Differential Pathways to Digitalisation: A Multi-group Analysis of Trade and Services SMEs

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Abstract. Digitalisation is critical for the survival of small and medium-sized enterprises (SMEs), yet the mechanisms adopted across sectors vary significantly. This study combines the technology-organisation-environment (TOE) and the technology acceptance model (TAM) to investigate the impact of perceived benefits and the role of government support on the adoption of digital technologies (ADT). It examines the mediating role of transformational governance (TG). Two research questions are posed. First, to what extent do perceived benefits and government support stimulate SMEs' transformational governance to adopt digital technologies? Second, are there statistically significant differences in the mechanisms of digital technologies adoption between SMEs in the trade and services sectors? Data were collected from 509 SMEs in Bulgaria – 198 in trade (retail and wholesale), and 311 in the services sector. The study raised four hypotheses, which were analysed employing Structural Equation Modelling and Multi-Group Analysis. Findings related to RQ1 revealed that perceived benefits were found to be the strongest driver of ADT. Government support, while significant, has a direct but rather low impact on TG. This further supports the conclusion that SMEs respond more to their own perceptions of the value of digitalisation than to external stimuli. TG emerged as a critical mechanism that mediates the impact of perceived benefits on the actual adoption of digital technologies. Importantly, the MGA results highlight some key differences between services and trade SMEs (RQ2). The impact of perceived benefits on transformational governance is invariant. While government support is a significant, though weak, driver of ADT in services SMEs via TG, it is insignificant for trade SMEs. Furthermore, ADT in trade SMEs is strongly dependent on TG, whereas in services SMEs, perceived benefits emerge as an important catalyst. This study's findings contribute to the literature by highlighting the sector differences and the need for sector-specific approaches. It provides practical insights for policymakers and managers for navigating digitalisation successfully.

Keywords: Digital technologies adoption, Trade SMEs, Services SMEs, Multi-group analysis (MGA)

1. Introduction

The adoption of digital technologies (ADT) is already shaping new business models and creating new opportunities for firms. Researchers and practitioners, however, highlight some specific challenges faced by SMEs, such as resource and skills limitations, that distinguish them from large enterprises and result in slower, less effective digital uptake (Sagala and Őri, 2024; Kallmuenzer et al., 2025). Although governments deploy SME-targeted policies to facilitate digitalisation and reduce resource constraints, their effects are dubious. However, as Li et al. (2025) argue, the relative dominance of government and market forces in enterprise digital transformation remains underexplored.

Furthermore, digital technologies are not spreading evenly across firms in different sectors; thus, not every sector or firm benefits equally (Grashof and Kopka, 2023). Different sectors face variations in the factors that determine firm success in ADT – they face a diverse technological landscape, unequal transformation speed, and different diffusion of new digital products (Calvino, Costa and Haerle, 2026). Oliveira et al. (2014) find significant differences in the determining factors between manufacturing and service firms with respect to cloud computing adoption. Some studies show that manufacturing firms implement new technologies more intensively (Xie, Zhang and Blanco, 2023; Da Silva et al., 2025), while others reveal that service SMEs are more interested in digital transformation (Ghobakhloo and Iranmanesh, 2021; Krajčík et al., 2023). Conversely, Chapano and Werner (2026) demonstrate that the manufacturing sector lags in terms of digital adoption, the retail sector is a moderate adopter, while the finance sector is perceived as a strong adopter.

Digital uptake requires proper strategies and governance mechanisms to ensure technologies are not only introduced but also effectively used to realise their benefits. Some authors call for more empirical evidence of SME digitalisation across sectors (Meier, 2021). Both empirical research and theoretical work provide fragmented insights into the factors influencing SMEs' digitalisation (Dörr et al., 2023; Kahveci, 2025). While some studies provide insights into manufacturing (Chirumalla et al., 2025) and services (Smith, 2024) firms, the trade sector remains less explored.

In retail, as in services, digital technologies' benefits are expected to align with sectoral specifics and the focus on customer relationships and personalised experiences. The reason is that customers increasingly switch from traditional services and in-store shopping to e-services and online shopping (Ingaldi and Klimecka-Tatar, 2022).

Digital technologies are transforming the retailer-consumer interface (Grewal et al., 2023), fundamentally reconfiguring the retail value chain and shaping new business models, including platform-based retail (Zhang and Hänninen, 2022). However, targeted government support policies are typically less focused on the retail sector (Tilly and Carré, 2026). Yet, few studies examine government policies' influence on the digitalisation of enterprises, and the impact mechanisms remain unclear (Yu et al., 2025).

Thus, the following research questions are posed. RQ1: To what extent do perceived benefits and government support stimulate SMEs' transformational governance to adopt digital technologies? RQ2: Are there statistically significant differences in the mechanisms of digital technologies adoption between SMEs in trade and services sectors?

2. Theoretical Background

The theoretical framework that guides this study integrates the technology-organisation-environment model (TOE) (Tornatzky and Fleischer, 1990) with the technology acceptance model (TAM) (Davis, 1989). TOE helps explain technology adoption through the interaction of available internal/external technologies, organisational factors, and environmental pressure, including government policies. However, the TOE model does not address factors influencing the decision-making process, such as the perception of benefits, included in the TAM model. Although the TAM and the TOE models operate at different levels of analysis, individual and organisational, respectively, they are not mutually exclusive and can be effectively integrated (Safie et al., 2025). This integration allows for exploration of the interaction between environmental influence (government support) and perceived usefulness (benefits) and organisational factors (transformational governance) in the adoption of digital technologies.

Government support (GS). Governments and intergovernmental organisations design various support instruments to ease resource constraints for SMEs. GS here reflects policies promoting SME digitalisation through direct and indirect mechanisms such as subsidies and tax breaks, but also other policies that extend normative pressure, such as in the area of procurement (Yu et al., 2025).

Perceived benefits (PB). PB in this study captures the assessment of the benefits associated with using digital technologies. PB are found to be among the most important drivers of enterprise systems adoption (Faiz, Le and Masli, 2024; Szwajca and Rydzewska, 2025). Theeb et al. (2023) find that perceived usefulness of smart technologies impacts retail stores' performance. Digital technologies are associated with better market and innovation performance (Wang et al., 2025); thus, perceptions of such benefits are expected to drive decisions to digitalise.

Transformational governance (TG). TG here reflects the clarity of roles, responsibilities, and performance measurement, such as goal setting and regular review of their achievement, in support of digitalisation. These are the internal organisational mechanisms that guide the adoption of digital technologies in SMEs. In order to realise their full value, investments in digital technologies should be aligned with organisational elements such as strategies and processes. That is, TG is expected to operationalise the drivers into guidance for ADT by setting clear goals and allocating resources (Chen et al., 2025; Rizana, Wiratmadja and Akbar, 2025).

Adoption of digital technologies (ADT). ADT measures the extent to which SMEs use digital technologies, such as social media, mobile, analytics, and cloud (SMAC) (Gonese and Ngepah, 2024), as well as more advanced technologies like artificial intelligence (AI), blockchain, and the internet of things (IoT) (Ingaldi and Klimecka-Tatar, 2022). Its success would depend on the alignment of drivers and organisational elements, as firms increasingly use multiple technologies simultaneously. ADT allows unveiling the extent to which firms implement these technologies in bundles.

Often, external drivers (including GS) are found to directly impact ADT. Similarly, positive perceptions (PB) of managers impact their willingness to pursue digitalisation. Other studies, however, highlight that while environmental factors initiate digitalisation, its success depends on balancing internal and external environments (Shao et al., 2025). Therefore, this study posits that ADT depends on how these drivers are interpreted within the SME governance mechanisms that guide the adoption and successful utilisation of digital technologies.

Thus, the following hypotheses are raised:

H1. PB of digitalisation has a positive impact on TG.

H2. GS has a positive impact on TG.

H3a. TG mediates the relationship between PB and ADT.

H3b. TG mediates the relationship between GS and ADT.

H4. There is a difference in the mechanism of ADT between trade and services SMEs.

3. Method

3.1 Context

The role of SMEs in the Bulgarian economy is similarly important as in other EU countries (Eurostat, 2026). In 2023, SMEs represented 99.8% of all firms, contributed 74% of total employment, and 67% of gross value added (BSMEPA, 2024). The Bulgarian SME Strategy highlights the need to support specialisation in high-tech manufacturing and knowledge-intensive services, and digitalisation in all economic sectors. However, in terms of adopting digital technologies, Bulgarian SMEs lag behind both local large firms (NSI, 2023) and SMEs in the EU. The e-commerce turnover share for Bulgarian SMEs is the lowest in the EU, accounting for 6.68%; similarly, only around 50% of the Bulgarian SMEs have at least a basic level of digital intensity (EC, 2025). The other digital transformation indicators tracking technology uptake show similar gaps.

3.2 Sample and Data Collection

The target population of this study included SMEs in the services and trade (retail and wholesale) sectors in Bulgaria. Sample acquisition was performed by a market research firm using non-probability convenience sampling. Data were collected during October-December 2023 using a standardised questionnaire with a single respondent per firm via personal interviews.

The sample includes 509 SMEs, of which 198 are in trade (38.9%), and 311 are in the services sector (61.1%). 51.5% are micro (up to 9 employees), 29.3% are small (10-49 employees), and 19.2% are medium-sized (50-249 employees) enterprises. 72.5% of the respondents are owners, partners, or members of the management board, and the rest are in senior management positions, making them qualified to respond to questions related to the adoption of digital technologies.

3.3 Variables' Definitions and Measures

The items to measure the four variables in this study were adapted based on the literature review and validated through interviews with subject-matter experts. The items were translated into Bulgarian and measured on a 5-point Likert scale (1=completely disagree/not at all important, 5=completely agree/very important). The final list of items is available in the Appendix.

3.4 Analytical Procedure

Data were analysed with lavaan in R (Rosseel, 2012). Structural Equation Modelling (SEM) was selected as an appropriate analytical procedure to explore RQ1. SEM allows the exploration of complex research models with many variables and relationships and is not dependent on the normality of data distribution (Hair et al., 2019). To explore RQ2, multi-group analysis (MGA) was performed.

4. Analysis and Results

4.1 Descriptive Statistics

All variables were significantly and positively correlated, meaning further analysis could be performed (Table 1). All correlation coefficients were below 0.8, suggesting multicollinearity was not expected. The problem of common method variance (CMV) was addressed using Harman's one-factor test (Podsakoff et al., 2003). The total variance extracted by a single factor was 42.682%, suggesting that CMV was unlikely to severely distort the findings. Procedural remedies were also applied during the survey design, such as ensuring respondent anonymity.

4.2 Measurement Model

The measurement model was tested using confirmatory factor analysis (CFA). Several of the initially included items were removed due to low loadings (in ADT and GS constructs). The resulting measurement model demonstrated good reliability and convergent validity. Standardised factor loadings for all items exceeded 0.7 except one ADT indicator (0.651), which was retained to represent the scale better. AVE values ranged from 0.553 to 0.824. Construct reliability was further supported by McDonald's omega values, all of which were above 0.70. The model demonstrated satisfactory fit indices: $\chi2(183)=265.04$, $p<0.001$; CFI=0.999; TLI=0.999;

RMSEA=0.030; and SRMR=0.032. The HTMT ratios ranged from 0.475 to 0.756, well within the recommended limit of 0.85, and supported the discriminant validity of the measurement model.

Table 1: Means, standard deviations, and correlations with confidence intervals

Variable	# of items	M	SD	1	2	3
1. ADT	3	2.55	1.04			
2. TG	6	3.04	1.02	0.60** [0.54, 0.65]		
3. PB	8	3.53	0.90	0.56** [0.50, 0.62]	0.65** [0.60, 0.70]	
4. GS	4	3.11	0.99	0.40** [0.33, 0.48]	0.44** [0.37, 0.51]	0.52** [0.46, 0.58]

Note. Values in square brackets indicate the 95% confidence interval for each correlation; **p<0.01.

4.3 Structural Model

Given the ordered categorical nature of all items, diagonally weighted least squares (DWLS) estimation with polychoric correlations was employed for the structural model. Collinearity issues were not identified for the model (VIF<3). The structural model demonstrated excellent fit to the data based on several fit indices: CFI=0.993, TLI=0.956, and SRMR=0.017, although RMSEA was 0.141 (90% CI [0.075, 0.221]), exceeding the conventional threshold. This discrepancy is a known statistical artefact common in models with small degrees of freedom; thus, the model was deemed to provide a robust representation of the data (Kenny, Kaniskan and McCoach, 2015).

The structural model results (Table 2) indicate that all hypothesised paths are statistically significant. PB exerted a strong positive direct effect on TG (β=0.641, p<0.001) and ADT (β=0.425, p<0.001). GS also positively predicted TG, albeit with a smaller effect size (β=0.103, p=0.021). Therefore, H1 and H2 were supported.

Mediation analysis revealed significant indirect effects for both predictors. TG was found to significantly mediate the relationship between PB and ADT (β=0.337, p<0.001, 95% CI [0.287, 0.387]), as well as between GS and ADT (β=0.054, p=0.026, 95% CI [0.006, 0.102]). Since the direct effect of PB remained significant after controlling for the mediator, partial mediation was established. The total impact of PB on ADT was substantial (β=0.762, p<0.001). Therefore, H3a and H3b were supported.

Table 2: Structural Model Path Coefficients and Mediation Analysis

Effect Type	Outcome	Predictor	SE	z	p	β (Std.)	95% CI Lower	95% CI Upper
Direct	TG	PB	0.039	16.281	<0.001	0.641	0.564	0.718
	TG	GS	0.045	2.301	0.021	0.103	0.015	0.191
	ADT	TG	0.029	18.072	<0.001	0.526	0.469	0.583
	ADT	PB	0.029	14.818	<0.001	0.425	0.368	0.481
Indirect	ind_GS_ADT	a2*b	0.024	2.224	0.026	0.054	0.006	0.102
	ind_PB_ADT	a1*b	0.026	13.169	<0.001	0.337	0.287	0.387
Total	total_PB_ADT	c1+(a1*b)	0.024	31.263	<0.001	0.762	0.714	0.810

To test H4, MGA was performed. First, a configural invariance model was assessed utilising the robust DWLS estimator for ordinal data. The configural model demonstrated excellent fit (Scaled $\chi^2(368)=648.85$, p<0.001; CFI=0.992; TLI=0.990; RMSEA=0.055; SRMR=0.043), establishing that the construct configurations are identical across the two groups (Vandenberg and Lance, 2000).

To evaluate the formal statistical equality of path coefficients between the Trade (n=198) and Services (n=311) groups, Wald Chi-square tests were run. The tests confirm that the differences are statistically significant for all paths except PB->TG (Table 3).

Table 3: Statistical Tests of Path Coefficient Differences and Structural Path Coefficients

Structural Path	Between-Group Wald Test Result	Trade	Services	Conclusion
PB→TG	$\chi^2(1)=0.055$, p=0.815 Statistically Not Significant	0.624***	0.576***	No statistically significant difference
GS→TG	$\chi^2(1)=4335$, p=0.037 Statistically Significant (p<0.05)	0.008	0.190***	Stronger in Services
TG→ADT	$\chi^2(1)=4.855$, p=0.028 Statistically Significant (p<0.05)	0.537***	0.314***	Stronger in Trade
PB→ADT	$\chi^2(1)=3.514$, p=0.061 Marginally Significant (p<0.1)	0.244*	0.449***	Marginally stronger in Services

Note. Standardised coefficients are reported. *p< .05, ***p<0.001.

The strongest gap is in the relationship GS->TG: while it is significant in services, it is not in trade. The impact of TG on ADT is stronger in trade, and the impact of PB on ADT is stronger in services. The impact of PB on TG is invariant. Therefore, H4 is confirmed.

The resulting model is illustrated in Fig. 1.

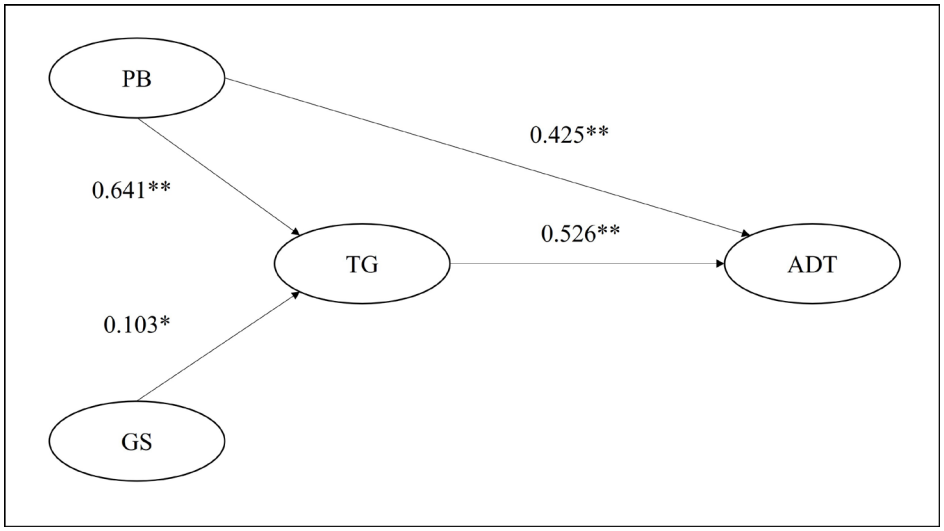


Figure 1: Resulting Model

Note. * $p < 0.05$; ** $p < 0.01$.

5. Discussion and Conclusion

This study aimed to explore the mechanisms of ADT in SMEs in two sectors (services and trade) and possible differences between them. The influence of PB and GS on TG, which shapes ADT, was evaluated.

PB was found to be the strongest driver of ADT. The strong effect of PB on TG suggests that when SMEs see value in digitalising, they engage in aligning the roles, responsibilities, and performance measurements to realise this value. This alignment positively impacts ADT.

Importantly, the direct impact of GS on TG, while significant, is rather low. This further supports the conclusion that SMEs respond more to their own perceptions of the value of digitalisation than to external stimuli. According to Yuen (2023), although government initiatives have encouraged SMEs to digitalise, their progress has been slow. One possible explanation could be that GS might not always align with management's aspirations and strategic plans, resulting in limited impact.

TG emerged as a critical mechanism that mediates the impact of PB on the actual ADT. PB impacts ADT both directly and indirectly. That is, digitalisation requires both understanding what the benefits are and aligning TG

accordingly to realise these benefits (Kallmuenzer et al., 2025). TG also mediates the effect of GS on ADT, although it seems to be valid only for services sector SMEs.

Importantly, MGA results highlight some key differences between the services and trade SMEs. The impact of PB on TG is invariant. In line with the TAM model, SME owners and managers who see the usefulness of ADT for improving performance would invest in designing appropriate governance mechanisms to reap the benefits (Yacob and Peter, 2022).

In the trade sector, TG's role is stronger. That is, proper management of the process (roles, responsibilities, strategy, measuring results) has a stronger effect on ADT. Conversely, the role of PB in fostering ADT is stronger in the services sector. Services sector SMEs seem more flexible in adopting digital technologies, which they perceive as beneficial. The results of Szwajca and Rydzewska (2025) also show that the economic sector has a significant role in shaping firms' expectations of the positive impact of digitisation.

Interestingly, GS impacts TG in the services sector only. One possible explanation of this finding can be the structure of government financing programs in Bulgaria, which are more targeted to manufacturing SMEs. Accordingly, the studied SMEs assess GS as rather neutral. Besides, as Tilly and Carré (2026) argue, retailers face multiple challenges and flaws in digital technologies themselves. Therefore, the studied trade SMEs seem to rely more on their internal TG processes to adopt digital technologies based on PB, and less on GS.

Even in the services sector, GS is not a strong predictor. This aligns with other studies that find a statistically significant, yet marginal role of government policies for the digitalisation of SMEs (Omrani et al., 2022).

This study's findings corroborate prior research findings that digitalisation is not a "one-size-fits-all" process and sectoral specifics should be considered. The OECD (2021) also find that the cross-industry differences in the diffusion of digital technologies are significant. Elo et al. (2026) reveal that firms in knowledge-intensive services have implemented most digitalisation projects, as contrasted with firms in the "other services" category (e.g., transport, warehousing).

From a theoretical perspective, the study confirms the applicability of a combined TOE-TAM model for investigating ADT in SMEs. Some practical recommendations can be derived as well. First, managers of trade SMEs should prioritise the formalisation of their digital strategies. TG is essential, as it helps translate organisational goals into actual technological adoption. Second, managers of services SMEs should continue investing in training and awareness about digital technologies' strategic advantages. PB emerges as the strongest driver for this group, thus fostering a culture that recognises the value of digitalisation is vital.

For policy-makers, these results suggest that GS should be combined with building awareness of the digitalisation benefits (especially for services SMEs), improving managerial capabilities and governance processes (especially in trade SMEs) to increase digital uptake.

This study has its limitations. First, it is cross-sectional, and data were collected from a single respondent in each SME; thus, CMV cannot be completely ruled out. It explores a single national context, with its specificities. As a single study, it could not explore more complex relationships and more variables that could have improved its explanatory strength. Adding manufacturing SMEs could help determine whether the revealed mechanisms are applicable across sectors or align more closely with services and trade SMEs only.

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Ethics Declaration: Data collection procedures were performed in accordance with the ethical standards of Sofia University St. Kliment Ohridski, the European Code of Conduct for Research Integrity, and the Ethics in Social Sciences and Humanities principles of the European Commission.

AI Declaration: AI tools were used for linguistic refinement during the review of draft versions of the article. The authors maintained full control, verified all AI-generated suggestions, and take full responsibility for the accuracy and integrity of the final text.

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Appendix 1

Table 4: Items' Loadings, Cronbach's Alpha, McDonald's Omega, and AVE

Constructs and Items	Loading	Alpha	Omega	AVE
ADT, adapted from Berger et al. (2018)*		0.677	0.718	0.553
Big Data	0.800			
Cloud computing	0.773			
Mobile technologies	0.651			
TG, adapted from Berghaus and Back (2016)		0.952	0.950	0.824
Digitalisation is integrated into our corporate strategy and follows a defined strategic plan	0.934			
Roles, responsibilities, and decision-making processes are defined	0.891			
Goals are defined measurably	0.907			
Goals are reviewed periodically	0.920			
The necessary resources for implementing new digital technologies are allocated	0.910			
The latest developments in digital technologies are constantly monitored	0.883			
PB, adapted from De Mattos et al. (2024)		0.939	0.938	0.720
Enable the processing of large and important data as a basis for management decisions	0.855			
Provide the opportunity for the electronic exchange of necessary documents	0.757			
Facilitate the development of new business models	0.871			
They are essential for innovation in the firm	0.885			
Lead to improvement of internal operational processes in the firm	0.852			
Help increase revenue	0.841			
Help reduce costs	0.825			
Help achieve competitive advantage	0.893			
GS, adapted from Luo and Yu (2022)		0.909	0.909	0.773
Government financial subsidies	0.860			
Tax breaks	0.839			
Government procurement policies	0.908			
National and EU-supported programs	0.907			

Note. *Indicators for usage of social media, IoT, and AI were omitted due to low loadings.