

The Impact of Frugal Innovation on Firm Performance: A Mediated Effect of Business Model Innovation

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ABSTRACT

The role and impact of frugal innovation have been theoretically analysed by many authors, but empirical evidence on this relationship remains limited. To address this gap, this study aims to examine the role of frugal innovation in firm performance by exploring the mediating role of business model innovation. Data from a sample of 103 ICT firms were collected, and mediation analysis using the PROCESS Macro (Hayes) in SPSS was conducted to investigate the relationships between the variables. The study highlights that frugal innovation, when strategically integrated into an innovative business model, can significantly enhance firm performance. By empirically demonstrating the mediating role of business model innovation, our findings help bridge the gap between theory and practice in frugal innovation research and provide actionable insights for ICT companies seeking to thrive in a dynamic and resource-constrained environment.

Keywords: Frugal innovation; business model innovation; firm performance; ICT sector.

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INTRODUCTION

Frugal innovation has emerged as an important strategy for firms seeking to create value under resource constraints by reducing cost, complexity and non-essential functionality while maintaining adequate performance and usefulness (Hossain, 2020; Weyrauch & Herstatt, 2017). It is particularly relevant in the ICT sector, where rapid technological change, price sensitivity and growing demand for accessible digital solutions require firms to balance affordability with functionality. By emphasising cost efficiency, core functionalities and resource optimisation, frugal innovation (FI) can help Information and Communications Technology (ICT) firms simplify technologies, expand digital inclusion and respond to market needs in environments where financial, human and technological resources are limited (Cai et al., 2019). Rosca et al. (2017) argue that the benefits of frugal innovation arise from the way in which these innovations are integrated into the firm's strategic and operational structure, particularly through business model innovation (BMI).

Although frugal innovation is increasingly discussed as a pathway to digitalisation and sustainable development (Le Bas, 2023; Al Omoush et al., 2025; Van Tuijl et al., 2024), its firm-level performance implications remain insufficiently understood. Moreover, it is important to understand all the mechanism because frugal products or services may not

produce superior outcomes unless firms adapt how they create, deliver and capture value.

Albania provides a useful context for examining this mechanism. Its ICT sector is developing within a broader process of digital transformation, supported by EU-aligned policy priorities and growing public and private demand for digital services. However, the sector also faces constraints associated with limited resource and development (R&D) investment, skills shortages, uneven technological adoption and a small domestic market. Recent indicators suggest that Albania performs relatively better in infrastructure and business sophistication than in advanced technology adoption, R&D intensity and high-technology trade. Earlier studies similarly characterise innovation in Albania as largely incremental and shaped by institutional and resource constraints (Nientied & Karafili, 2016).

These characteristics suggest that frugality in Albania, particularly in the ICT sector, may emerge from producer-side constraints associated with limited financial and human resources, a small domestic market, restricted R&D capacity, and the need to adapt existing technologies to local requirements. This reflects the context of an emerging-market environment such as Albania, which differs from the contexts in which most studies on frugal innovation have been developed, particularly India and Africa. Whereas earlier research has frequently associated frugal innovation with low-income consumers, and the provision of affordable solutions for underserved populations,

These conditions create a distinctive setting for FI in ICT firms in Albania. Firms must operate with constrained financial and human resources while serving customers who may have limited capacity to purchase sophisticated digital solutions. As a result, ICT firms may seek performance gains not only by developing new technologies, but also by recombining existing digital tools, simplifying functionalities, lowering costs and adapting externally developed technologies to local needs. In this context, frugality is not merely a response to poverty or basic access problems; it is a strategic approach to using digital resources efficiently in a small European transition economy.

This study therefore examines the relationship between FI, BMI and firm performance in Albania's ICT sector. It argues that FI can encourage firms to redesign their value propositions, cost structures, delivery channels and revenue mechanisms, and that these business model changes are central to translating frugal solutions into performance outcomes. The study contributes to the literature in three ways. First, it provides quantitative evidence on the FI–BMI–performance relationship in an underexplored emerging-economy context. Second, it conceptualises BMI as a dynamic capability that enables firms to reconfigure resources and convert frugal solutions into organisational value (Teece, 2010; Zott & Amit, 2007; Foss & Saebi, 2017). Third, it broadens the geographical scope of FI research beyond its traditional focus on low-income markets by showing how digital diffusion and resource constraints jointly shape innovation in Albania's ICT sector.

THEORETICAL BACKGROUND

What is Frugal Innovation?

Frugal innovation has gained increasing attention because it explains how firms create acceptable value under conditions of resource scarcity by doing more with fewer resources (Hossain, 2020; Ernst et al., 2015). Although initially associated with low-cost products for low-income consumers in developing economies, FI is now understood more broadly as a mindset, capability and innovation approach that can apply to products, services, processes and business models (Soni & Krishnan, 2014; Prabhu & Jain, 2015). Its defining feature is not low price alone, but purposive reconfiguration of resources to reduce cost and complexity while preserving essential functionality, usability and performance (Weyrauch & Herstatt, 2017).

Frugal Innovation is therefore a cross-sector phenomenon. It may appear in simplified products and processes, affordable services or redesigned value delivery systems. However, the mechanisms through which frugality is achieved differ across sectors. Melnikova and Gilsanz (2022) identify healthcare, ICT, product design and manufacturing as the main sectors examined in FI research. In manufacturing and

healthcare, FI often involves product simplification, efficient material uses and redesigned production or distribution processes (Bhatti et al., 2018). In ICT, frugality depends less on physical resource reduction and more on the efficient configuration of digital technologies, platforms, infrastructure and services. Frugal innovation in ICT can reduce transaction costs, technology costs and generate network or data-related externalities that increase economic and social value (Howell et al., 2018).

This distinction is important because ICT firms can create frugal solutions by simplifying interfaces, reusing existing technologies, modularising services, adapting external technologies to local needs and maintaining core functionality at lower cost. Ahuja and Chan (2014) similarly argue that IT capabilities, organisational learning and dynamic knowledge processes support FI. Thus, in ICT, FI should be understood as a strategic approach to reducing digital and organisational complexity while maintaining sufficient value for users in resource-constrained markets.

Business Model Innovation

Frugal innovation is not limited to developing cheaper products or services, it often requires firms to reconsider how value is created, delivered and captured (Hossain, 2021). Business model innovation is therefore central to understanding how frugal solutions become sustainable solutions. Business models are dynamic and evolve in response to changes in the external environment (Saebi et al., 2017), while firms operating under resource and institutional constraints need to adapt their business models to local conditions rather than simply replicate models developed for developed markets (George et al., 2012). In emerging and resource-constrained contexts, firms must adapt business models to local purchasing behaviour, infrastructure, institutional conditions and customer needs (Winterhalter et al., 2017).

The literature identifies affordability, accessibility, resource efficiency and contextual adaptability as key characteristics of business models that support FI (Hossain, 2022; Bhatti et al., 2018). Winterhalter et al. (2017) show that value proposition, value creation and value capture are interdependent in resource-constrained environments: firms must offer relevant and affordable solutions while maintaining efficient operations and viable revenue logic. Rosca et al. (2017) similarly demonstrate that firms combine business model elements in different ways to generate economic, social and environmental value, while Hossain (2021) argues that novel business models can help frugal innovations reach underserved customers.

In Information and communications technology sector, the FI–BMI relationship is important because low-cost digital innovation does not automatically generate firm value. Firms must connect frugal solutions to users, organise delivery, define revenue mechanisms and align value creation with value capture (Howell et al., 2018). Business model innovation can therefore be

viewed as the organisational mechanism that enables firms to commercialise frugal solutions and transform resource efficiencies into performance outcomes. This provides the theoretical basis for examining BMI as a mediator between FI and firm performance. While FI and BMI may reinforce each other over time, we model FI as the antecedent, resource constraints first drive frugal solutions, which then require firms to reconfigure their business models to capture value from them (Teece, 2010; Zott et al., 2011).

HYPOTHESIS DEVELOPMENT

Frugal innovation goes beyond redesigning affordable products or services to include changes in production processes, organisational routines and business models (Prahalad & Mashelkar, 2010; Sehgal et al., 2010). Business model innovation refers to the development and implementation of new or improved ways of creating, delivering and capturing value (Morris, Schindehutte & Allen, 2005; Teece, 2010). These two concepts are closely linked because frugal solutions often require firms to rethink their value propositions, cost structures, delivery channels and revenue mechanisms. By reconfiguring these elements, firms can align their business models with resource constraints and the needs of underserved or price-sensitive markets (Sarkar & Mateus, 2022). To further examine the link between frugal innovation and business model innovation, the following hypothesis is proposed:

H1a: Frugal innovation has a positive impact on business model innovation.

Frugal innovation may also improve firm performance by enabling more efficient use of resources. By reducing the cost and complexity of innovation while maintaining sufficient functionality, firms can offer affordable, accessible and good-quality solutions in constrained markets (Albert, 2019; Weyrauch & Herstatt, 2017). Such efficiency can improve the price–performance ratio, support access to underserved customer segments and strengthen both financial and non-financial outcomes (Soni & Krishnan, 2014; Hossain et al., 2021). Firm performance reflects how effectively firms use resources to achieve organisational objectives, including profitability, sales, market position, reputation and customer-related outcomes (Chen et al., 2009). Therefore:

H1b: Frugal innovation has a positive effect on firm performance.

Business model innovation may independently enhance firm performance by improving how firms organise activities and exchange relationships to create value (Amit & Zott, 2011; Foss & Saebi, 2017).

Innovative business models can generate cost advantage (Szulanski & Jensen, 2008), increase profitability, expand revenue streams (Winter & Szulanski, 2001), facilitate market penetration and improve operational efficiency (Teece, 2010; Johnson et al., 2008; Heikkilä et al., 2018). Although some studies report mixed findings, the dominant view is that BMI supports long-term competitiveness because it enables firms to adapt to changing technologies, markets and customer expectations (Clauss et al., 2019; Latifi et al., 2021). Therefore, following hypothesis is proposed:

H2: Business model innovation has a positive effect on firm performance.

Frugal innovation and business model innovation are closely linked; they both focus on creating value in resource-constrained environments and fostering sustainable growth. As frugal innovation focuses on the development of affordable, simple, and efficient solutions for underserved emerging markets, it creates the need to rethink traditional business models (Ebolor et al., 2022).

Scholars argue that implementing frugal innovation requires firms to change the way they do business, meaning transforming how they create, deliver, and capture value (Foss & Saebi, 2017). Innovations in the business model can lead to cost advantages (Szulanski & Jensen, 2008), increase revenue streams (Winter & Szulanski, 2001), and facilitate market penetration (Johnson et al., 2008), which in turn may increase operational efficiency and effectiveness, translating into better firm performance (Heikkilä et al., 2018).

Business model innovation as positively drive firm performance and long-term competitiveness (Clauss et al., 2019; Latifi et al., 2021), can serve as an essential mechanism through which frugal innovation generates positive organizational outcomes.

Many authors argue that often the relationship between frugal innovation and firm performance is not direct but rather mediated through intermediary mechanisms that strengthen the impact of this relationship (Hossain, 2021; Dost & Umrani, 2024; Berndt et al., 2024). Building on this literature, the following hypothesis is proposed:

M1: Business model innovation mediates the relationship between frugal innovation and firm performance.

METHOD AND DATA

Sampling Frame

Data were collected via a questionnaire distributed to ICT firms in Tirana, Albania, drawn from a sample of 121 firms randomly selected from 714 companies listed on Albania's Open Data Platform¹. The ICT sector was

¹ <https://opencorporates.al/sq/companyfrom2016>

defined using NACE Rev. 2 divisions J58, J61, J62 and J63, consistent with Eurostat's classification (European Commission, 2008).

Firms were first contacted by telephone to introduce the study, followed by an online questionnaire in Albanian administered via Google Forms. The instrument was reviewed by innovation experts and pre-tested with 10 respondents to improve clarity and reduce ambiguity (Podsakoff et al., 2003). Respondents were CEOs or senior managers across varied professional backgrounds (e.g., programmers, developers, project managers, finance and business administration staff), all responses were anonymous and were collected between late 2024 and early 2025.

Missing Data

Prior to empirical analysis, the dataset was examined for missing values, unengaged responses, and outliers following Hair et al. (2017). Missing data were minimal (<2%), and Little's MCAR test confirmed that data were missing completely at random ($p > 0.05$). Accordingly, missing values were handled using median substitution at the construct level and the Expectation-Maximization (EM) algorithm at the item level.

To detect unengaged responses on the 7-point Likert scale, cases with identical responses across all items were identified, resulting in the removal of 6 cases. Outliers were then detected using the modified Z-score method (Iglewicz & Hoaglin, 1993), leading to the exclusion of 12 additional cases. The final dataset consisted of 103 valid observations.

Common Method Bias

Given that the data were collected using a self-reported instrument, both procedural and statistical approaches were applied to address common method bias (CMB) (Podsakoff et al., 2003). In the ex-ante phase, face validity was ensured through pre-testing of the questionnaire, and respondent anonymity and confidentiality were guaranteed. In the ex-post phase, full collinearity assessment was conducted (Kock & Lynn, 2012). The Variance Inflation Factor (VIF) values, calculated against a random variable, were below the critical threshold of 5, with most below 3, indicating no evidence of substantial common method bias.

Discriminant Validity

Discriminant validity was assessed using two complementary criteria. First, the Fornell-Larcker (1981) criterion was applied: discriminant validity is established when the square root of each construct's AVE exceeds its correlation with every other construct. As shown in Table 1, this criterion is satisfied for all constructs. Second, the Heterotrait-Monotrait (HTMT) ratio (Henseler et al., 2015) was computed, all HTMT values fall below the recommended threshold of 0.85. Together, these results provide strong support for the discriminant validity of all three constructs.

Reliability and Validity

To evaluate reliability and validity, exploratory factor analysis was performed using the Varimax rotation method. Table 2 reports factor loadings for all 29 items alongside Cronbach's alpha (α), composite reliability (CR), and average variance extracted (AVE) for each scale. Most of the items show factor loadings above 0.6, indicating strong reliability among them. There are only three items with loadings below 0.5: FI1 (0.468), FI7 (0.49), BMI6 (0.477), and BMI7 (0.397). Given that none of them are below 0.3, these items can be considered acceptable (Hair et al., 1995). BMI7 (loading = 0.397) was retained in the primary analysis to preserve scale integrity but excluded in Robustness Check 1.

AVE of FI (0.461) is marginally below 0.50 but CR (0.868) comfortably exceeds 0.70, indicating adequate convergent validity (Hair et al., 2019). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy yielded a value of KMO = 0.872, which classifies as 'meritorious' (≥ 0.80). Bartlett's test of sphericity was significant ($\chi^2(406) = 2,106.14$, $p < .001$), confirming that the 29-item correlation matrix departs significantly from an identity matrix and that the inter-item correlations are sufficiently large to support meaningful factor extraction.

Table 1. Discriminant Validity: Fornell-Larcker Criterion and HTMT Ratios

Fornell-Larcker Criterion

Construct	FI	BMI	PERF
FI	0.679	-	-
BMI	0.613	0.917	0.449
PERF	0.449	0.636	0.974

HTMT Ratio

Construct	FI	BMI	PERF
FI	-	-	-
BMI	0.758	-	-
PERF	0.554	0.703	-

Note: 1 The diagonal values (in bold) are the square root of the AVE values of the latent variables. 2 HTMT ratio < 0.85 is a threshold limit (Henseler et al., 2015).

Table 2. Reliability and Validity

Item	Item Wording	Loading	Reference	α	CR	AVE			
FRUGAL INNOVATION (FI)									
Substantial cost reduction									
FI1	solutions that offer “good and cheap” products/services	0.468	Rossetto et al., 2017	0.771	0.868	0.461			
FI2	significant cost reduction in the operational process	0.809							
FI3	the significant reduction of the final price of the product/service.	0.797							
Create a frugal ecosystem									
FI4	environmental sustainability in the operational process	0.659							
FI5	partnerships with local companies in the operational process	0.648							
FI6	efficient and effective solutions to customers, social/environmental needs	0.791							
Focus on core functionality and performance									
FI7	the core functionality of the product/service rather than additional functionality	0.490							
FI8	ease of use of the product/service.	0.670							
BUSINESS MODEL INNOVATION (BMI)									
BMI1	The business model offers new combinations of products, services and information	0.640	Zott & Amit, 2007	0.918	0.983	0.840			
BMI2	The business model brings together new participants.	0.649							
BMI3	Incentives offered to participants in transactions are novel	0.800							
BMI4	The business model gives access to an unprecedented variety and number of participants and/or goods	0.650							
BMI5	The business model links participants to transactions in novel ways.	0.729							
BMI6	The richness (i.e., quality and depth) of some of the links between participants is novel	0.477							
BMI7	Extent to which the business model relies on trade secrets and/or copyrights	0.397							
BMI8	The focal firm has continuously introduced innovations in its business model.	0.835							
BMI9	There are competing business models with the potential to leapfrog the firm’s business model	0.687							
BMI10	There are other important aspects of the business model that make it novel	0.762							
BMI11	Overall, the company's business model is novel	0.679							
FINANCIAL PERFORMANCE (FP)									
FP1	we have enhanced sales and profitability of the firm.	0.642	Chen et al., (2009)	0.918	1.058	1.377			
FP2	we have been profitable.	0.796							
FP3	we have achieved profit objectives.	0.797							
FP4	we have achieved sales objectives.	0.724							
FP5	we have achieved market share objectives.	0.785							
NON-FINANCIAL PERFORMANCE (NFP)									
NFP1	we have improved the loyalty of existing customers.	0.582		0.887	0.932	0.736			
NFP2	we have attracted a significant number of new customers.	0.642							
NFP3	we have had an important competitive advantage.	0.758							
NFP4	we have had a well perceived image.	0.822							
NFP5	we have had a good reputation.	0.904							
Total Total Variance (%)				66.958					
Kaiser-Meyer-Olkin (KMO)				0.872					
Bartlett's χ^2 (df = 406)				Approx. Chi-Square	2,106.14				
				df	406				
				Sig. (p)	< .001				

RESULTS

The relation between FI, BMI and firm performance is analysed using Macro Hayes SPSS. The mediation analysis is conducted using model 4 of the PROCESS macro (Hayes, 2022), to test the effect of Frugal Innovation of Firm Performance through the Business Model Innovation as mediator. Table 3 presents the descriptive statistics for all study variables. FI ($M = 5.34$, $SD = 0.77$), BMI ($M = 5.53$, $SD = 0.96$), and PERF ($M = 5.52$, $SD = 0.99$). The two control variables Firm

age ($M = 2.40$, $SD = 1.22$) and firm size ($M = 1.98$, $SD = 0.76$), were included in all regression models to account for firm-level heterogeneity.

To test these hypotheses, this study adopts a quantitative research approach to examine the relationships between frugal innovation, business model innovation, and firm performance. The primary objective is to assess the mediating role of business model innovation (BMI) in the link between frugal innovation (FI) and firm performance (PERF), using mediated path analysis conducted through the

PROCESS Macro in SPSS. Given the sample size of 103 firms, the PROCESS Macro was chosen because it does not require a minimum sample size (Creedon & Hayes, 2015) and can meaningfully test mediation in smaller

samples when model assumptions are met (Hayes, 2022); samples around 100 are generally considered acceptable for such models (Kline, 2005; Hair et al., 2019).

Table 3. Descriptive Statistics

Variable	Mean	SD	Min	Max	Skewness	Kurtosis
Frugal Innovation (FI)	5.34	0.77	3.25	7.00	+0.04	−0.31
Business Model Innovation (BMI)	5.53	0.96	2.82	7.00	−0.43	−0.51
Firm Performance (PERF)	5.52	0.99	2.20	7.00	−0.74	+0.48
Financial Performance (FP)	5.14	1.22	1.00	7.00	−0.53	+0.12
Non-Financial Performance (NFP)	5.90	0.91	3.40	7.00	−0.84	+0.05
Ln(Firm Age)	2.40	1.11	0.00	5.57	—	—
Ln(Firm Size)	1.98	0.76	0.00	3.50	—	—

M = mean; *SD* = standard deviation. All composite scores are unweighted item means on 7-point ordinal scales. *Ln* = natural logarithm. Controls log-transformed to reduce skewness.

Table 4. Pearson Correlation Matrix

Variable	M	SD	FI	BMI	PERF	FP	NFP
1. FI	5.34	0.77	—				
2. BMI	5.53	0.96	0.613	—			
3. PERF	5.52	0.99	0.449	0.636	—		
4. FP	5.14	1.22	0.374	0.529	0.945	—	
5. NFP	5.90	0.91	0.472	0.669	0.898	0.705	—

Frugal Innovation (FI); Business Model Innovation (BMI); Firm Performance (PERF); Financial Performance (FP); Non-Financial Performance (NFP)

Table 5. Direct Effects

Hypothesis	Path	Path coefficient (β)	Standard error	t	p-value (2-sided)
H1a	FI $\rightarrow$ BMI	0.608	0.079	0.079	< .001
H1b	FI $\rightarrow$ PERF (total)	0.452	0.089	5.075	< .001
H1b	FI $\rightarrow$ PERF (direct, <i>c'</i>)	0.099	0.097	0.097	.308
H2	BMI $\rightarrow$ PERF	0.579	0.097	0.097	< .001

Direct Effects

Control variables (firm size and firm age) shown no significant association with performance ($R^2 = 0.017$, $p = .434$).

Direct effects analysis (Table 5) shows that Frugal Innovation (FI) have a significant positive effect on Business Model Innovation (BMI) ($\beta = 0.608$, $SE = 0.079$, $p < .001$), thereby supporting Hypothesis 1a. This finding suggests that ICT firms that engage in frugal innovation practices are more likely to develop and implement innovative business models.

Regarding the total effect of Frugal Innovation on Firm Performance, the results indicate a significant

positive relationship ($\beta = 0.452$, $SE = 0.089$, $p < .001$), providing initial support for Hypothesis 1b. However, when BMI is introduced into the model as a mediator, the direct effect of FI on PERF becomes non-significant ($\beta = 0.099$, $SE = 0.097$, $p = .308$), suggesting that the relationship between FI and Firm Performance operates primarily through an indirect way rather than a direct one.

Business model innovation effect on firm performance is positive and significant ($\beta = 0.579$, $SE = 0.097$, $p < .001$), supporting Hypothesis 2. This indicates that ICT firms that successfully innovate their business models achieve superior performance outcomes. The model explained approximately 43% of the variance in performance ($R^2 = 0.427$).

Indirect Effect and Mediation

Table 6 presents the indirect effect of frugal innovation on firm performance through business model innovation, estimated through bias-corrected percentile bootstrapping (5,000 samples). The indirect effect is significant ($\beta = 0.352$), the confidence interval [0.201, 0.533] excludes zero, confirming a statistically significant indirect effect. This supports H3.

Table 6. Mediation effect

Hypothesis	Path	Path co-efficient (β)	SE	[LL, UL]	Type of mediation
M1	FI $\rightarrow$ PERF via BMI	0.352	0.083	[0.201, 0.533]	full mediation

These findings indicate a full mediation effect, suggesting that Frugal Innovation enhances firm performance only through the mechanism of Business Model Innovation, rather than directly.

Robustness Checks

Two robustness checks confirmed the mediation finding was not an artefact of analytical choices. First, excluding weak-loading items (FI1: 0.468; FI7: 0.490) and re-estimating with cleaned composites (FI: 6 items; BMI: 9 items) left the indirect effect significant ($\beta = 0.387$, Boot SE = 0.096, 95% CI [0.217, 0.593]) and the direct effect non-significant ($\beta = 0.066$, $p = .522$); the slightly larger indirect effect is consistent with attenuation bias from the excluded borderline items.

Second, re-estimating separately for financial ($\beta = 0.293$, 95% CI [0.138, 0.476]) and non-financial performance ($\beta = 0.370$, 95% CI [0.228, 0.528]) replicated full mediation in both cases, confirming the mechanism operates consistently across performance types.

In both cases, the confidence interval excludes zero, the direct FI effect is non-significant, and full mediation is replicated. The mediation mechanism operates consistently across both financial and non-financial performance outcomes.

DISCUSSION

The results of this study provide important theoretical and practical contributions to research on innovation and organizational performance, especially in the context of resource scarcity and the need for efficiency. The study advances understanding of how ICT firms operating in resource-constrained environments can experiment with and develop innovative approaches by adopting frugal innovation practices. Consistent with prior research, the findings show that frugal innovation does not directly affect firm performance (Berndt et al., 2023; Chen & Zhang, 2024),

but its impact is mediated through business model innovation. Meaning, frugal innovation can improve cost efficiency, simplify products and services by developing core functionalities and improve performance optimization, its potential impact on the outcomes can be realized when firms adapt their business models to integrate these innovations.

The strong relationship between frugal innovation and business model innovation ($\beta = 0.608$, $p < 0.001$), confirms that firms that implement frugal innovation are more likely to transform or improve the way they create, deliver and capture value. This supports the arguments of (Sarkar & Mateus, 2022; Dabić et al., 2022) arguing that frugal innovation and business model innovation are directly linked together.

The mediation effect of BMI on the FI-PERF relationship is statistically significant ($\beta = 0.579$), suggesting that higher levels of frugal innovation are associated with competitive advantage and improved performance, via business model innovation. This finding is consistent with previous studies which highlight that the relationship between frugal innovation and company performance is often mediated, rather than directly driven (Hossain, 2021; Dost & Umrani, 2024; Berndt et al., 2024). This provides strong results that ICT firms cannot focus only on developing frugal innovation but also complement these efforts to improve their business models, so that the contribution to performance is positive.

Interestingly, the lack of a direct effect of FI on firm performance ($\beta = 0.099$, $p = .308$) highlights the importance of considering mechanisms that can amplify the value of frugal innovations. Frugal innovations cannot directly translate into good performance for firms, their benefits depend on how they are embedded in the firm's operational and strategic framework.

Firm age and firm size, included as control variables are non-significant across all regression models (all $p > .10$). Future research incorporating larger, more size-diverse samples would be better positioned to assess firm size as a moderator of the observed associations.

CONCLUSIONS

This study examined the association between frugal innovation and firm performance in the ICT sector, and whether business model innovation mediates this relationship. The findings support a strong FI-BMI association, a significant BMI-performance link, and full mediation of the FI-performance relationship by BMI.

From a practical perspective, the results offers important managerial implications, the findings suggesting that ICT firms should not treat frugal innovation as a strategy that focuses on cost reduction or functionality reduction, but rather as an approach that is accompanied by changes in the business model, both of which act as integral processes with each other.

The analysis of the data shows a series of practical approaches indicating that the firms included in this

study are more focused on significant cost reduction in the operational process (FI2, factor loading = 0.809), significant reduction in the final price of the product/service (FI3, factor loading = 0.797), delivering efficient and effective solutions to customers' social and environmental needs (FI6, factor loading = 0.791), ease of use of the product/service (FI8, factor loading = 0.670), and partnerships with local companies in the operational process (FI5, factor loading = 0.648). This suggests that cost reduction and collaboration with local companies constitute important factors in the development of frugal innovation within the sample analyzed. Meanwhile, items describing solutions that offer "good and cheap" products/services (FI1, factor loading = 0.468) and a focus on the core functionality of the product/service rather than additional functionality (FI7, factor loading = 0.490) exhibit lower factor loadings. These results suggest that ICT firms pursue frugal innovation less through the reduction of product functionalities and more through the reconfiguration of operational costs, prices, and local partnerships, while maintaining an existing functional foundation.

A similar approach can be observed in the business model innovation (BMI) dimension. The data analysis indicates that the ICT firms included in the study demonstrate business model innovation primarily through the continued introduction of innovations into their business models (BMI8, factor loading = 0.835), novel incentives offered to participants in transactions (BMI3, factor loading = 0.800), and the presence of other important aspects that make the business model innovative (BMI10, factor loading = 0.762). Furthermore, connecting participants to transactions in new ways (BMI5, factor loading = 0.729) represents another important element of this dimension. These results suggest that business model innovation among the analyzed firms is more closely associated with the continuity of innovation, the reconfiguration of relationships between participants, and the creation of new transaction mechanisms than with limited changes to specific elements of the business model.

In contrast, the lowest factor loadings were observed for elements related to the reliance of the business model on trade secrets and/or copyrights (BMI6, factor loading = 0.397), as well as innovation in the quality and depth of relationships between participants (BMI6, factor loading = 0.477). This indicates that ICT firms in the analyzed sample pursue business model innovation less through intellectual property protection mechanisms and the enrichment of relationships between participants, and more through the continuous renewal of their business models, the introduction of new incentives, and innovative ways of organizing transactions.

This suggests that business model redesign, which links frugal innovation to performance, is achieved primarily through gradual and continuous adjustments to pricing and incentive schemes in relationships with existing customers and partners, rather than through a comprehensive reinvention of the parties with whom firms conduct transactions or of their offerings. Taken

together, these patterns reveal a more specific mechanism than simply "simplify and adapt": in this context, ICT firms reduce operational costs and prices, collaborate through local partnerships, and translate these efficiencies into performance by continuously adapting how they determine prices and provide incentives in their relationships with customers and partners, rather than by radically reducing product functionalities or creating entirely new business models. These findings are robust across alternative item specifications, across financial and non-financial performance outcomes, and across the inclusion of firm age and firm size as control variables. They extend the frugal innovation literature into a new geographic and sectoral context, provide one of the first quantitative tests of the FI-BMI-performance chain, and offer a foundation for future experimental and longitudinal research into the mechanisms through which frugal innovation generates organizational value.

Implications for Future Innovation Experiments

These findings offer several implications for future experimental research. First, the estimated effects (FI → BMI: $\beta = 0.608$; BMI → PERF: $\beta = 0.579$; indirect effect: $\beta = 0.352$) provide useful benchmarks for power analysis in future studies of similar mechanisms.

Second, an experimental design contrasting high/low FI adoption with high/low BMI capacity could directly test the mediation mechanism: firms high in FI but low in BMI should show minimal performance gains, while the strongest effects should emerge when both are high.

Third, future experiments should examine boundary conditions, firm characteristics, market orientation, and institutional environment, that may shape firms' ability to translate frugal innovation into business model innovation and performance.

Limitations

This study has two main limitations.

First, the sample is limited to 103 firms in Albania, restricting generalisability; future research should replicate the model with larger, multi-sector samples, including comparative studies across Western Balkans or Central and Eastern European economies with similar institutional environments. Second, future research should examine the roles of market orientation and entrepreneurship in shaping how frugal innovation translates into business model change and performance and extend the analysis to other sectors.

CONFLICTS OF INTERESTS

None to declare

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APPENDIX

Distinguishing characteristics of frugal innovations

Although frugal innovation (FI) has received considerable attention in the literature, its definition remains contested. Scholars have identified several characteristics commonly associated with FI, including low cost, simplicity, ease of use, limited functionality, and resource efficiency. However, these characteristics can also be found in related concepts such as low-cost innovation, good-enough innovation, jugaad, frugal engineering, constraint-based innovation, Gandhian innovation, and reverse innovation (Bhatti & Ventresca, 2013; Brem & Wolfram, 2014; Ostraszewska & Tylec, 2015; Zeschky et al., 2014).

Several frameworks have therefore been proposed to distinguish FI from these related concepts. Cunha et al. (2014) differentiate FI from bricolage and improvisation according to the type of scarcity involved, while Brem and Wolfram (2014) distinguish FI based on sophistication, sustainability, and emerging-market orientation. Zeschky et al. (2014) characterize FI as “new for less”, distinguishing it from cost innovation “the same for less” and good-enough innovation “adapted for less”. Similarly, Basu et al. (2013)

associate FI with need-based drivers, bottom-up processes, simplicity and functionality, and developing or emerging-market contexts. Other studies emphasize characteristics such as ruggedness, lightweight design, simplification, local resources, affordability, and sustainable solutions (Basu et al., 2013; Bhatti et al., 2018).

Despite these contributions, the literature does not provide a universally accepted set of criteria for identifying FI. Hindocha et al. (2021) note that studies often fail to specify explicitly the criteria used to classify an innovation as frugal. To address this conceptual ambiguity, Rossetto et al. (2017) identify three main dimensions of FI: concentration on core functionalities and performance, substantial cost reduction, and the creation of a frugal ecosystem. More restrictively, Weyrauch and Herstatt (2017) argue that three criteria must be present simultaneously: substantial cost reduction, concentration on core functionalities, and an optimized level of performance. These criteria provide a particularly clear basis for distinguishing FI from innovations that merely reduce costs or simplify existing products. Table 1 summarizes the main approaches used in the literature to distinguish frugal innovation from related innovation concepts.

Table 7. Distinguishing characteristics of frugal innovation

Author(s)	Distinguishing characteristics	Distinction from other innovation types
Basu, Banerjee & Sweeny (2013)	Identify four characteristics of FI: Driver; process; core capability; location.	Need-based / bottom-up / functionality-focused / emerging-market
Basu et al. (2013); Bhatti et al. (2018)	Ruggedisation, lightweight, mobile-enabled, human-centric design, simplification, new distribution models, adaptation, local resources, green technologies, affordability.	No specified threshold of competencies required; used to assess likelihood rather than binary classification
Cunha et al. (2014)	Product innovation under scarcity of affluent customers.	Distinguished from bricolage (scarcity of material resources) and improvisation (scarcity of time)
Brem & Wolfram (2014)	Sophistication; sustainability; emerging-market orientation.	Frugal innovation: low-to-medium sophistication, medium sustainability, medium emerging-market orientation, vs. jugaad or reverse innovation
Zeschky et al. (2014)	Technical novelty and market novelty.	Frugal innovation (“new for less”) has higher technical and market novelty than cost innovation (“same for less”) or good-enough/Gandhian innovation
Weyrauch & Herstatt (2017)	Identified criteria are needed to define FI Substantial cost reduction; concentration on core functionalities; optimized performance level – all three required simultaneously.	Any single criterion could describe another innovation type (e.g., cost innovation); only frugal innovation requires all three together
Rossetto et al. (2017)	Identified dimensions of FI.	Concentration on core Functionalities and Performance; Substantial Cost Reduction; Creation of Frugal Ecosystem
Pineda-Escobar (2025)	Affordability & cost minimization; optimal design/function/performance; resource-constrained context (multiplicity of actors/motivations as transversal element).	Qualitative likelihood scale (high/medium/low/none) rather than a binary criteria check