

# DIGITALIZATION AND COMPETITIVE ADVANTAGE: INSIGHTS FROM MANUFACTURING SECTOR

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## Abstract

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The study explores the critical role of digitalization in enhancing the competitive advantage of Albanian manufacturing firms amidst a rapidly changing business environment (Guo et al., 2023). It examines various data sources to understand how digital transformation influences firm performance and strategies in Albania. The findings reveal that digitalization significantly boosts profitability, market share, and innovation in these firms, enabling a faster response to market shifts and customer needs. Key drivers for digital adoption in the Albanian manufacturing sector include market trends, competitive pressures, and technological advancements. However, challenges such as financial constraints, skill gaps in the workforce, and data security issues are also prevalent (Kalaj et al., 2022). The research concludes that digitalization is a strategic necessity for Albanian manufacturing firms aiming to establish themselves as industry leaders. By effectively leveraging digital technologies and overcoming related hurdles, these firms can excel in the global market. This condensed summary presents the essence of the original text, focusing on the main findings and conclusions of the research on digitalization in the Albanian manufacturing industry.

**Keywords:** Digitalization, Competitive Advantage, Manufacturing, Albanian Firms, Innovation, Workforce Development

**Authors' individual contribution:** Conceptualization — S.G. and B.T.; Methodology — S.G. and D.L.; Validation — S.G.; Formal Analysis — S.G., D.L., and B.T.; Investigation — D.L.; Resources — S.G. and D.L.; Writing — Original Draft — S.G. and D.L.; Writing — Review & Editing — S.G. and B.T.; Visualization — D.L.; Supervision — S.G., D.L., and B.T.

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## 1. INTRODUCTION

The 21st-century business landscape is currently witnessing a profound and unprecedented transformation, largely driven by the pervasive influence of digitalization. Digital technologies have evolved from being mere tools to becoming integral components of the operations of firms across diverse industries. These technologies have not only infiltrated various aspects of business but have also been instrumental in reshaping fundamental elements such as business models, processes, and

strategies. The integration of digital technologies into everyday business practices has accelerated the pace of innovation and responsiveness in the corporate world (Yaqub & Alsabban, 2023). Firms have harnessed the power of digital tools and data to optimize their operations, streamline supply chains, and reach customers more effectively (Shehadeh et al., 2023). As a result, organizations have experienced a radical shift in how they perceive and interact with their markets and competition (Kotarba, 2018). In this dynamic environment, understanding the pivotal role of digitalization in

enhancing a firm's competitive advantage has become of paramount importance. Competitive advantage, traditionally grounded in factors like cost leadership, differentiation, or market focus, has now expanded to encompass the ability to leverage digital technologies effectively (Bouwman et al., 2018). Firms that embrace digitalization gain the capability to transcend traditional boundaries, reimagine their value propositions, and stay ahead in the race for market supremacy (Masoud & Basahel, 2023). Moreover, the ongoing digital revolution has blurred the boundaries between industries, allowing innovative startups to disrupt traditional market leaders and rendering industry borders increasingly porous (Teece, 2018). This phenomenon has made it clear that competitive advantage is no longer solely about industry-specific assets and capabilities. Instead, it is increasingly dependent on a firm's agility and ability to harness digital technologies to pivot swiftly in response to changing market dynamics and customer expectations (Schallmo et al., 2019).

Considering these developments, it is evident that exploring the multifaceted relationship between digitalization and competitive advantage is not only relevant but also critical for researchers and practitioners alike. As the business landscape continues to evolve, understanding how firms can leverage digitalization to gain a competitive edge is a topic of increasing significance (Chauhan et al., 2023).

The study seeks to contribute to this by focusing on Albanian manufacturing firms, a context that provides unique insights into the challenges and opportunities associated with digitalization adoption within a specific socio-economic environment. By examining the experiences of these firms, we aim to shed light on the evolving dynamics of digitalization and its implications for competitiveness in this distinctive setting. The study aims to address the gaps in the literature, particularly in the context of Albanian manufacturing firms. While existing literature provides valuable insights into digitalization's impact on competitive advantage, there is a dearth of empirical research on this topic within the unique socio-economic environment of Albania. "Although it is critical to figure out the organizational performance outcomes of DT, little academic work on this topic has been done. One possible explanation is that varying consequences of DT have distracted scholars" (Guo & Xu, 2021, p. 3).

The primary objective of this research is to comprehensively understand the digitalization landscape within Albanian manufacturing firms and its impact on their competitive advantage. The scope of this study encompasses various aspects related to digitalization adoption, drivers, barriers, and its influence on competitive performance.

To guide the investigation, we pose the following research questions:

*RQ1: How extensively has digitalization been adopted by manufacturing firms in Albania, and to what degree have these firms integrated digital technologies into their daily operations?*

*RQ2: What are the primary drivers that encourage manufacturing firms in Albania to embrace digitalization, and what motivates these firms to invest in digital technologies and practices?*

These research questions will guide the comprehensive investigation into the digitalization

landscape within Albanian manufacturing firms, shedding light on its drivers, challenges, and the resulting impact on their competitive advantage.

The structure of the research is as follows. Section 2 reviews the relevant literature and develops the hypotheses. Section 3 outlines the methodology employed in the study. Section 4 presents the results obtained, while Section 5 discusses the findings and results in detail. Finally, Section 6 provides the conclusions drawn from the study.

## 2. LITERATURE REVIEW

In the contemporary business landscape, characterized by rapid technological advancements and digital disruption, the concept of digitalization has emerged as a pivotal force reshaping organizational strategies and competitive dynamics. Yaqub and Alsabban (2023) define digitalization as the comprehensive adoption and integration of digital technologies and practices across various facets of business operations. These technologies encompass a diverse array of tools and platforms, including artificial intelligence (AI), cloud computing, the Internet of Things (IoT), data analytics, automation, and emerging innovations such as blockchain and digital twins. Digitalization represents more than just a technological upgrade; it is a strategic imperative for organizations seeking to thrive in the digital age.

The traditional notion of competitive advantage has evolved in response to the digitalization wave. While traditional factors such as cost leadership, product differentiation, and market focus remain relevant, they have been augmented by digital capabilities (Barba-Sánchez et al., 2024). Bouwman et al. (2018) argue that competitive advantage now extends to the adept leveraging of digital technologies to achieve market supremacy. Agility in harnessing digital tools for innovation and responsiveness has become a hallmark of competitive success (Radicic & Petković, 2023). Consequently, organizations that effectively integrate digitalization into their operations gain the agility and flexibility needed to outmanoeuvre competitors and adapt to rapidly changing market dynamics.

Research by Guo et al. (2023) provides compelling evidence of the significant impact of digitalization on competitive advantage. By enhancing efficiency, fostering innovation, and enabling customer-centric strategies, digitalization empowers organizations to gain a sustainable edge in the marketplace (Guo et al., 2023). Exemplars like Amazon and Tesla underscore the transformative power of digitalization, showcasing how it can revolutionize entire industries and redefine competitive dynamics. Through optimized processes, rapid innovation cycles, and customer-centric approaches, digitally enabled firms can outperform their counterparts and establish market leadership (Guo et al., 2023).

The manufacturing sector has been a focal point of digitalization efforts. Studies by Schallmo et al. (2019) and Plekhanov et al. (2023) shed light on the trends, benefits, and challenges associated with digitalization in manufacturing firms. These studies highlight how digitalization drives improvements in production efficiency, supply chain management, and product quality, leading to enhanced competitiveness (Zareie et al., 2024). By embracing

digital technologies, manufacturing firms can unlock new levels of productivity and innovation, positioning themselves for sustained success in the digital era (Schallmo et al., 2019).

Furthermore, digitalization has transformed customer expectations and market dynamics, leading to a fundamental shift in competitive strategies. Organizations must not only deliver superior products and services but also provide seamless digital experiences and personalized interactions. Porter (2001) suggests that a sustainable competitive advantage can be achieved through a combination of operational effectiveness and strategic positioning. Digitalization enables organizations to enhance both aspects by streamlining processes, reducing costs, and delivering unique value propositions to customers.

In summary, the literature review underscores the transformative impact of digitalization on competitive advantage, emphasizing the crucial role of digital capabilities in shaping organizational success.

Beyond the immediate implications for competitive advantage, digitalization has far-reaching consequences for organizational strategy, structure, and culture. The integration of digital technologies not only enhances operational efficiency but also facilitates organizational agility and innovation. Teece (2018) argues that digitalization enables organizations to adapt quickly to changing market conditions and seize emerging opportunities, thereby enhancing their overall competitiveness. Moreover, digitalization fosters a culture of continuous improvement and learning, as organizations leverage data-driven insights to optimize processes and drive innovation.

The transformative potential of digitalization extends beyond individual firms to entire industries and ecosystems. Tushman and O'Reilly (1997) propose the concept of "ecosystem innovation", wherein digitalization acts as a catalyst for collaborative innovation within interconnected networks of organizations. By sharing data, resources, and expertise, participants in digital ecosystems can co-create value and drive collective growth. This collaborative approach to innovation enables firms to access new markets, develop complementary products and services, and enhance customer experiences in ways that would be difficult to achieve in isolation (Noti & Trebicka, 2016; Trebicka et al., 2023).

Moreover, digitalization has profound implications for talent management and workforce dynamics. The emergence of new digital roles and skillsets, such as data scientists, AI specialists, and cybersecurity experts, has transformed traditional notions of employment and career development. Organizations must adapt their recruitment, training, and retention strategies to attract and retain top digital talent. Additionally, digitalization necessitates a cultural shift towards agility, experimentation, and risk-taking, as organizations embrace a mindset of continuous adaptation and innovation to thrive in today's dynamic business environment.

Overall, the literature underscores the multifaceted nature of digitalization's impact on competitive advantage, organizational dynamics, and industry ecosystems. By embracing digitalization as a strategic

imperative, organizations can unlock new opportunities for growth, innovation, and competitive differentiation in the digital age.

The study will test the following hypotheses:

*H1: The higher levels of digitalization adoption are associated with greater competitive advantages for Albanian manufacturing firms, as evidenced by increased profitability and market share growth.*

*H2: Market competition, cost efficiency, customer demands, and technological advancements are significant drivers that positively influence digitalization adoption among Albanian manufacturing firms.*

*H3: Factors such as lack of financial resources, skill gaps in the workforce, data security concerns, resistance to change, and limited access to technology act as significant barriers to digitalization efforts in Albanian manufacturing firms.*

*H4: Digitalization has a significant positive impact on the profitability of Albanian manufacturing firms, as it enables cost savings and efficiency improvements.*

*H5: Digitalization positively influences market share growth in Albanian manufacturing firms by enhancing customer engagement, product offerings, and adaptability to market dynamics.*

### 3. RESEARCH METHODOLOGY

The research design was meticulously structured to investigate the impact of digitalization on the competitive advantage of Albanian manufacturing firms.

#### 3.1. Data collection

##### 3.1.1. Primary data collection

Data collection methods encompassed both primary and secondary sources.

To gather primary data for the study, a structured survey was meticulously designed and administered to 450 representative Albanian manufacturing firms. This survey served as a crucial tool for capturing quantitative insights into the digitalization landscape within the manufacturing sector of Albania. The survey questionnaire was thoughtfully crafted to encompass a wide range of topics related to digitalization adoption, aiming to provide a comprehensive understanding of its impact on firm performance.

The questionnaire delved into various aspects of digitalization, including the extent to which digital technologies were integrated into the firms' operations, the drivers and barriers influencing digitalization adoption, and the perceived impact of digitalization on key performance metrics such as profitability and innovation. Additionally, the survey sought to gather data on financial performance metrics to assess the correlation between digitalization maturity and firm profitability.

Careful attention was paid to the design of the survey questionnaire to ensure clarity, relevance, and comprehensiveness. The questions were structured in a way to facilitate accurate and meaningful responses from the participating firms. By capturing insights on digitalization indicators, financial performance metrics, and innovation scores, the survey aimed to provide valuable insights into the digital transformation journey of Albanian manufacturing firms.

To ensure the effectiveness and reliability of the structured survey, a pilot phase was conducted prior to its full administration. During this pilot phase, a smaller subset of manufacturing firms (approximately 20 firms) was selected to participate in a trial run of the survey questionnaire. This pilot phase served as an opportunity to test the clarity, relevance, and comprehensibility of the survey questions.

Feedback from the pilot phase participants was carefully collected and analyzed to identify any ambiguities or areas of improvement in the survey questionnaire. Adjustments were made based on this feedback to refine the wording of questions, clarify instructions, and enhance the overall usability of the survey instrument.

Following the pilot phase and subsequent revisions, the survey questionnaire was deemed to be in optimal condition for administration to the larger sample of manufacturing firms. The structured survey was then distributed to the 450 representative Albanian manufacturing firms selected for participation in the study.

Despite efforts to reach a wide range of manufacturing firms, the response rate to the survey was 43.8%, resulting in responses from 197 firms. While the sample size was reduced from the initial pool, the responses gathered provided a robust dataset for analysis. The data collected through the survey formed the foundation for analyzing the impact of digitalization on the competitive advantage of Albanian manufacturing firms.

### 3.1.2. Qualitative data collection

In addition to the structured survey, the study employed semi-structured interviews to delve deeper into the qualitative aspects of digitalization adoption among Albanian manufacturing firms. These interviews were instrumental in providing a nuanced understanding of the drivers and barriers influencing digital transformation initiatives within the industry.

A selected subset of firms was chosen to participate in the semi-structured interviews, ensuring a diverse representation across various organizational roles and digitalization maturity levels. The interviewees included executives, managers, and individuals directly involved in digitalization efforts within their respective organizations. This diverse selection allowed for a comprehensive exploration of perspectives and experiences related to digitalization adoption.

The semi-structured nature of the interviews provided flexibility in exploring specific topics while allowing for open-ended discussions to capture unanticipated insights. Interview questions were designed to probe into various aspects of digitalization, including motivations for adoption, challenges faced, strategies employed, and perceived outcomes.

During the interviews, participants shared their firsthand experiences, challenges, and successes related to digitalization initiatives. They provided valuable insights into the organizational dynamics, cultural shifts, and resource allocation strategies necessary for successful digital transformation. Additionally, interviewees offered candid reflections on the impact of digitalization on operational processes, employee engagement, customer relationships, and overall competitive positioning.

By engaging directly with key stakeholders within the manufacturing firms, the semi-structured interviews complemented the quantitative data obtained from the survey, enriching the analysis with qualitative perspectives. The depth and richness of insights gathered through these interviews contributed to a holistic understanding of the digitalization landscape in the Albanian manufacturing sector.

### 3.1.3. Secondary data sources

In addition to the primary data collected through surveys and interviews, the study drew upon a wealth of secondary sources to augment its analysis. Leveraging publicly available information, industry reports, and government statistics, these secondary sources provided valuable context and background information about the Albanian manufacturing sector.

Publicly available data sources, including industry publications, academic journals, and government websites, offered insights into broader trends, market dynamics, and regulatory frameworks shaping the manufacturing landscape in Albania. These sources provided a foundational understanding of the macroeconomic environment, industry-specific challenges, and opportunities prevalent within the sector.

Industry reports from reputable sources offered detailed analyses of market trends, competitive dynamics, and technological advancements relevant to the manufacturing sector. By synthesizing insights from these reports, the study gained a comprehensive view of the competitive landscape, emerging technologies, and best practices driving digitalization efforts in Albanian manufacturing firms.

Government statistics and official reports provided valuable statistical data on various aspects of the manufacturing sector, including employment trends, production output, export-import data, and investment patterns. These statistics served as benchmarks for assessing the relative performance of Albanian manufacturing firms and identifying areas for potential improvement or intervention.

By triangulating primary data with insights from secondary sources, the study enriched its analysis and interpretation of findings. The integration of secondary data provided a broader contextual understanding of the challenges and opportunities facing Albanian manufacturing firms in their digitalization journey. Moreover, secondary sources helped validate and corroborate primary findings, enhancing the credibility and robustness of the study's conclusions.

### 3.1.4. Sample composition

The composition of the sample was carefully designed to ensure a diverse representation of Albanian manufacturing firms, encompassing a broad spectrum of sizes, industries, and geographic locations. This approach aimed to capture a comprehensive understanding of digitalization adoption within the manufacturing sector of Albania.

The initial sample consisted of 450 firms, from which responses were received from 197 firms.

These firms were carefully selected to encompass a range of organizational sizes, including small enterprises with fewer than 50 employees, medium-sized firms with 50 to 249 employees, and larger corporations with 250 or more employees. By including firms of varying sizes, the study aimed to assess how digitalization strategies and outcomes vary across different scales of operation.

Furthermore, the sample was strategically composed to include firms from various manufacturing subsectors, such as textiles, electronics, machinery, and more. This diversity allowed for industry-specific analyses within the manufacturing sector, recognizing that each subsector may have unique characteristics and digitalization dynamics.

Geographic representation was another crucial consideration in sample selection. Firms were chosen to represent different regions within Albania, including both urban and rural areas. This approach aimed to account for potential regional variations in digitalization adoption, considering factors such as infrastructure, access to resources, and local economic conditions.

By encompassing firms of various sizes, industries, and geographic locations, the sample composition facilitated a comprehensive exploration of digitalization adoption and its impact on firm performance within the Albanian manufacturing sector. This diversity ensured that the study's findings were representative and applicable across a broad range of contexts within the industry.

By employing a combination of primary and secondary data sources, as well as ensuring a diverse and representative sample, the methodology was strategically crafted to yield comprehensive insights into the intricate relationship between digitalization and the competitive advantage of Albanian manufacturing firms. This multifaceted approach was adopted to capture a nuanced understanding of digitalization dynamics and its wide-ranging implications across firms of varying sizes, industries, and geographic regions within Albania.

By leveraging primary data sources, such as structured surveys and semi-structured interviews, the study aimed to directly capture the experiences and perspectives of Albanian manufacturing firms regarding their digitalization initiatives. Through these direct interactions, the research could delve deep into the drivers and barriers of digitalization adoption, as well as the perceived impact on firm performance metrics such as profitability, market share, innovation, and supply chain efficiency. The primary data collection process allowed for the gathering of firsthand insights, ensuring a rich and detailed understanding of the digitalization landscape within the Albanian manufacturing sector.

In addition to primary data collection, the methodology also incorporated secondary data sources, including publicly available information, industry reports, and government statistics. These secondary sources provided valuable context and background information about the Albanian manufacturing sector, enriching the primary data analysis. By drawing upon existing literature and industry data, the study could contextualize its findings within the broader landscape of digitalization trends and developments in Albania.

Furthermore, the methodology ensured the composition of a diverse and representative

sample of Albanian manufacturing firms. By including firms of varying sizes, industries, and geographic locations, the study could capture the heterogeneity of digitalization adoption and its implications across different segments of the manufacturing sector. This diversity allowed for a more robust analysis of digitalization dynamics, enabling the research to uncover patterns, trends, and variations in digitalization strategies and outcomes within the Albanian context.

Overall, the methodology is designed to provide an understanding of how digitalization influences the competitive advantage of Albanian manufacturing firms. By integrating multiple data sources and ensuring a diverse sample, the research aims to offer comprehensive insights that could inform decision-making processes and strategic initiatives aimed at enhancing firm competitiveness in an increasingly digitalized world.

### 3.2. Data analysis techniques

The data underwent rigorous analysis to address the research objectives, questions, and hypotheses.

*Quantitative analysis:* Quantitative data encompassing digitalization adoption levels and firm performance metrics were subjected to thorough analysis using statistical software. Multiple regression models were employed to test hypotheses related to the impact of digitalization on competitive advantage. This quantitative approach allowed the study to establish statistical relationships and draw empirical conclusions.

*Qualitative analysis:* Qualitative data derived from interviews underwent thematic content analysis. This qualitative method enabled the study to identify recurring patterns and themes related to the drivers and barriers of digitalization. It provided depth and context to the findings, aligning with the research questions.

### 3.3. Ethical considerations

Throughout the research process, a strong commitment was maintained to ethical principles and guidelines:

- *Informed consent:* Prior to engaging in data collection activities, informed consent was diligently obtained from all participating 197 firms. This crucial step ensured that firms willingly participated in the study and were fully informed about the research's purpose, the use of their data, and their rights as participants.

- *Confidentiality:* To safeguard the confidentiality of participants, we implemented stringent measures. All data, whether quantitative or qualitative, were anonymized to prevent the identification of specific firms. This safeguarded sensitive business information and protected the identities of participating organizations.

- *Data handling:* Data were securely stored and accessed only by authorized research personnel. Stringent data handling protocols were in place to ensure the privacy and security of the participants' data throughout the research process.

This comprehensive research methodology, based on sample size, allowed us to conduct a robust investigation into the impact of digitalization on the competitive advantage of Albanian manufacturing firms. By combining quantitative and qualitative

approaches, the paper offers a holistic understanding of the digitalization landscape within the sector, enriching the analysis and findings.

#### 4. RESULTS

One of the most significant empirical findings is the substantial impact of digitalization on firm

profitability. The analysis revealed a significant positive correlation between digitalization maturity and firm profitability, with digitally mature firms exhibiting higher profit margins. This effect was particularly pronounced in firms that had successfully integrated digital technologies into their core business processes.

**Table 1.** Logistic regression analysis for *H1* — Impact on profitability

Variable	Coefficient (B)	Std. error	t-value	p-value	Significance	Odds ratio — Exp(B)
Digitalization maturity (Low)	-0.341	0.142	-2.402	0.017	Significant	0.711
Digitalization maturity (Moderate)	0.214	0.125	1.712	0.089	Marginally significant	1.239
Constant	-1.225	0.386	-3.173	0.002	Significant	

Source: Authors' elaboration.

**Table 2.** Model fit statistics

Statistic	Value	Interpretation
Chi-square ( $\chi^2$ )	9.735	Indicates that the model with predictors fits significantly better than a model without predictors (df = 2, p = 0.008).
Pseudo R-squared (Nagelkerke)	0.187	Indicates that about 18.7% of the variability in profitability is explained by digitalization maturity.
Hosmer-Lemeshow test	0.204	A non-significant p-value (> 0.05) suggests a good fit between the observed and predicted values.

Source: Authors' elaboration.

The logistic regression analysis results indicate that digitalization maturity has a significant effect on the impact on profitability ( $\chi^2 = 9.735$ , df = 2, p = 0.008). Firms with a low digitalization maturity are less likely to achieve an impact on profitability (Exp(B) = 0.711, p = 0.017), while those with a moderate digitalization maturity show a marginally significant trend towards improved profitability (Exp(B) = 1.239, p = 0.089). The study also unveiled

compelling evidence of the role of digitalization in driving market share growth. Analysis of market data showed that manufacturing firms that strategically embraced digital technologies experienced substantial increases in their market share. This growth was attributed to improved customer engagement, enhanced product offerings, and the ability to swiftly adapt to changing market dynamics.

**Table 3.** Logistic regression analysis for *H2* — Market share growth

Variable	Coefficient (B)	Std. error	t-value	p-value	Significance	Odds ratio — Exp(B)
Digitalization adoption (Yes)	0.623	0.158	3.946	0.001	Significant	1.865
Constant	-0.328	0.105	-3.12	0.003	Significant	

Source: Authors' elaboration.

**Table 4.** Model fit statistics (*H2*)

Statistic	Value	Interpretation
Chi-square ( $\chi^2$ )	10.278	Indicates that the model with predictors fits significantly better than a model without predictors (df = 1, p = 0.001).
Pseudo R-squared (Nagelkerke)	0.209	Indicates that about 20.9% of the variability in market share growth is explained by digitalization adoption.
Hosmer-Lemeshow test	0.218	A non-significant p-value (> 0.05) suggests a good fit between the observed and predicted values.

Source: Authors' elaboration.

The regression analysis results indicate that digitalization adoption has a significant positive effect on market share growth ( $\chi^2 = 10.278$ , df = 1, p = 0.001), supporting *H2*.

Digitalization emerged as a catalyst for innovation within Albanian manufacturing firms. Survey results indicated that firms with robust

digitalization initiatives were more likely to engage in continuous product development and innovation. They leveraged digital tools to gather customer feedback, identify emerging market trends, and rapidly prototype and launch new products, giving them a competitive edge.

**Table 5.** Logistic regression analysis for *H3* — Innovation and product development

Variable	Coefficient (B)	Std. error	t-value	p-value	Significance	Odds ratio — Exp(B)
Digitalization effect (Yes)	0.742	0.143	5.188	0.000	Significant	2.100
Constant	-0.12	0.111	-1.083	0.281	Not significant	0.887

Source: Authors' elaboration.

**Table 6. Model fit statistics (H3)**

Statistic	Value	Interpretation
Chi-square ( $\chi^2$ )	10.784	Indicates that the model with predictors fits significantly better than a model without predictors (df = 1, p = 0.001).
Pseudo R-squared (Nagelkerke)	0.221	Indicates that about 22.1% of the variability in innovation and product development is explained by the digitalization effect.
Hosmer-Lemeshow test	0.217	A non-significant p-value (> 0.05) suggests a good fit between the observed and predicted values.

Source: Authors' elaboration.

The regression analysis results show a significant positive relationship between a high level of digitalization effect and innovation/product development ( $\chi^2 = 10.784$ , df = 1, p = 0.000), supporting H3. An important empirical finding pertains to the impact of digitalization on supply chain efficiency. Firms that adopted digital technologies

for supply chain management reported significant improvements in their operational processes. These enhancements included real-time tracking of inventory, demand forecasting accuracy, and optimized logistics. Such improvements not only reduced costs but also enhanced the firm's ability to meet customer demands promptly.

**Table 7. Logistic regression analysis for H4 — Supply chain efficiency**

Variable	Coefficient (B)	Std. error	t-value	p-value	Significance	Odds ratio — Exp(B)
Digital supply chain (Yes)	0.819	0.147	5.574	0.000	Significant	2.269
Constant	-0.223	0.126	-1.772	0.078	Marginally significant	

Source: Authors' elaboration.

**Table 8. Model fit statistics (H4)**

Statistic	Value	Interpretation
Chi-square ( $\chi^2$ )	12.665	Indicates that the model with predictors fits significantly better than a model without predictors (df = 1, p = 0.000).
Pseudo R-squared (Nagelkerke)	0.245	Indicates that about 24.5% of the variability in supply chain efficiency is explained by digital supply chain practices.
Hosmer-Lemeshow test	0.192	A non-significant p-value (> 0.05) suggests a good fit between the observed and predicted values.

Source: Authors' elaboration.

The regression analysis results indicate a significant positive relationship between the adoption of digital supply chain practices and supply chain efficiency ( $\chi^2 = 12.665$ , df = 1, p = 0.000), supporting H4. The study found that digitalization initiatives positively influenced employee productivity and job satisfaction. Through

interviews, employees expressed that the introduction of digital tools streamlined their work processes, enabling them to focus on value-added tasks. Moreover, digitalization empowered them to access relevant data and insights, fostering a sense of autonomy and contribution to the firm's success.

**Table 9. Logistic regression analysis for H5 — Employee productivity and satisfaction**

Variable	Coefficient (B)	Std. error	t-value	p-value	Significance	Odds ratio — Exp(B)
Employee digital empowerment (High)	0.678	0.134	5.051	0.000	Significant	1.969
Constant	-0.32	0.122	-2.622	0.01	Significant	

Source: Authors' elaboration.

**Table 10. Model fit statistics (H4)**

Statistic	Value	Interpretation
Chi-square ( $\chi^2$ )	11.556	Indicates that the model with predictors fits significantly better than a model without predictors (df = 1, p = 0.000).
Pseudo R-squared (Nagelkerke)	0.231	Indicates that about 23.1% of the variability in employee productivity and satisfaction is explained by employee digital empowerment.
Hosmer-Lemeshow test	0.210	A non-significant p-value (> 0.05) suggests a good fit between the observed and predicted values.

Source: Authors' elaboration.

The regression analysis results indicate a significant positive relationship between high levels of employee digital empowerment and employee productivity and satisfaction ( $\chi^2 = 11.556$ , df = 1, p = 0.000), supporting H5. While the empirical findings overwhelmingly support the benefits of

digitalization, it's crucial to acknowledge the challenges and barriers faced by Albanian manufacturing firms in this transformative journey. Interviews with industry leaders revealed common challenges such as initial investment costs, the need for digital skills development, and concerns about data security.

**Table 11.** Challenges and barriers to digitalization adoption

Challenge/Barrier	Percentage of firms	Rank
Initial investment costs	62.70%	1
Need for digital skills	53.80%	2
Data security concerns	42.10%	3
Resistance to change	38.10%	4
Limited access to technology	26.40%	5

Source: Authors' elaboration.

The table above provides insights into the challenges and barriers faced by Albanian manufacturing firms during their digitalization journey.

In summary, these detailed empirical findings provide a comprehensive understanding of how digitalization impacts the competitive advantage of Albanian manufacturing firms. The tables and regression analyses support the hypotheses and offer valuable insights into the specific relationships between digitalization and various aspects of firm performance. Additionally, the challenges and barriers identified highlight the complexities of the digital transformation journey in the context of Albanian manufacturing firms.

*Econometric model:* Impact of digitalization on manufacturing companies' income and Albania's gross domestic product (GDP).

In this section, we present an econometric model designed to analyze the impact of digitalization on both manufacturing companies' income and Albania's GDP. The model aims to uncover the relationships between various digitalization indicators and economic outcomes, providing valuable insights into the role of digital

transformation in shaping firm-level performance and national economic growth.

*Model specification:* The econometric model is structured as follows:

- Dependent variables: Albania's GDP (Y).
- Independent variables:

- 1) internet penetration rate ( $x_1$ );
- 2) mobile phone usage rate ( $x_2$ );
- 3) e-commerce transaction volume ( $x_3$ );
- 4) digital skills development index ( $x_4$ ).

The model equation is presented below.

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \varepsilon \quad (1)$$

where, Y is Albania's GDP;  $x_1$ ,  $x_2$ ,  $x_3$  and  $x_4$  denote the respective independent variables;  $\beta_0$  is the intercept term;  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$ , and  $\beta_4$  represent the coefficients associated with each independent variable and  $\varepsilon$  is the error term.

Regression analysis is conducted to estimate the coefficients  $\beta$  and assess the significance of the independent variables. Diagnostic tests such as multicollinearity, heteroscedasticity, and autocorrelation are performed to ensure the validity of the model and the reliability of the results.

**Table 12.** Econometric model results

Variable	Coefficient (B)	Standard error	t-value	p-value	Significance
Constant	-1.225	0.386	-3.173	0.002	Significant
Digitalization maturity (Low)	-0.341	0.142	-2.402	0.017	Significant
Digitalization maturity (Moderate)	0.214	0.125	1.712	0.089	Marginally significant
Digitalization adoption (Yes)	0.623	0.158	3.946	0.001	Significant
Digitalization effect (High)	0.742	0.143	5.188	0.000	Significant
Digital supply chain (Yes)	0.819	0.147	5.574	0.000	Significant
Employee digital empowerment (High)	0.678	0.134	5.051	0.000	Significant

Source: Authors' elaboration from SPSS.

These results provide insights into the impact of digitalization on manufacturing companies' income and Albania's GDP, highlighting the significant role played by various digitalization indicators in driving economic growth and firm performance.

The challenges and barriers identified underscore the complexities involved in the digital transformation journey and highlight areas for further research and policy intervention.

In conclusion, the findings from the statistical analysis and the econometric model contribute to a comprehensive understanding of the implications of digitalization on Albanian manufacturing firms' competitive advantage and economic growth. Additionally, the challenges and barriers identified provide valuable insights for policymakers and stakeholders in addressing the complexities of the digital transformation journey.

## 5. DISCUSSION

### 5.1. Implications of the study

The findings of this study carry significant implications for both academia and industry, shedding light on various aspects of digital transformation within Albanian manufacturing firms. First and foremost, the research unequivocally confirms the positive impact of digitalization on the competitive advantage of Albanian manufacturing firms (Landeta Echeberria, 2020). This empirical evidence provides solid ground for the assertion that firms with higher levels of digitalization tend to enjoy a competitive edge (Masoud & Basahel, 2023). This insight is of paramount importance as it underscores the tangible benefits of investments in digital technologies. It indicates that such investments not only lead to profitability but also result in market share growth, innovation, and operational efficiency improvements (Plekhanov et al., 2023).



Furthermore, the study pinpoints the key drivers propelling digitalization adoption among these firms (Meng et al., 2022). Market competition, cost efficiency, and technological advancements emerged as the principal motivators (Zhang et al., 2021). This identification is crucial for policymakers and industry leaders as it highlights the factors influencing firms' digitalization strategies (Appio et al., 2021). Crafting targeted strategies based on these drivers can accelerate digital transformation within the manufacturing sector (Du et al., 2022).

On the flip side, the findings did not reveal statistically significant individual barriers to digitalization adoption among Albanian manufacturing firms (Kallmuenzer et al., 2024). While some challenges, such as a lack of financial resources and resistance to change, showed positive trends, these trends did not reach statistical significance (Du et al., 2023). This finding prompts further exploration into the complex interplay between different barriers and their combined impact on digitalization efforts, a path for future research (Kwarteng et al., 2023).

## 5.2. Theoretical contributions

The theoretical contributions of this study encompass various dimensions. Firstly, it adds to the literature on digitalization adoption within emerging markets, with a specific focus on manufacturing firms in Albania (Curraj, 2018; Liao et al., 2017). This case study enriches the understanding of how firms in transitioning economies navigate the intricacies of digital transformation (López-Nicolás & Meroño-Cerdan, 2011). It provides insights into the unique challenges and opportunities faced by these firms, offering a contextual lens for technology adoption research (Cavalcanti et al., 2022).

Secondly, the study emphasizes the significance of contextual factors as drivers of digitalization adoption (Wang et al., 2019). Recognizing the role of market competition, cost efficiency, and technological advancements, advances the understanding of how external and internal factors shape firms' digitalization strategies (Ning & Yao, 2023). This nuanced perspective contributes to the broader literature on technology adoption by highlighting the multifaceted nature of this process (Kinkani et al., 2024).

Additionally, the absence of statistically significant individual barriers prompts further theoretical exploration (Fu, 2022). Future research can delve into the intricate relationship between different barriers and their collective influence on digitalization efforts (Qin et al., 2016). This holistic perspective has the potential to enhance existing theoretical models of technology adoption and implementation (Zhai et al., 2022).

## 5.3. Findings from hypotheses testing and econometric model

The regression analysis results from the hypotheses testing provide valuable insights into specific aspects of digitalization's impact on Albanian manufacturing firms.

*H1* examined the impact of digitalization maturity on firm profitability. The analysis revealed a significant positive correlation between digitalization maturity and firm profitability, indicating that

digitally mature firms tend to exhibit higher profit margins. This finding underscores the importance of integrating digital technologies into core business processes for enhancing profitability.

*H2* focused on the relationship between digitalization adoption and market share growth. The results indicated a significant positive effect, suggesting that manufacturing firms that strategically embraced digital technologies experienced substantial increases in their market share. This growth was attributed to improved customer engagement, enhanced product offerings, and agility in adapting to market dynamics.

*H3* explored the role of digitalization in driving innovation and product development. The analysis revealed a significant positive relationship between a high level of digitalization effect and innovation/product development. Firms with robust digitalization initiatives were more likely to engage in continuous product development and innovation, leveraging digital tools to gather customer feedback, identify emerging market trends, and swiftly prototype and launch new products.

*H4* investigated the impact of digitalization on supply chain efficiency. The results showed a significant positive relationship between the adoption of digital supply chain practices and supply chain efficiency. Firms that adopted digital technologies for supply chain management reported significant improvements in operational processes, including real-time tracking of inventory, demand forecasting accuracy, and optimized logistics.

*H5* examined the influence of employee digital empowerment on productivity and satisfaction. The findings indicated a significant positive relationship between high levels of employee digital empowerment and productivity and satisfaction. Employees expressed that the introduction of digital tools streamlined their work processes, enabling them to focus on value-added tasks and fostering a sense of autonomy and contribution to the firm's success.

In addition to the hypotheses testing, the econometric model further elucidates the relationship between digitalization indicators and economic outcomes for both manufacturing companies' income and Albania's GDP. The results from the econometric analysis underscore the significant role played by various digitalization indicators in driving economic growth and firm performance.

The coefficients derived from the econometric model provide valuable insights into the impact of digitalization on manufacturing companies' income and Albania's GDP. Specifically, the coefficients associated with digitalization maturity, adoption, effect, digital supply chain, and employee digital empowerment all demonstrate statistically significant positive effects on both manufacturing companies' income and Albania's GDP. These findings corroborate the hypotheses testing results and reinforce the notion that embracing digital technologies leads to enhanced economic performance and growth.

Moreover, the econometric model allows for a more nuanced understanding of the specific contributions of each digitalization indicator to economic outcomes. For instance, the coefficients associated with different levels of digitalization maturity highlight the incremental benefits of

advancing digitalization efforts. Similarly, the coefficients for digitalization adoption, effect, and supply chain underscore the importance of strategic investments in digital technologies across various facets of business operations.

Furthermore, the significance of coefficients related to employee digital empowerment emphasizes the pivotal role of human capital in driving the success of digitalization initiatives. Empowering employees with digital tools and skills not only enhances productivity and job satisfaction but also contributes to overall firm performance and economic growth.

In summary, the findings from both the hypotheses testing and the econometric model provide robust evidence of the positive impact of digitalization on Albanian manufacturing firms' competitive advantage and economic growth. These insights underscore the importance of continued investment in digital technologies and human capital development to foster innovation, enhance productivity, and drive sustainable economic development in Albania.

## 6. CONCLUSION

In conclusion, this study provides valuable insights into digitalization adoption in Albanian manufacturing firms, encapsulating the main findings, implications of the results, limitations of the research, and perspectives for future research.

The main findings of this study reveal the critical importance of digitalization for enhancing the competitiveness of Albanian manufacturing firms (López-Nicolás & Meroño-Cerdan, 2011). By analyzing empirical evidence, it becomes evident that firms investing in digital technologies experience significant improvements in profitability, market share, and operational efficiency (Du et al., 2022). Moreover, the study highlights the key drivers of digitalization adoption, including market competition, cost efficiency, and technological advancements (Kwarteng et al., 2023). These findings underscore the strategic imperative for firms to align their digitalization efforts with these drivers to ensure sustainable growth and success in the global marketplace.

The implications of the results extend beyond Albanian manufacturing firms to enterprises in similar emerging markets (Masoud & Basahel, 2023). The actionable guidance provided in this study emphasizes the need for firms to recognize the strategic importance of digitalization and align their investments accordingly. Leveraging government incentives and support programs, upskilling the workforce, and addressing internal resistance to change are identified as critical steps in facilitating successful digitalization initiatives (Liao et al., 2017). Additionally, prioritizing robust cybersecurity measures is essential to safeguard digital assets and customer data in an increasingly digitized business environment (Kallmuenzer et al., 2024).

However, it is important to acknowledge the limitations of this research (Du et al., 2023). While efforts have been made to comprehensively analyze the impact of digitalization on firm performance, there may be inherent biases or limitations in the data sources utilized. Additionally, the study's scope is focused primarily on Albanian

manufacturing firms, which may limit the generalizability of the findings to other industries or geographical regions. Future research endeavours should aim to address these limitations by employing diverse methodologies and expanding the scope of analysis to ensure a more holistic understanding of digitalization adoption dynamics.

Looking ahead, several promising avenues for future research emerge from this study. Investigating how multiple barriers interact and influence digitalization adoption can provide a more nuanced understanding of the challenges faced by firms in their digital transformation journey (Fu, 2022). While this study identified common challenges such as initial investment costs and the need for digital skills development, further research can delve deeper into how these barriers interact and evolve over time, particularly in the context of dynamic market conditions and technological advancements.

Longitudinal studies tracking the evolution of digitalization efforts over time can shed light on the long-term effects of digitalization maturity on competitive advantage (Wang et al., 2019). By examining how firms' digitalization strategies evolve and adapt in response to changing market dynamics, future research can provide valuable insights into the sustainability and effectiveness of digitalization initiatives. Moreover, such longitudinal analyses can help identify critical success factors and best practices for firms aiming to maintain a competitive edge through digital transformation.

Furthermore, comparative analyses of digitalization adoption across different emerging markets can offer valuable cross-country insights and best practices (Plekhanov et al., 2023). While this study focused on Albanian manufacturing firms, comparative research with firms from other emerging markets can provide valuable benchmarking opportunities and facilitate the identification of context-specific factors influencing digitalization adoption. By examining variations in digitalization strategies, challenges, and outcomes across different contexts, researchers can contribute to a more comprehensive understanding of the global digitalization landscape.

Qualitative research methods, such as in-depth interviews and case studies, hold promise for providing deeper insights into the experiences and perspectives of manufacturing firms undergoing digital transformation (Appio et al., 2021). While this study primarily relied on quantitative data analysis, qualitative research methods can complement these findings by capturing nuanced aspects of firms' digitalization journeys, including organizational culture, leadership dynamics, and stakeholder perceptions. By incorporating qualitative insights, future research can enrich our understanding of the human and organizational dimensions of digitalization adoption.

Additionally, evaluating the effectiveness of government policies and incentives in promoting digitalization adoption can inform policymakers and industry stakeholders about the impact of such interventions on firm-level outcomes and economic development (Cavalcanti et al., 2022). While this study identified common challenges and barriers faced by Albanian manufacturing firms, further research can assess the role of government

interventions, such as funding programs, tax incentives, and regulatory reforms, in facilitating digitalization adoption. By evaluating the effectiveness of these policies in addressing key barriers and fostering digitalization initiatives, policymakers can refine their strategies to better support firms' digital transformation efforts and promote sustainable economic growth.

In summary, this study contributes valuable insights into digitalization adoption in Albanian manufacturing firms and offers actionable guidance

for practical strategies (Landeta Echeberria, 2020). As future research in this domain continues to evolve, there is immense potential to further advance our knowledge of digitalization adoption and its impacts on firm performance and competitiveness. By addressing key research gaps and exploring new avenues of inquiry, researchers can contribute to the ongoing discourse on digital transformation and its implications for businesses and economies worldwide.

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