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What is the Impact of Technological Turbulence on Business Model Novelty and Efficiency?

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Abstract: *In today's rapidly evolving business landscape, technological turbulence has become a defining factor that reshapes traditional business models. This paper explores the relationship between technological turbulence and the transformation of business models. To do so, a survey involving 201 businesses operating in Albania was conducted. The survey results show that technological turbulence has a significant positive impact on the development of novel business models and efficient business models. This paper concludes with theoretical and practical implications.*

1. INTRODUCTION

The crucial role that technology plays in the economic development of a nation is widely recognized. Research conducted in both developed and developing countries consistently demonstrates the lasting impact of technology on a nation's competitiveness and its overall growth potential (Haque et al., 1996). According to industrial organization theorists such as Mason (1939), Bain (1968), and Porter (1985), technological change not only stimulates competition but also shapes the structure and rules of industries. In this context, technological turbulence (TT) is defined as the rate of change in product and process technologies used to convert inputs into outputs (Kohli & Jaworski, 1990), representing a critical factor in environmental turbulence (Mason, 1939).

At the firm level, the consequences of a dynamically changing technological landscape can be detrimental if companies do not respond promptly (Ali et al., 2016; Zott & Amit, 2017). Falling behind the technology frontier, as emphasized by Schilling (1998, p. 263), can pose serious risks to firms in certain industries, and catching up becomes a challenging and costly endeavor. Interestingly, despite investments in technology, firms relying solely on technological innovation may not achieve success (Christensen, 1997; Chesbrough & Rosenbloom, 2002; Chesbrough, 2007; Teece, 1988). The failure to extract value from new technologies is a recurring theme in the literature (Chesbrough, 2007; Teece, 1988, 2006). Some scholars argue that it is the business model (BM) that serves as the key to unlocking the potential value of technology (Chesbrough & Rosenbloom, 2002; Johnson et al., 2008; Teece, 2006). Despite its significance, the relationship between technology as a driver of business model innovation (BMI) and its outcomes remains inadequately explored (Foss & Saebi, 2017).

Existing empirical research on this topic is fragmented, with studies showing mixed results. While some indicate that technological turbulence is a crucial driver of Business Model Innovation (BMI) (Bouwman et al., 2018; Guo et al., 2017), others find no direct relationship between technological turbulence and BMI (Pucihar et al., 2019). Notably, the exploration of the

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quantitative impact of technological turbulence on BM design, despite being a key precursor to dynamic capabilities (Teece, 2018, p. 49), has been limited. This article seeks to fill this gap by evaluating the influence of technological turbulence on business model novelty and efficiency. Empirical and conceptual studies indicate that when faced with high levels of TT, companies strive to adapt by engaging in Business Model (BM) experimentation, particularly through the incorporation of new Information and Communication Technologies (ICT) (Bouwman et al., 2018). While there is consensus regarding the impact of TT on the BMI, there remains uncertainty in the evidence regarding its effect on specific BM design themes. To investigate this relationship more comprehensively, it is essential to grasp the core concept of BM design themes. These themes are described as "the primary drivers of value creation within a system. Design themes represent configurations of design elements or the extent to which they are coordinated and connected by distinct themes" (Amit & Zott, 2010, p. 221). Novelty is identified as the primary value creation driver for Novel Business Models (NBM), while transaction efficiency takes precedence for Efficient Business Models (EBM) (Amit & Zott, 2010).

Based on this definition, this paper contends that the external environment plays a pivotal role in influencing the selection of the BM design adopted by a firm. On one hand, TT has been shown to elevate employee creativity (Deegahawature, 2014) and, consequently, spur organizational innovation (Amabile, 1996). Hence, it is reasonable to expect that TT enhances the NBM design theme since creativity is intimately linked to NBM, as suggested by Amit and Zott (2010, 2015). On the other hand, TT introduces uncertainty regarding the optimal BM design to adopt. Consequently, new entrant firms may opt to emulate incumbent firms by adopting the dominant design, which is more inclined towards cost reduction and efficiency (Amit & Zott, 2015), thereby suggesting the adoption of a BME design theme.

Building on this rationale, this paper presents the following hypotheses:

H1. TT positively affects NBM.

H2. TT positively affects EBM.

The research is based on a 2019 survey of a diverse sample of 201 Albanian firms located in Tirana and Durres, the capital and main port of the country, respectively. The structure of this paper unfolds as follows: Section 2 outlines the research design used to assess the hypothesis, Section 3 presents the study's results, and the final section discusses the main conclusions and implications of the research.

2. DATA, VARIABLES AND METHODS

2.1. Data

The sample for this study was extracted from a comprehensive database encompassing all limited liability companies operating in the most economically significant regions of Albania. These regions, namely the capital city Tirana and Durres, account for 41% of all businesses in the country (National Statistical Business Register, 2019). Data collection primarily relied on a questionnaire protocol, with 62% of respondents participating in face-to-face interviews, while the remaining responses were gathered through email survey protocols. Face-to-face interviews were favored due to their effectiveness in establishing trust, boosting response rates, and ensuring the reliability and validity of the information obtained. To uphold ethical standards, all respondents were explicitly informed

that survey data would be treated as confidential and solely used for academic purposes. The survey was conducted by four trained researchers who adhered to written guidelines outlining the appropriate methods for conducting interviews and addressing survey items. The final sample encompasses 201 cases out of 505 active companies, resulting in a response rate of 39.8%. It is noteworthy that despite repeated attempts to reach them, a considerable number of companies (52 cases) proved unreachable. Therefore, the active response rate, accounting for reachable companies, stands at 44.37%.

2.2. Variables

All variables in the study were quantified through multi-item self-assessed indicators, employing a seven-point Likert-type scale. Appendix A (refer to Table 2) provides a comprehensive overview of all items, adapted from existing literature. To measure the NBM and EBM design themes, the original scales developed by Zott and Amit (2008) were utilized as dependent variables. TT was measured using four items, with respondents indicating the perceived extent of technological turbulence. An EFA with promax rotation was conducted to validate the self-assessed, multi-item variables, with maximum likelihood factor extraction used for normally distributed data. Factors including TT, NBM and EBM that showed high loadings were kept, while items with low loadings and cross-loadings were removed based on reliability analysis. Additionally, firm size and age were introduced as firm-level controls, and these variables were transformed as specified earlier. This incorporation aims to account for potential influences stemming from the size and age of the firms in the analysis.

2.3. Modelling Framework

To evaluate the influence of TT on NBM and EBM design themes, a linear regression model was employed. Before conducting the regression analysis, preliminary checks were carried out to ensure that the assumptions of linearity, independence, homoscedasticity, and normality of errors were met. The ultimate econometric model is articulated as follows:

$$pi^* = \beta 0 + \beta 1 X1 + \ldots \beta nXn + \beta jCj + \varepsilon i$$

where pi* represents business model design themes, Cj represents TT, Xn encompasses other determinants of business model design themes, and εi represents the error term.

3. FINDINGS

The final dataset for analysis comprises predominantly smaller entities, with 62.1% representing micro and small organizations, while medium and large firms make up the remaining 37.9%, as illustrated in Table 1. In terms of age distribution, approximately 46% of the sampled firms are less than ten years old, about 35% fall within the 11-20 years age bracket, and the remaining entities are older than 20 years.

Moving on to the results of the linear regression analysis, presented in Table 1, it is evident that TT has a statistically significant and positive impact on both NBM and EBM. This implies that as the perceived level of technological turbulence increases, there is a corresponding positive effect on the adoption and development of both innovative and efficient business models. The outcomes of the regression analysis provide empirical support for the notion that technological turbulence plays a noteworthy role in shaping the design themes of business models within the sampled firms.

However, it is noteworthy that the adjusted R-squared for business model efficiency is reported to be very low. The adjusted R-squared is a measure of how well the independent variable (Technological Turbulence) explains the variability in business model efficiency. A low adjusted R-squared indicates that the model, as currently specified, explains only a small proportion of the observed variation in business model efficiency. This may suggest that factors beyond technological turbulence, which were not considered in the analysis, could be influencing business model efficiency. It is essential to recognize the complexity of the relationship between technological turbulence and business model efficiency, and future research may benefit from exploring additional variables to enhance the explanatory power of the model.

The regression analysis also examined the influence of firm age and firm size on both NBM and EBM. The results, as depicted in Table 1, indicate that neither firm age nor firm size has a statistically significant impact on NBM and EBM. In other words, the age of the sampled firms and their size, whether micro/small, medium, or large, do not seem to be significant predictors of the adoption and efficiency of business models.

This suggests that, within the scope of this study, factors related to firm age and size are not key determinants in explaining the variations observed in the development of new and efficient business models. It is important to note that while technological turbulence emerged as a significant factor influencing both NBM and EBM, other contextual or industry-specific variables not considered in this analysis might contribute more substantially to the observed outcomes. These findings underscore the nuanced nature of the relationship between organizational characteristics such as age and size and the evolution of business models. Future research endeavors may explore additional dimensions or firm industry-specific variables to gain a more comprehensive understanding of the factors influencing business model dynamics.

Table 1. Linear regression results

	Model 1: Novel Business Model		**Model 2: Efficient Business Model**	
Variables	B	Std. Error	B	Std. Error
Constant	3,489	,359	5,179	,329
Technology Turbulence	,337***	,051	,112**	,046
Firm size (log)	-,013	,052	-,009	,047
Firm age (log)	,110	,113	,080	,104
Adjusted R Square	,183		,018	
N	201		201	

*Note: ***p < 0,01, **p < 0,05, *p < 0,1.*

Source: Own research

4. CONCLUSION

This article sought to explore the correlation between TT and Business Model design by analyzing a diverse sample of 201 firms situated in Albania, a post-communist developing country. The research uncovered a significant influence of TT on businesses, manifesting in both the inclination to innovate and the enhancement of operational efficiency within their business models.

These findings hold particular significance from an entrepreneurial perspective, as they underscore the importance of adapting to technological changes. The observed impact of TT on both innovation and operational efficiency suggests that businesses in the sampled context need to navigate and harness technological turbulence to stay competitive and thrive in a dynamic

market environment. The implications extend beyond the individual firms studied, providing valuable insights for entrepreneurs and decision-makers navigating the challenges posed by technological disruptions in the evolving business landscape.

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Appendix A

Table 2. Measurement items

Novel Business model design theme (NBM)	Zott & Amit (2008)
Our business model offers new combinations of products, services, and information (NBM1). The business model brings together new participants (NBM2). Incentives offered to participants in transactions are novel (NBM3). Our business model gives access to a wide variety and number of participants and/or goods/services (NBM4). The richness (i.e., quality and depth) of some of the enabled links between participants is novel (NBM5). In our industry, we are a pioneer in exploiting our business (NBM6). We have continuously introduced innovations to make our business more effective (NBM7). There are no competing businesses in our industry that are threatening ours (NBM8). There are other important aspects of the business model that make it novel (NBM9). Our business model, overall, is novel (NBM10).	
Efficient Business model design theme (EBM)	Zott & Amit (2008)
Inventory costs for participants in the business model are reduced (EBM1). Transactions with our firm are simple from the customer's/user's point of view (EBM2). Our business model enables a low number of errors in the execution of transactions (EBM3). Costs for participants in our business are reduced (i.e., marketing and sales costs, transaction-processing costs, communication costs, etc.) (EBM4). Our business model can handle small as well as large transaction volumes (EBM5). Our business model enables participants to make informed decisions (EBM6). Our business model enables benefits through demand aggregation (e.g., bundling of smaller volumes) (EBM7). Transactions are transparent: flows and use of information, services, goods can be verified (EBM8). Our business model enables fast execution of transactions (EBM9). Our business model, overall, offers high transaction efficiency (EBM10).	
Technology turbulence (TT)	Slater & Narver (1994)
The technology in our industry is changing rapidly (TT1). Technological changes provide significant opportunities in our industry (TT1). It is very difficult to forecast where the technology in our industry will be in 3 to 5 years (TT1). A large number of new product ideas have been made possible through technological breakthroughs in our industry (TT1).	

Source: Own research