain other acts (Journal of Laws of 2016, item 1020). The examples described in the literature clearly show that it is possible to implement Agile in the execution of relatively large projects in public administration. Researchers specializing in Agile management often emphasize that the implementation of Agile does not have to be exclusively related to the execution of IT projects.

Among researchers specializing in the implementation of Agile in public sector institutions, there is consensus that the greatest challenge in effectively implementing Agile is the hierarchical organization and bureaucratization of public organizations (Neumann et al., 2024). Despite the presence of many significant barriers to implementing Agile in the public sector, a growing number of governments believe that adopting Agile is essential to build innovative economies that will meet citizens' needs (Australia and New Zealand School of Government, 2025). It may be reasonable to strive for full agility in public sector organizations by gradually adopting Agile and implementing hybrid techniques.

Research methodology

The case study method was used to conduct the research. A case study is a qualitative research approach that allows detailed analysis of a given case in relation to a specific organization. The aim of the case study method is to understand the specificity of the object being studied, its causes and effects. The case study method is characterized by an individual approach, focusing on one case or a small number of cases, which enables in-depth analysis. The research unit is the Information Processing Center – the National Research Institute. It is an entity that is part of the Polish public sector. The public sector is defined as a set of entities and organizations owned by the state or managed or supervised by public authorities, with the aim of providing public services, regulating economic activity and carrying out tasks of social and public importance (Kulesza & Sześciło, 2013). These units can be classified according to specific features and criteria, of which the key ones for specifying the definition for the purposes of the issues discussed in this article are: ownership and management – public sector organizations are owned by the state; local governments or other public entities – they are managed by public authorities and their activities are regulated by public law; the public sector focuses on providing social

services, such as education, health care, infrastructure, public safety, judiciary and administration; the goal is not to generate profit, but to meet social needs; it is financed mainly from the state budget, local governments, taxes and public fees. The case study focused on the use of different management methods, with the main focus on the use of Agile management methodologies by the Information Processing Center – the National Research Institute. The analysis covered projects conducted by the organization over the past few years.

Results

The elements that determine the specificity of IT projects in the public sphere are its highly analytical and process complexity as well as compliance with legal regulations. Many IT systems are direct implementations of complex rules and complicated administrative processes. The principles of the Agile Manifesto emphasizing working software over detailed documentation are very often questioned in the case of such a specific category of solutions. Agile methodologies do not completely separate themselves from the documentation-oriented, formalized traditional methodologies, but they have their own individual properties and are more adaptive than predictive (Kos, 2019).

One of the leading institutions implementing projects and developing products for the public sector is the National Information Processing Institute (OPI PIB). The institution carries out its work mainly for the Ministry of Science and Higher Education as well as science agencies, such as the National Science Centre (NCN), the National Agency for Academic Exchange (NAWA), the National Centre for Research and Development (NCBiR), and the Council for Scientific Excellence (RDN). The Centre has existed since 1991, and in 2013 it gained the status of a State Research Institute supervised by the Minister responsible for Science and Higher Education. From the point of view of the status of OPI in the structure of state administration entities, its status is primarily determined by the Act on State Research Institutes (Act of 30 April 2010 on Research Institutes (Journal of Laws 2010, No. 96, item 618, as amended)). In addition, it is subject to a number of other regulations that affect the form of implementation of IT services and projects. Since its inception, the organization has been responsible for collecting data and performing analyses on the state of higher education and science in Poland, as well as digitizing processes in this area. The Information Processing Center – the National Research Institute, as an Agile and learning organization, draws directly from the latest and proven techniques, management methodologies: Agile and Project Management Body of Knowledge (PMBOK). The organization adopts an Agile approach as the basis for project implementation – Agile, which is closely tailored to a given project scope. The methodology, method or framework related to Agile will be used in the implementation of a given project depends primarily on the degree of its complexity and uncertainty of requirements. Key projects and IT products developed in OPI PIB include:

- POL-on System – a central IT system that collects, processes and provides data on the Polish science and higher education system. The system supports public administration, scientific institutions and universities by providing information on, among others, research workers, students, research infrastructure and financing. POL-on is a key tool for monitoring and managing the Polish education and science sector, ensuring transparency and access to current data for all interested parties (Michajłowicz, 2021).
- NAVOICA System – the Polish educational platform offering open online courses (MOOCs – Massive Open Online Courses). The initiative was created to promote knowledge and raise users' competences in various fields. The courses are created by Polish universities and educational institutions, and the platform allows one to obtain certificates confirming the completion of training (OSF System, 2025).
- NAWA System – a public system for registering and processing applications for financing projects and research in the field of science – mainly intended for students, scientists and institutions of the higher education and science system (NAWA System, 2025).
- The Polish Science System (People of Science) – the oldest database available free of charge on the Internet since 1999. It contains data on Polish science in terms of institutions, people, scientific works, publications and conferences. Since 2018, it has been part of the POL-on system in the archival dimension. Since 2024, the People of Science 2.0 system is being developed in place of the Polish Science database (Nauka Polska, 2025).

Since 2011, the organization has produced over 20 large nationwide systems for science and higher education, as well as a number of smaller applications for business and industry. All of them were based on the Agile approach in terms of implementation, in particular the Scrum framework. This enabled their effective implementation in terms of time, budget and scope, meeting the expectations of all stakeholders. However, for most, it was necessary to provide a detailed, methodical formula for settlement and the monitoring of progress. In practice, a model of coordination of project work was developed, where the actual implementation of the product takes place in teams that meet the criteria of self-sufficiency and autonomy necessary to carry out work in an incremental model. The overall implementation and measurement of project progress, both in terms of schedule and scope, is managed by a dedicated project management office (PMO). Within the adopted production methodology, the choice of the form of implementation depends on many criteria, such as the formal requirements of the project imposed by the project ordering party or its specific conditions, the key of which is the scale of the project (in the case of smaller projects, the Agile approach is almost exclusively used, where the designated product owner is responsible for all the work, and he is assisted in the reporting process by office staff). The adopted work methodology skillfully balances agility with the formal conditions of project implementation, providing a number of simple procedures describing and simplifying many formal activities, ultimately striving to automate them.

The first project developed by the National Information Processing Institute (OPI PIB), using an Agile approach, was the POL-on project. This is the IT system that collects data on science and higher education throughout Poland. The data is analyzed by the Ministry of Science and Higher Education (MNiSW). Thanks to this, the Ministry can effectively manage the science and education sector, for example, to plan expenses. As early as 2011, the Scrum framework was adopted as the basis for running the project. The project, at the strategic management level, met more traditional assumptions of project implementation and accounting (a top-down, rigid schedule and a scope resulting from the terms of the contract and legal regulations), but at the level of implementation of individual products (system modules) it fully referred to the assumptions of the Scrum framework. This model was then successfully replicated in subsequent IT projects, effectively combining the requirements of formal project organization at the strategic level with a focus on producing IT products based on an Agile approach. This approach proved effective enough that they were completed on time and on budget, and the scope was more aligned with the actual expectations of the stakeholders and end users. Despite the many rigid rules for the systems being created, in particular the implementation of standards resulting from legal acts, the Agile approach proved particularly beneficial in scope management. This approach ensured the avoidance of many problems resulting from difficulties in defining the shape of the IT system solely from the perspective of the regulator – the Ministry of Science and Higher Education. The Agile approach assumed a focus on the working product and learning the needs of all its stakeholders, thanks to iterative production and appropriate techniques encouraging dialogue and learning about internal motivations (user stories), instead of focusing solely on agreeing on specifications and the interpretation of legal standards. This allowed projects to be implemented faster and with greater emphasis on the actual experiences of end users (user experience). The method also proved beneficial from the point of view of the main project stakeholders, who thanks to this approach, were able to verify many of the adopted interpretation assumptions related to the shape of the regulations being created.

Another project developed by the National Information Processing Institute, which is implemented fully using the Agile approach, is the NAWA project. The system was created by the Centre in 2017 (first implementation 2018) and is intended to support processes related to applying for and awarding financial resources under grants and subsidies. The NAWA system supports the entire implementation of recruitment in the program – from the program configuration to the final settlement of the beneficiary from the funds received. Due to the specific nature of the NAWA System, a decision was made to divide the management methods used in relation to the main modules; for the application part, strictly related to software development, the Scrum framework was adopted, while for the part related to the generation of forms, which constitute an input, a source of data for the System, the ScrumBan method was introduced. This method is a synergistic use of the Scrum framework and Kanban approaches (Knapik & Werewka, 2022). ScrumBan was born from the application of the Scrum framework process extended with Kanban

practices. It allows the creation of a more Agile process that we can continuously improve. The combination of these two well-known methods brings many benefits. Iterations related to work on forms for the implementation of the NAWA project constitute a continuous process, characterized by relatively short planning periods and longer production cycles. Tasks carried out by the NAWA team are taken and assigned on an ongoing basis to individual team members. An important element in ensuring the efficiency and quality of the implemented process is setting a strict limit on work in progress. Due to the largely repetitive scope of work related to form production by the NAWA team, planning is only done when necessary, which directly saves time by reducing ineffective meetings and placing emphasis on meetings strictly related to form production work. In the adopted scheme of work on forms, an important factor that distinguishes it from work on the application version of the system is the fact that task estimation is optional, which is due to the fact that tasks are generally characterized by a similar size and level of complexity, which directly translates into the time required for their execution by the team. The team dedicated to developing forms is characterized by interdisciplinarity. The leading meeting for the NAWA forms development team is the daily one, during which key issues related to currently ongoing tasks are discussed. ScrumBan used in the NAWA forms development team places great emphasis on systematic and consistent improvement of the process and the team, which is largely facilitated by a cyclical event called the retrospective.

Through the prism of the implementation of many projects by the National Information Processing Institute in accordance with the Agile approach, a number of benefits and challenges associated with it can be distinguished. The most important benefits of adopting an Agile approach in the implementation of large IT projects by OPI PIB for the science and higher education sector include:

- flexibility in resource allocation for project implementation, which creates space for their optimization. The decisive element in assigning teams to implement specific tasks are stages such as backlog refinement and sprint planning, which verify the actual scope of work to be performed
- iteratively defining and verifying the effects of the manufactured product as well as the expectations and opinions of users
- using prototypes and demo versions to confirm assumptions and interpretations resulting from legal acts in addition to the expectations of public administration employees
- reducing the costs of implementing IT projects through the effective management of resources and project scope, the introduction of a system for monitoring work efficiency
- building a culture of trust through direct communication focused on the product instead of extensive specifications. Striving for simplicity in communication, operating on practical examples.

Table 1 presents the most significant barriers encountered by the National Information Processing Institute when implementing Agile management in projects and product development, as well as ways to reduce or eliminate them.

Table 1. Most significant barriers related to implementation of Agile management by the National Information Processing Institute and methods of limiting or eliminating them

Barrier	Method of limitation or elimination
Top-down, rigid schedule and scope resulting from terms of the contract and legal provisions	At level of implementation of individual products (system modules), operational part refers fully to assumptions of Scrum framework
Lack of specialist knowledge related to use of Scrum framework and Kanban frameworks among development team members, necessary to effectively use advantages of the hybrid approach	Training of members of production team in Agile methods of project management and product development. Significant part of organization's members have Professional Scrum Master™ certificates, from Scrum.org organization. Organizing cyclical "guilds" and lectures – OPI Know How Days, thematically related to best practices related to Agile management. Creating culture of continuous development and sharing knowledge, best practices in the organization
Lack of information flow throughout the organization due to adoption of Agile or hybrid model of project management and product development	Introduction of organization-wide Project Portfolio Management Policy and Projects in OPI PIB, which transparently deals with the way projects are conducted and products are developed in the Center. Promotion of knowledge sharing, best practices among members of the organization
Difficulty in selecting appropriate Agile method for given project or product	Introduction in 2025 of Project Portfolio Management Policy and Projects and procedures for selecting project management methods and product development at National Information Processing Institute. Each project before its commencement and during its implementation is closely analyzed in terms of relevance, effectiveness of the adopted work and development model. Adopted Policy and management procedures are systematically monitored and improved, based on PMBOK update, development, and self-improvement of the Institute based on acquired practice
Tool constraints relating to efficient use of Agile project management and product development	Adaptation of currently used tools (mainly Jira and confluence – development with analytical elements, allowing work progress to be tracked and its effectiveness, application of simple and useful dashboards) to requirements of running projects and product development in an agile way. Acquisition of new tools that streamline the implemented process, e.g. Parabol, Easyretro.io (mainly used in team retrospective meeting – Agile retrospective is a workshop format used for reflection and improvement of cooperation, as well as quality of entire production process

Source: Authors' own study based on research

The barriers presented above have been largely limited or solved by adopting a systemic solution in the form of implementing the Project Portfolio and Project Management Policy – the National Research Institute. The aim of developing the document was to meet the identified needs and expectations related to improving the quality of project and project portfolio management at the National Information Processing Institute and to systematically and continuously improve the organization in terms of applying best management practices. The document includes the best practices and principles related to effective project management in OPI PIB aimed at increasing the efficiency and quality of work. The adopted solution is flexible in nature as it provides the possibility of using methodologies and frameworks consistent with Agile principles. When creating a document in the form of a management policy, a systemic solution is absolutely insufficient. It is necessary to systematically monitor the employed solutions and to continuously develop them, ensuring a balance between the possibility of using Agile management and rigidly imposed requirements for the implemented projects.

Conclusion

The public sector in Poland is increasingly reaching for Agile and hybrid approaches to project management and product development, which brings many tangible benefits, primarily related to greater flexibility in scope and resource management; meeting customer needs and expectations through iterative value delivery; increasing transparency in the scope of work being performed and trust among stakeholders. In many cases, it turns out to be very difficult to adopt a fully Agile way of running projects. Rigid regulations and deadlines introduced by state bodies do not support agility. It is then reasonable to introduce an agile way of managing at the operational level, or to use hybrid solutions, which also bring many tangible benefits. The element that facilitates the adaptation of Agile management in the National Information Processing Institute is the specific nature of the institution. The focus on practical effects, typical of research and development units, carried out by autonomous research teams based on experiments and the free exchange of ideas within the scientific discourse, meant that the choice of agility as a form of implementing even complex projects commissioned by government institutions was completely natural. The additional advantage is the relatively flat management structure and organization based on small cells and teams. Examples of effective implementations of systems such as POL-on, JSA or NAWA, show that with the right combination of flexibility and formal supervision, it is possible to achieve success in large-scale IT projects. The limitations related to legal regulations, the need for strict specification at the stage of public procurement and complex decision-making processes constitute significant challenges. The National Information Processing Institute, thanks to the adoption of a systemic solution in the form of implementation of the Project Portfolio and Project Management Policy, procedures dedicated to project management and product development, events conducted for the entire organization, such as OPI-Know-How Days, and adaptation of the tool workshop, significantly reduce or even eliminate the barriers related to the use of Agile management. A certain

research limitation related to the chosen topic was the relatively low number of scientific publications referring to the use of Agile in public administration, as well as the relatively low number of projects in relation to the overall number of projects that were fully implemented using Agile in the analyzed research unit. Future research directions planned by the authors will focus on exploring the optimal use of Agile management methods to enhance the efficiency of public administration entities.

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AGILE W JEDNOSTCE SEKTORA PUBLICZNEGO W POLSCE NA PRZYKŁADZIE OŚRODKA PRZETWARZANIA INFORMACJI – PAŃSTWOWEGO INSTYTUTU BADAWCZEGO (OPI PIB)

Streszczenie: Zwinne metody zarządzania towarzyszą nam od początku XXI wieku, z sukcesem sprawdzają się w nowoczesnych i rozwijających się organizacjach, na ogół ich implementacja utożsamiana jest z organizacjami prywatnymi, korporacjami. Obecnie Agile i jego odmiany stanowią jedne z najpowszechniejszych podejść do tworzenia oprogramowania, realizacji prac badawczo-rozwojowych, przynosząc wiele wymiernych korzyści w odniesieniu do tradycyjnego zarządzania waterfalowego. W ostatnich latach obserwujemy zwiększony stopień wdrażania metodologii zwinnych w sektorze publicznym, jednak tempo implementacji należy określić jako powolne, fakt ten znajduje odzwierciedlenie również w literaturze, ponieważ relatywnie niewiele jest badań odnoszących się do przyjęcia zwinnych metodyk w sektorze publicznym. Celem artykułu jest określenie możliwości wykorzystania zwinnego zarządzania projektami przez jednostki sektora publicznego. Dokonano porównania zwinnego sposobu zarządzania z tradycyjnym. Wyniki otrzymane dzięki przeglądowi literatury oraz analizie studium przypadku obrazują możliwości, zagrożenia, bariery oraz konkretne rekomendacje związane z wykorzystaniem zwinnego zarządzania w sektorze publicznym. Podmiot badawczy stanowi Ośrodek Przetwarzania Informacji – Państwowy Instytut Badawczy, który jest jednym z wiodących państwowych instytutów badawczych, które realizują prace badawczo-rozwojowe oraz związane z tworzeniem i rozwojem oprogramowania.

Słowa kluczowe: Agile, Scrum Framework, metodyka Waterfall, zarządzanie projektami, sektor publiczny, Ośrodek Przetwarzania Informacji – Państwowy Instytut Badawczy