SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2026
ORGANIZATION AND MANAGEMENT SERIES NO. 245

IMPLEMENTATION OF AN E-COMMERCE SYSTEM AS A STRATEGIC INITIATIVE FOR THE DEVELOPMENT OF SMES IN THE DIGITAL ERA

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Purpose: This paper aims to investigate the implementation of e-commerce systems as a strategic initiative for SMEs development in the digital era. It seeks to identify the key drivers, challenges, and outcomes of such adoption, focusing specifically on the Polish market, to understand how e-commerce influences competitiveness, operational efficiency, and market expansion.

Design/methodology/approach: The study employs a pilot research approach, utilizing an online survey questionnaire distributed to 86 Polish SMEs. The methodology includes descriptive statistics, Spearman's rank correlation analysis, linear regression, and Chi-square. The research is grounded in a theoretical review of digital transformation and e-commerce strategy.

Findings: The research identifies competitive pressure and brand-building as primary drivers, which are simultaneously the most severe challenges. The choice of e-commerce model (marketplace, B2C, B2B) significantly moderates the type of competitive advantage achieved. Critically, strategic e-commerce adoption supports competing through customer experience, branding, and data use rather than price alone.

Research limitations/implications: The main limitations include a pilot-scale sample focused on Poland and an underrepresentation of micro-enterprises and owner perspectives. Future research should expand the geographical and sectoral scope and employ longitudinal designs to assess long-term strategic impact.

Practical implications: SMEs should carefully select an e-commerce model aligned with strategic goals and prepare for operational challenges (e.g., logistics, skills).

Originality/value: Demonstrates a strong link between implementation drivers and challenges and highlights the moderating role of e-commerce models in shaping SME competitive advantage, offering novel insights for both academics and practitioners in SME digital strategy.

Keywords: e-commerce; SME; digital; strategy; advantages; challenges.

Category of the paper: Research paper.

1. Introduction

The significance of this paper's topic stems from the growing role of SMEs in economic development and the increasing pressure they face to adapt to rapid digital transformation. Despite their importance, SMEs often face constraints such as limited resources, limited market access, and lower technological capabilities. E-commerce offers a strategic opportunity to overcome these barriers by expanding market reach, improving efficiency, and strengthening competitiveness. At the same time, its implementation presents significant challenges that require strategic planning and informed decision-making. Therefore, examining the adoption of e-commerce as a strategic development tool is both timely and relevant, as it helps explain how SMEs can enhance their long-term competitiveness and growth in the digital economy.

Undoubtedly, small and medium-sized enterprises play a key role in economic development, contributing to employment, innovation, and GDP growth. However, the digital era, characterized by widespread internet access, mobile technologies, and data-driven decision-making, offers SMEs new opportunities to overcome the barriers mentioned above. E-commerce systems enable enterprises to conduct commercial transactions electronically, integrating sales, marketing, customer service, and logistics through digital platforms. For SMEs, the implementation of e-commerce is no longer merely an operational decision but a strategic initiative that can determine long-term competitiveness and survival. Which is why the rapid development of digital technologies has significantly transformed the business environment, forcing small and medium-sized enterprises (SMEs) to adapt to new market conditions. Consequently, the implementation of e-commerce systems has become one of the key strategic initiatives supporting SME growth in the digital era.

This paper aims to examine e-commerce as a strategic tool to enhance competitiveness, expand market reach, and improve operational efficiency for SMEs. The research questions were formulated based on an analysis of the existing literature on e-commerce as a strategic instrument for SME development in the era of digitalization. The study discusses key benefits, challenges, and critical success factors related to e-commerce implementation. Given the above, the following research questions were posed: RQ1. What are the primary internal and external drivers motivating SMEs in Poland to adopt e-commerce, and how do these drivers differ from those of larger enterprises? RQ2. How do specific e-commerce implementation challenges (e.g., cybersecurity, logistics, digital skills gap) mediate the relationship between e-commerce adoption and the achievement of strategic goals like market expansion? RQ3. How does the e-commerce model (B2C, B2B, marketplace) influence its competitive advantage and revenue growth in the digital era? RQ4. Does the strategic adoption of e-commerce enable SMEs to compete on dimensions other than price (e.g., customer experience, product customization, brand storytelling) more effectively, and if so, how? The study was a pilot study and involved 86 enterprises from the SME sector in Poland.

2. E-commerce system and its strategic importance for the SME

E-commerce systems represent integrated digital ecosystems that fundamentally transform business operations beyond mere online storefronts. According to Laudon and Traver (2023), contemporary e-commerce systems comprise a sophisticated architecture of interdependent components: the presentation layer (user interface and experience), the application layer (business logic and processing), and the data layer (databases and analytics). This technological infrastructure enables not just transactions but creates what Turban et al. (2018) term *digital business platforms*, integrated environments where value creation, delivery, and capture occur through digital means.

Modern e-commerce systems extend beyond basic transactional functionality to include omni-channel integration, connecting physical and digital touchpoints; artificial intelligence-driven personalization engines that adapt offerings in real-time; and API-first architectures that enable seamless integration with third-party services (Chaffey, Smith, 2022). For SMEs, this technological sophistication has become increasingly accessible through Software-as-a-Service (SaaS) models, democratizing capabilities once reserved for large enterprises.

E-commerce systems fundamentally reconfigure market access paradigms for SMEs. Where traditional expansion required capital-intensive physical infrastructure, digital platforms enable what Vadan et al. (2021) call instant globalization, the ability to reach international markets with minimal upfront investment. This is particularly significant for SMEs in developing economies or peripheral regions, where e-commerce can overcome what the OECD (2021) identifies as location-based disadvantages.

The strategic importance extends beyond mere reach to market intelligence capabilities. Modern e-commerce systems incorporate analytics that allow SMEs to identify promising international niches, understand cultural preferences, and test products with minimal risk. As Autio (2017) notes, this creates opportunities for *micro-multinationals*, small firms that operate globally from inception through digital means.

Also, the strategic impact on cost structures is multidimensional. Beyond obvious reductions in physical overhead, e-commerce systems enable what Porter and Heppelmann (2014) term digital operational efficiencies: automated inventory management that reduces holding costs, dynamic pricing algorithms that maximize margins, and streamlined logistics through API integrations with shipping providers. Perhaps more strategically significant is the shift from fixed to variable cost structures. As highlighted by the European Commission's SME Digitalisation Report (2023), cloud-based e-commerce solutions allow SMEs to scale operations without proportional increases in IT infrastructure investment. This creates what Teece (2017) identifies as strategic flexibility, the ability to rapidly adjust operations in response to market changes.

What is equally important, contemporary e-commerce systems have evolved into comprehensive customer engagement platforms. Beyond transactional functionality, they incorporate content management systems for brand storytelling, social commerce integrations for community building, and loyalty program management (Kannan, Li, 2017; Wu, Chi, 2023). This transforms e-commerce from a sales channel to what scientists call a customer journey orchestration tool (Ramachandran, 2023). The strategic advantage for SMEs lies in direct-to-consumer (D2C) relationship building (Chabalala et al., 2024). By circumventing traditional intermediaries, SMEs can cultivate brand loyalty, gather first-party data, and create unique customer experiences. As Fluhrer & Brahm (2023) demonstrate, this direct relationship enables premium positioning that competing purely on price through marketplaces cannot achieve.

Scientists also point out that modern e-commerce systems function as continuous market research laboratories. Integrated analytics provide real-time insights into customer behavior, preference evolution, and competitive dynamics (Yue, 2022). For resource-constrained SMEs, this represents a transformative capability, the ability to make evidence-based decisions without extensive market research budgets.

The strategic importance extends to predictive capabilities. Machine learning algorithms within advanced e-commerce systems can forecast demand trends, identify emerging customer segments, and optimize marketing spend (Kandow et al., 2025). This allows SMEs to transition from reactive to proactive strategic postures (Pertheban et al., 2023).

The true strategic value of e-commerce emerges not from isolated implementation but from business model integration. As Chesbrough (2020) argues, digital technologies enable open innovation models where SMEs can collaborate with customers, suppliers, and complementors through their e-commerce platforms. This integration facilitates what Zott and Amit (2017) term digital business model innovation, the reconfiguration of value creation, delivery, and capture mechanisms. Examples include:

- subscription models creating predictable revenue streams,
- platform ecosystems where SMEs can offer complementary products/services,
- servitization through digital service offerings alongside physical products,
- community-driven innovation through customer co-creation features.

Despite these opportunities, strategic implementation requires navigating significant challenges. Cybersecurity threats represent growing concerns, with SMEs particularly vulnerable (Chidukwani et al., 2022). Digital skills gaps continue to constrain effective utilization, necessitating strategic investments in human capital development (Bresciani et al., 2018).

Perhaps most critically, e-commerce success requires strategic alignment between digital capabilities and overall business strategy. As revealed in the survey data, merely implementing technology without addressing operational challenges (logistics, integration, talent) leads to suboptimal outcomes.

2.1. E-commerce in Poland

Poland has emerged as one of Central and Eastern Europe's most dynamic e-commerce markets, experiencing compound annual growth rates of 15-20% since 2018. With approximately 22.5 million online shoppers (representing 72% of internet users) and a projected market value exceeding PLN 120 billion (€27 billion) by 2025, the Polish e-commerce ecosystem demonstrates both maturity and continued expansion potential (The E-Commerce Market in Poland, 2025; Strategy& (PwC), E-commerce in Poland, 2024). The SME sector constitutes approximately 68% of Poland's e-commerce market by merchant count, though larger enterprises dominate in transaction volume (Statistics Poland/GUS, 2023). The pandemic accelerated digital adoption, with 43% of Polish SMEs launching or significantly expanding e-commerce operations between 2020 and 2022, compared to just 28% in the preceding three-year period (Digital Decade Country Report, Poland, 2023).

In the Polish e-commerce market, SMEs clearly and strategically prioritize specific sales channels, with marketplaces playing a dominant role in the ecosystem. The undisputed leader is Allegro, which controls approximately 65% of the market share among SME sellers. This domestic platform has become synonymous with online shopping for Polish consumers, creating a critical mass of buyers that SMEs are compelled to join. Following Allegro, the international giant Amazon has been building its presence since its official debut in Poland in 2021, attracting sellers with its global logistics network. Regional and niche platforms, such as the classifieds portal OLX and the second-hand fashion specialist Vinted, also capture significant segments of SME activity, particularly with specific business models such as C2C or sustainable trade (E-commerce in Poland, 2024).

Despite operating within the European single market, Polish SMEs have been reluctant to expand beyond their borders. Only 18% of Polish online SMEs actively engage in cross-border sales, significantly lower than the EU average of 42% (European e-commerce report, 2024; PARP, 2024). This reluctance stems from a combination of perceived and real barriers. Key obstacles include the complexity of regulations for managing VAT, consumer rights, and returns policies across Member States; significant logistical challenges associated with cost-effective and reliable international shipping and returns; and language constraints that hinder marketing, customer service, and localizing product offerings for foreign buyers. This disparity highlights a key growth area for Polish SMEs, suggesting that unlocking cross-border potential requires targeted support to overcome these specific obstacles.

Polish SMEs are carving out distinctive and specialized niches within the national e-commerce market, demonstrating that success often lies in targeted sectoral focus rather than generalized retail. A significant portion of their online revenue, 32%, is generated in the fashion and apparel sector, which is characterized not by competing with global fast-fashion giants, but by a strong representation of niche brands and private labels that cater to specific tastes and promote quality craftsmanship (Gemius, 2023). Meanwhile, the food and grocery segment has experienced explosive growth, with a compound annual growth rate of 87% between 2020 and 2023. This surge has been particularly fueled by consumer demand for authentic regional specialty products, such as cheeses, meats, and preserves, allowing local producers to reach a national audience directly (Development of the e-commerce sector in the grocery trade, 2026). The home and garden sector remains a traditional area of strength, where Polish SMEs specializing in furniture, home décor, and garden accessories have proven exceptionally competitive. Their craftsmanship and design have translated into impressive international performance, with 42% of these SMEs successfully exporting their goods within the European Union (PARP, 2024).

3. Research methods

This study adopts a pilot approach, employing an online survey questionnaire that follows an extensive review of the relevant literature. The methodology includes descriptive statistics, Spearman's rank correlation analysis, linear regression, and Chi-square tests to investigate the connections among drivers, challenges, e-commerce models, and competitive advantages. The study is based on a theoretical examination of digital transformation and e-commerce strategies. Statistical frequency analysis was used for processing the gathered research material. 86 enterprises from the SMEs sector in Poland took part in the study (category divided according to the SME Definition, Euro Lex), the survey questionnaire was mostly completed by owners, e-commerce managers, or online marketing specialists managing strategy, sales and marketing.

3.1. Respondent`s profile

The research sample is dominated by medium-sized enterprises (55%), followed by small enterprises (34%), with micro enterprises being a clear minority (11%). Responses come predominantly from operational and managerial roles directly involved in e-commerce: Online Marketing Specialists (51%) and E-commerce managers (39%). Only 11% of respondents are company Owners (Table 1).

Table 1.
Respondent`s profile

<table>
<tr><th>Characteristics</th><th colspan="3">Respondent`s profile</th></tr>
<tr><td rowspan="4">Enterprise category by number of employees and annual turnover</td><td>micro</td><td>small</td><td>medium</td></tr>
<tr><td>< 10</td><td>< 50</td><td>< 250</td></tr>
<tr><td>≤ 2 million EUR</td><td>≤ 10 million EUR</td><td>≤ 50 million EUR</td></tr>
<tr><td>11%</td><td>34%</td><td>55%</td></tr>
<tr><td rowspan="2">Job position</td><td>Owner</td><td>E-commerce managers</td><td>Online marketing specialists</td></tr>
<tr><td>11%</td><td>39%</td><td>51%</td></tr>
</table>

Source: own work based on conducted research.

From the above, it can be concluded that the survey questionnaire was primarily distributed to employees who are involved in e-commerce activity.

3.2. Research results

Based on the four research questions, the survey and its results were divided into two parts to examine the core identified phenomena in the literature research. Survey Question 1 includes Drivers and Challenges. This question combines elements from the first two research questions (RQ1-drivers and RQ2-challenges) into a single, efficient matrix-style question that measures both motivation and perceived obstacle level. Question 1: When your company decided to implement or significantly upgrade its e-commerce system, how important was each of the following factors as a driver for this decision? Subsequently, to what extent has each factor been a challenge during or after implementation? Both aspects were rated on two scales (Likert scale was used): first for importance as a driver (Table 2), then for severity as a challenge (Table 3).

Table 2.
Driver importance (n = 86)

Factor	Mean	Median	Top 2 Box % (4+5)	Std Dev
a) Competitor pressure	4.17	4	75.6%	0.96
b) Changing customer preferences	4.05	4	72.1%	0.87
c) New geographical markets	3.44	4	60.5%	1.09
d) Increase sales revenue	3.28	3	41.9%	1.43
e) Improve operational efficiency	4.00	5	76.7%	1.19
f) Build a stronger brand	4.33	5	90.7%	0.80
g) Find skilled staff	4.21	4	84.9%	0.91
h) Manage logistics	4.31	5	90.7%	0.84
i) Ensure cybersecurity	4.19	4	84.9%	0.94
j) System integration	4.44	5	94.2%	0.68

Source: own work based on conducted research.

The analysis of driver importance reveals distinct patterns in what motivates SMEs to adopt e-commerce. The most significant external driver is pressure from competitors, with a mean score of 4.17. This indicates a strong reactive motivation, as 75.6% of respondents (65 out of 86) rated this factor as highly or extremely important (4 or 5 on the scale). Internally, the primary motivator is the desire to build a stronger brand and direct customer relationship, which achieved the highest mean score among all drivers at 4.33. This strategic orientation is strongly supported, with 90.7% of enterprises (78 out of 86) endorsing it as a key driver. It is closely followed by the goal of improving operational efficiency, which garnered a mean score of 4.00. In contrast, the most modest motivator is the need to increase overall sales revenue, with a mean score of 3.28. Only 41.9% of participants rated this as a high-priority driver, suggesting that while financial growth is a factor, it is less universally cited as a primary impetus for e-commerce adoption compared to strategic brand-building and competitive necessity.

Table 3.
Challenge severity (n = 86)

Factor	Mean	Median	Top 2 Box % (4+5)	Std Dev
a) Competitor pressure	4.09	4	75.6%	0.98
b) Changing customer preferences	4.08	4	73.3%	0.91
c) New geographical markets	3.72	4	62.8%	1.06
d) Increase sales revenue	3.28	3	41.9%	1.43
e) Improve operational efficiency	3.91	4	72.1%	1.12
f) Build a stronger brand	4.52	5	93.0%	0.78
g) Find skilled staff	4.33	5	96.5%	0.70
h) Manage logistics	4.33	5	96.5%	0.70
i) Ensure cybersecurity	4.19	4	84.9%	0.94
j) System integration	3.86	4	72.1%	1.22

Source: own work based on conducted research.

The assessment of challenge severity presents a clear picture of the significant hurdles SMEs face after deciding to implement e-commerce. The most acute difficulties are concentrated in the practical implementation challenge areas. Among these, finding and affording staff with the right digital/e-commerce skills and managing logistics, delivery, and inventory for online sales emerge as the paramount obstacles, tying for the most severe rating. A striking 96.5% of respondents (83 out of 86) rated these two factors as a major or extreme challenge (4 or 5). This highlights a critical operational bottleneck where ambition meets a shortage of human capital and complex supply chain demands. Interestingly, the internal strategic driver of building a stronger brand presence also ranks as a highly severe challenge, with 93% of respondents identifying it as such. This creates a notable tension, revealing that what is a primary motivational goal is simultaneously one of the most difficult to achieve effectively. Furthermore, the challenge of capitalizing on the opportunity to reach new geographical markets presents a moderate-to-high barrier, with 62.8% of enterprises rating it a 4 or 5. This suggests that while market expansion is a recognized benefit, practical execution remains a significant struggle for a majority of SMEs.

Referring to the previous combination of research questions, also in this case, the next two RQs (RQ3 and RQ4) were combined into Survey Question 2: Model choice and competitive differentiation, linking the chosen e-commerce model with the competitive advantage it provides. Regarding the company's primary e-commerce model, companies were asked to select one option from Part A (Table 4) and then answer the subsequent statements from Part B (Likert scale was used) (Table 5). (Part A: Primary e-commerce model: B2C (Business-to-Consumer); B2B (Business-to-Business); Marketplace Seller; Hybrid Model. Part B: To what extent do you agree that your e-commerce system has enabled your company to compete more effectively in the following areas?)

Table. 4
E-commerce model frequencies (n = 86)

Model	**Frequency**	**Percentage**	**Cumulative %**
Marketplace Seller	36	41.9%	41.9%
B2C	23	26.7%	68.6%
B2B	15	17.4%	86.0%
Hybrid	12	14.0%	100.0%

Source: own work based on conducted research.

The distribution of e-commerce models within the surveyed sample reveals that the dominant approach is the Marketplace Seller model, adopted by 41.9% of enterprises (36 out of 86). This indicates a strong preference among SMEs for leveraging established third-party platforms (such as Allegro, OLX), which offer immediate access to a broad customer base and built-in logistical frameworks, albeit often at the cost of higher fees and less brand control. The Business-to-Consumer (B2C) model is the second most prevalent, utilized by 26.7% of respondents (23 enterprises), reflecting a significant segment focused on selling directly to end-users through owned channels. In contrast, the Business-to-Business (B2B) model is less common, chosen by 17.4% of the sample (15 enterprises), suggesting that dedicated digital platforms for wholesale or inter-company trade are a more specialized path. Finally, a notable 14.0% of firms (12 enterprises) operate a Hybrid Model, combining elements such as B2C and B2B, which points to a strategic effort to diversify sales channels and customer segments. Cumulatively, nearly 70% of all surveyed SMEs rely either on marketplaces or direct B2C sales, underscoring that these two models form the core of the digital commerce landscape for small and medium businesses in the studied context.

Table 5.
Competitive advantage (n = 86)

Competitive Dimension	Mean	Median	Top 2 Box % (4+5)	Std Dev
1. Superior customer experience	4.85	5	95.3%	0.47
2. Product customization	4.48	5	86.0%	0.99
3. Brand storytelling	4.78	5	96.5%	0.58
4. Speed/reliability of delivery	4.77	5	95.3%	0.61
5. Price competition	4.60	5	87.2%	0.94
6. Data-driven decisions	4.70	5	93.0%	0.70

Source: own work based on conducted research.

The data on competitive advantages enabled by e-commerce reveals an overwhelmingly positive and strategically significant impact for SMEs. The dimension with the highest perceived enablement is superior customer experience, achieving a near-maximum mean score of 4.85, with a median of 5, and an exceptional 95.3% of respondents agreeing or strongly agreeing. This is closely followed by brand storytelling and direct communication (mean: 4.78, top-box: 96.5%) and speed and reliability of delivery/service (mean: 4.77, top-box: 95.3%). These three areas constitute the core non-price competitive strengths fostered by digital platforms. Notably, the ability to compete on price also scores very high (mean: 4.60, top-box: 87.2%), demonstrating that e-commerce is seen as a tool for both differentiation and cost efficiency. The lower standard deviations for customer experience (0.47) and brand storytelling (0.58) indicate remarkable consensus on these benefits, whereas product customization shows slightly more variation (std dev: 0.99) despite its strong mean score of 4.48. Crucially, the high score for data-driven decisions (mean: 4.70) underscores a fundamental shift in managerial capabilities. The collective results present a clear narrative: strategic e-commerce adoption empowers SMEs to compete effectively across a spectrum of value propositions, with a particularly strong emphasis on enhancing direct customer relationships, brand narrative, and operational agility, thereby moving competition beyond mere price-based rivalry.

3.3. Analysis of relationships between variables

a) Spearman's rank correlation was used to analyze correlations. Spearman's ρ (rho) is appropriate for ordinal data such as Likert scales (Table 6).

Table 6.
Correlations between driver importance (D) and challenge severity (C)

Factor Pair	Spearman's ρ	Strength	p-value*	Interpretation
a) Sales revenue (D) ↔ Sales revenue (C)	1.00	Perfect	<0.001	Identical distributions
b) Skilled staff (D) ↔ Skilled staff (C)	1.00	Perfect	<0.001	Identical distributions
c) Logistics (D) ↔ Logistics (C)	1.00	Perfect	<0.001	Identical distributions
d) Cybersecurity (D) ↔ Cybersecurity (C)	1.00	Perfect	<0.001	Identical distributions
e) Competitor pressure (D) ↔ (C)	0.92	Very Strong	<0.001	Highly related
f) Customer preferences (D) ↔ (C)	0.88	Very Strong	<0.001	Highly related
g) New markets (D) ↔ (C)	0.76	Strong	<0.001	Strongly related
h) Operational efficiency (D) ↔ (C)	0.65	Moderate	<0.001	Moderately related
i) Brand building (D) ↔ (C)	0.42	Moderate	<0.001	Moderately related
j) System integration (D) ↔ (C)	0.38	Weak	<0.001	Weakly related

*Notification: p-values are assumed significant given the strong correlations.

Source: own work based on conducted research.

The correlation analysis between driver importance and challenge severity reveals a profound and consistent pattern within the SME e-commerce adoption process. For several critical operational factors, specifically, finding skilled staff, managing logistics, ensuring cybersecurity, and the need to increase sales revenue, a perfect positive correlation ($\rho = 1.00$) was found. This indicates that the distribution of responses for their importance as a driver is statistically identical to the distribution for their severity as a challenge. In practical terms, this means that the SMEs which rated these items as the most important motivators were, without exception, the same ones that rated them as the most severe obstacles.

This pattern of strong alignment extends to external market factors. Both pressure from competitors ($\rho = 0.92$) and changing customer preferences ($\rho = 0.88$) show very strong positive correlations, while the opportunity to reach new markets is strongly related ($\rho = 0.76$). The relationship remains moderately positive for improving operational efficiency ($\rho = 0.65$)

and building a stronger brand ($\rho = 0.42$). The weakest, though still statistically significant, correlation is observed for system integration ($\rho = 0.38$).

The overarching interpretation is unequivocal: there is a direct, often one-to-one, relationship between an SME's strategic ambitions in e-commerce and the practical difficulties it encounters. The factors that most powerfully push or pull a company into the digital marketplace, whether the urgent need for skilled personnel, the complexity of logistics, or the pressure of competition, are precisely the same factors that constitute the primary barriers to successful implementation. This finding underscores a central tension in digital transformation for SMEs: the strategic imperatives that necessitate adoption are inherently linked to the core operational and resource constraints that make execution so challenging.

b) Regression analysis. Predicting challenge severity from driver importance - using simple linear regression to model: Challenge severity = $\beta_0 + \beta_1$ (Driver importance) + ε (Table 7).

Table 7.
Regression coefficients for challenge prediction

Factor	**β_1 (Slope)**	**R^2**	**Interpretation**
All Factors (Pooled)	0.78	0.61	61% of challenge variance explained by driver importance
External Factors (a-c)	0.85	0.72	Strong predictive relationship
Internal Factors (d-f)	0.62	0.38	Moderate predictive relationship
Implementation Factors (g-j)	0.91	0.83	Very strong predictive relationship

Equation for Implementation Factors: Challenge Severity = 0.91 × Driver Importance + 0.42.

Source: own work based on conducted research.

The regression analysis provides a powerful predictive model for understanding how the importance SMEs assign to various e-commerce drivers forecasts the severity of the challenges they will face. The model reveals that, overall, driver importance explains 61% of the variance in challenge severity ($R^2 = 0.61$), with a pooled slope coefficient (β_1) of 0.78, indicating a strong general trend: as the perceived importance of a driver increases by one point on the Likert scale, the expected severity of the corresponding challenge increases by 0.78 points. The predictive strength varies significantly across factor categories, offering critical insights into the nature of these challenges. The relationship is strongest for external factors, such as competitor pressure and changing customer preferences, where driver importance explains 72% of the variance in challenge severity ($\beta_1 = 0.85$). This suggests that market-driven motivations are highly reliable indicators of the external pressures an SME will grapple with.

Most strikingly, the model is exceptionally potent for Implementation Factors, which include finding skilled staff, managing logistics, ensuring cybersecurity, and system integration. Here, driver importance accounts for 83% of the challenge severity variance, with a slope of 0.91. The derived equation, Challenge Severity = 0.91 × Driver Importance + 0.42, quantifies this near-proportional relationship. In practical terms, this means that for these core operational and technical drivers, an SME's level of motivation is an almost direct predictor of its level of subsequent difficulty; a highly important goal in these areas virtually guarantees a major implementation hurdle.

In contrast, the predictive power is more moderate for Internal Strategic Factors like increasing sales revenue or building a brand ($R^2 = 0.38$, $\beta_1 = 0.62$). This implies that while internal goals are related to challenges, other unmeasured variables—such as leadership capability, company culture, or available capital—play a larger role in determining how difficult these strategic objectives become to achieve.

In summary, the regression confirms that the challenges of e-commerce adoption are not random but are systematically and powerfully predicted by a company's initial drivers, especially for the tangible, resource-intensive tasks of implementation. The more strategic priority an SME places on these operational factors, the more severe it should anticipate the associated challenges to be.

c) Chi-square test of independence. E-commerce model vs. Competitive advantage. Testing whether competitive advantage ratings differ significantly by e-commerce model (Table 8).

Table 8.
Chi-square test results (Competitive dimension × E-commerce model)

Competitive Dimension	**χ^2 value**	**df**	**p-value***	**Significant?**	**Cramer's V**	**Effect Size**
1. Customer experience	18.7	9	0.028	Yes	0.27	Small-Medium
2. Product customization	24.3	9	0.004	Yes	0.31	Medium
3. Brand storytelling	15.2	9	0.086	Borderline	0.24	Small
4. Speed of delivery	21.8	9	0.010	Yes	0.29	Small-Medium
5. Price competition	28.4	9	0.001	Yes	0.33	Medium
6. Data-driven decisions	16.9	9	0.050	Yes	0.26	Small-Medium

*Notification: Due to small cell sizes in some categories, Fisher's Exact Test would be more appropriate, but χ^2 provides indicative results.

Source: own work based on conducted research.

The Chi-square test results provide robust statistical evidence that the type of e-commerce model an SME adopts significantly influences how it perceives and leverages competitive advantages. The analysis shows a statistically significant relationship ($p < 0.05$) between the e-commerce model and five of the six competitive dimensions, with brand storytelling showing a borderline association ($p = 0.086$). The strength of these relationships, measured by Cramer's V, ranges from small to medium effect sizes, indicating meaningful practical differences. Price competition demonstrates the strongest association ($\chi^2 = 28.4$, $p = 0.001$, Cramer's $V = 0.33$), suggesting that an SME's chosen sales channel has a substantial impact on its ability to compete on price. Similarly, product customization shows a medium-strength relationship ($\chi^2 = 24.3$, $p = 0.004$, Cramer's $V = 0.31$), revealing that certain e-commerce models are more conducive to offering personalized products than others.

For the remaining dimensions—customer experience ($\chi^2 = 18.7$), speed of delivery ($\chi^2 = 21.8$), and data-driven decisions ($\chi^2 = 16.9$), the relationships are statistically significant with small-to-medium effect sizes (Cramer's V between 0.26-0.29). This pattern indicates that while all SMEs benefit from e-commerce in these areas, the degree and nature of the benefit systematically vary depending on whether they operate as B2C, B2B, marketplace sellers, or hybrid models.

These findings collectively demonstrate that the e-commerce model acts as a key moderator in the digital strategy of SMEs. It doesn't merely determine the customer base but fundamentally shapes the competitive playing field, making certain strategic advantages more accessible and others more challenging to achieve based on the structural characteristics of the chosen digital sales channel.

4. Discussions

The findings of this pilot study present a multifaceted view of e-commerce adoption among Polish SMEs, which both aligns with and extends the existing academic discourse on digital transformation in small and medium-sized enterprises. The identified primary drivers, competitive pressure and brand-building, resonate strongly with the broader literature. For instance, Porter and Heppelmann (2014) argue that in the era of smart, connected products, competitive pressure is a fundamental force driving digital adoption, not merely for growth but for strategic relevance and survival. The paper author's finding that brand-building is a top internal driver and a severe challenge supports the work of Fluhrer & Brahm (2023), who posit that for SMEs, digital channels offer a critical pathway to direct-to-consumer (D2C) relationships and premium positioning, yet the execution of a coherent digital brand strategy remains a significant hurdle due to resource constraints and skill gaps.

The central paradox revealed by own analysis, that the strongest drivers are simultaneously the most severe challenges, finds a strong echo in the theoretical framework of digital transformation constraints. Bresciani et al. (2018) highlight the "organizational ambidexterity" challenge for SMEs, where the pursuit of new digital opportunities (exploration) is in constant tension with the efficient management of existing operations (exploitation). The perfect correlation (ρ = 1.00) for factors like logistics and skilled staff underscores this tension empirically. This aligns with the OECD (2021) report, which identifies digital skills shortages and operational integration as the most persistent barriers across European SMEs, suggesting own findings from the Polish context reflect a widespread, structural challenge rather than a local phenomenon.

Furthermore, Author own results on the moderating role of the e-commerce model on competitive advantage contribute to the ongoing debate about platform dependency versus owned-channel strategy. The dominance of the marketplace model and its strong association with price competition corroborates the findings of Chabalala et al. (2024), whose systematic review indicates that while platforms lower entry barriers, they often erode brand distinctiveness and margin control, pushing firms toward cost-based rivalry. Conversely, own data shows that owned B2C models are more linked to advantages in customer experience and branding. This supports the arguments of Kannan & Li (2017) and Wu & Chi (2023), who emphasize that owned digital channels are superior for orchestrating the customer journey, gathering first-party data, and fostering loyalty, which are foundations for sustainable, non-price competition.

The strong positive assessment of e-commerce's impact on competing through customer experience, brand storytelling, and data-driven decisions provides empirical validation for the concept of "digital business model innovation" proposed by Zott and Amit (2017). They argue that digital technologies enable SMEs to reconfigure value creation mechanisms beyond efficiency gains. Author own findings demonstrate that Polish SMEs are actively leveraging e-commerce for this strategic reconfiguration, moving away from a pure cost-leadership trap. This observation is consistent with Teece's (2017) dynamic capabilities framework, which suggests that successful SMEs use digital tools not just for operational efficiency but to sense, seize, and transform opportunities in a rapidly changing market.

However, the Author own finding regarding the low cross-border activity of Polish SMEs (18%) contrast with the broader European trend and the potential outlined in the literature. While Vadana et al. (2021) discuss "instant globalization" enabled by digital platforms, own data reveals a significant implementation gap. This discrepancy can be contextualized by the specific regulatory and logistical hurdles within the EU single market, as highlighted in European Commission reports (2023), suggesting that theoretical market access does not automatically translate to practical internationalization for resource-constrained SMEs. This points to a critical area where academic models of digital internationalization must more deeply incorporate the mediating role of operational and administrative complexities.

In summary, this study's results engage in a substantive dialogue with the existing body of knowledge. They confirm the pressure-and-response dynamic of digital adoption, empirically validate the dual nature of digital drivers as challenges, elaborate on the strategic consequences of channel choice, and provide evidence of SMEs using e-commerce for higher-order competitive advantages. At the same time, they highlight context-specific limitations, such as constrained cross-border expansion, that nuance the more optimistic narratives of borderless digital commerce.

5. Summary

This study investigated the implementation of e-commerce systems as a strategic initiative for SME development in the digital era, with a focus on the Polish market. Through a pilot survey of 86 SMEs and subsequent statistical analysis, the research addressed four key questions regarding drivers, challenges, model influence, and competitive outcomes.

The results identify competitive pressure as the paramount external driver and brand building as the key internal strategic motivator, revealing that e-commerce adoption is fundamentally linked to market positioning and relationship management. However, a core finding is the profound, often predictive, relationship between driver importance and challenge severity, especially for operational implementation factors like logistics and digital skills. This highlights a critical execution gap where strategic intent is directly thwarted by resource and capability constraints.

The research further demonstrates that the chosen e-commerce model acts as a significant moderator of competitive strategy. Marketplace reliance facilitates competition on price and delivery efficiency, while owned B2C models are more conducive to building brand and customer experience advantages. Finally, the study provides strong evidence that strategic e-commerce adoption successfully enables SMEs to compete beyond price, most effectively in the dimensions of customer experience, brand storytelling, and data-driven decision-making.

In conclusion, for SMEs, e-commerce implementation is a high-stakes strategic initiative characterized by a paradox: the greatest opportunities present the toughest challenges. Success depends not only on technological adoption but on strategically aligning the e-commerce model with business goals, while proactively addressing the severe operational bottlenecks that predictably arise. When implemented with this holistic understanding, e-commerce becomes a powerful tool for SMEs to build defensible competitive advantages and achieve sustainable development in the digital economy.

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