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RESILIENCE THROUGH STRATEGY: INVESTMENT DECISIONS AND DYNAMIC CAPABILITIES IN CAPITAL-INTENSIVE SECTORS

Abstract:

The research investigates investment policy as a unique resource and business model innovation as a dynamic capability, considering these two elements as key factors contributing to resilience in the aftermath of an economic shock. We conduct a comprehensive statistical analysis using panel regression and DiD methods and spanning global telecommunications operators from 2012 to 2022, supplemented by case studies of operators in three countries. Authors propose theoretical framework of resilience capabilities for capital intensive sector that extends Resource Based View and Dynamic Capability theories. Findings confirm that firms that prioritize leading investments in core infrastructure outperform competitors. For capital heavy firms' innovation in business model proves to be a powerful factor of resilience but secondary to investment as unique resource. The market advantage of firms that built both capabilities extends during crises, however, making quick adjustments during crisis in investment or business model innovation strategy does not lead to significant gains in market position.

Keywords:

Digital Resilience (DR), Investment strategy, Dynamic Capability (DC), Business Model Innovation (BMI), Crisis Management

1 Introduction

The pandemic instigated widespread disruptions across various industries, with lockdown measures upending established practices worldwide. In telecommunications, businesses experienced multidirectional trends. Lockdowns prompted explosive growth in broadband subscriptions, driven by the realization that mobile phones were inadequate for video communications essential for remote work as many office workers relocated to secondary residences equipped with high-speed communication, further boosting demand for landline services. This surge strained both fixed and mobile networks, necessitating additional investments in network capacity, coverage, and customer experience. At the same time other telecom clients, e.g. small and medium businesses, stagnated. During the pandemic amidst market uncertainty, telecommunications operators had to decide whether to freeze or accelerate investments, maintain steady infrastructure spending, or expand into the digital realm with new business models. This study aims to analyze the strategies of large operators across different countries and determine whether investment strategies and BMI were significant factors of firm resilience during the pandemic. Through comprehensive empirical and case study analysis, we seek to provide insights into navigating crises and enhancing resilience in the capital-intensive sector of telecommunications.

2 Literature review – resilience theoretical framework

Resilience, as a concept, is multifaceted and has been explored across various domains, including enterprise resilience (Sanchis and Poler, 2013), supply-chain resilience (Hosseini and Barker, 2016), and financial resilience (Lee and Chen, 2022). However, for the purposes of this study, we adopt a specific focus on *economic resilience* within the context of capital-intensive industries, particularly telecommunications. Economic resilience, as defined in this study, refers to the ability of firms to absorb economic shocks, recover critical functionality, and sustain competitive advantage through strategic investment and business model innovation (BCG, 2020).

In exploring economic resilience, this study distinguishes between static and dynamic resilience as defined by Holling (1973) and Pimm (1984), respectively. *Static resilience* refers to a firm's ability to maintain operational stability during a shock, while *dynamic resilience* involves the efficient use of resources for recovery and future growth. In the context of this research, we focus on how strategic investments, conceptualized within the Resource-Based View (RBV), and dynamic capabilities, particularly business model innovation (BMI), contribute to both forms of resilience. By integrating these constructs, our study aims to understand how firms in the telecommunications sector can leverage their resources and capabilities to not only withstand economic shocks but also emerge stronger.

While prior research has explored various aspects of resilience, this study specifically examines the role of strategic investment decisions and business model innovation (BMI) in fostering economic resilience within telecommunications operators. We argue that *investment resources* (e.g., CAPEX) in technological capabilities (e.g., 4G/5G infrastructure), and *organizational processes* are critical for maintaining and enhancing market share during and after economic shocks. These factors are analyzed within the framework of RBV and dynamic capabilities, providing a comprehensive view of how firms can achieve resilience through strategic resource

allocation and continuous business model adaptation. This focus allows us to contribute to the ongoing debate on the most effective strategies for resilience building in capital-intensive industries.

The Resource-Based View (RBV) (Barney 1991) asserts that firms achieve competitive advantage and resilience by leveraging unique resources and capabilities that are valuable, rare, inimitable, and non-substitutable (VRIN). In capital-intensive industries like telecommunications, these resources include investment capital, technological assets, skilled human capital, and efficient organizational processes. Strategic management of these resources enables firms to withstand disruptions and maintain a competitive edge, though traditional investment theories often fall short in addressing the complexities introduced by crises like the pandemic.

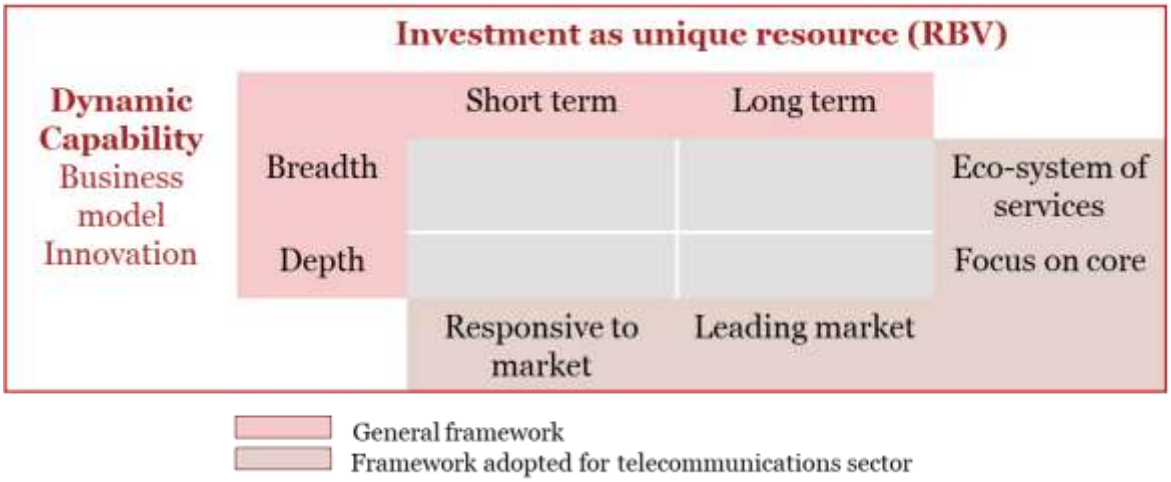
Dynamic Capabilities theory (Teece 2010) extends RBV by focusing on a firm's ability to adapt to rapidly changing environments through three core processes: sensing opportunities and threats, seizing them through strategic investments, and transforming organizational structures to remain competitive. Recent research highlights the importance of business model innovation (BMI) as a dynamic capability, allowing firms to continuously adjust and reinvent their business models to confront challenges effectively.

In telecommunications, companies face the dual challenge of exploring new revenue streams while fending off aggressive new entrants. Two primary business models have emerged to address these challenges (Friedrich and Meakin 2017):

- Focus on Core: This model integrates digital technologies across operations, including marketing, sales, customer interaction, and network management.
- Digital Ecosystem: This model emphasizes IT transformation and collaboration with external providers, positioning the operator as a central platform within a broader ecosystem.

While extensive research exists on investment and business model strategies, there is no definitive answer on the best approach during crises. This study explores how strategic investments and dynamic capabilities, particularly through these business models, contribute to economic resilience in telecommunications before, during, and after economic shocks. Based on the proposed theoretical framework (Figure 1) of resilience for capital intensive sector, it aims to provide empirical insights and case study evidence to guide resilience-building strategies in high-investment industries.

Figure 1. The resilience theoretical framework for capital intensive sector.



3 Research question and methodology

The economic resilience of telecom operators is heavily reliant on investments, as the quality of their core communications product – voice and data services – is defined by the network infrastructure. While traditional metrics like revenues and earnings are commonly used to gauge firm performance, they can be influenced by various factors like accounting methods and shareholder expectations. Instead, to assess the impact of capital investments on market positions, the number of subscriber connections serves as a proxy, with subscriber market share indicating operator resilience.

In navigating this crisis, telecom providers had to weigh different scenarios and competitive options to determine the most effective strategy for enhancing economic resilience. Should they aggressively invest to capture market share during the shock period, or maintain a steady investment approach? Should they aggressively expand with innovative business models in adjacent sectors, or focus on core services? These questions underscored the need for careful analysis and strategic decision-making amid unprecedented uncertainty in the telecommunications industry.

The answer to the questions includes several steps of data analysis on telecommunication providers' strategies before and during the pandemic. The first step is using empirical methods to analyze how capital investment behavior of operators changed in 2020 and whether it had a material impact on their market performance over the reviewed period. According to the theoretical framework from Fig. 1 we test whether telecom operators with leading[1] investment strategies outperform their competitors on the market. **Hypothesis 1** posits that the market share of subscribers is contingent upon the proportion of investment undertaken by the operator in comparison to its competitors within the specified year. **Hypothesis 2** stipulates those operators that rapidly adopted investment share policy in response to 2020 lockdowns demonstrated better economic resilience through maintaining or increasing their subscriber market share.

The second step is utilizing selected case studies of operators' strategies to test whether BMI becomes a significant factor in improving economic resilience. **Hypothesis 3** suggests that operators that invested in innovative business models demonstrated better economic resilience after the pandemic shock in 2020.

3.1 Empirical and case study methods

The authors use the panel data of world telecom operators[2] from 2012 to 2022 on their financial performance and market position for longitudinal analysis. The dataset contains key attributes on world operators from 144 countries including revenue, subscriber base (connections), capital expenditures and EBITDA margin with quarterly data.

Based on original data several attributes were calculated – subscriber (connections) market share of each operator for every period, share of capital expenditure that operator spent each period to total telecommunications capital expenditure in a country, and other ratios. With this data authors run the panel regression analysis to understand the impact of capital investment shares in different years on market and financial performance.

[1] By leading investment strategy authors understand dominant share of investment in a period or that an operator is ahead in investment share compared to its competitors.

2 Source of original data is GSMA database

To test hypothesis 1, we use panel regression analysis that is applied to analyze dependency of operator's market share from share of capital investments in a country using Stata software. The general regression model is defined as follows (see Table 1 for variables description):

(1) $MS\_subs(it)=\beta 0+\beta i*Share\_capex(it) +\alpha i+\epsilon it$

The authors test whether Hypothesis 2 holds true using DiD regression analysis that is evaluating dependency of operator's market share from operator's investment policy for countries where lockdowns measures had higher stringency index[1]. The stringency index above 90 (80) is considered significant to have an impact on the operators' investment behavior. The DiD regression model is defined as follows:

(2) $MS\_subs(it)=\beta 0+\beta 1 * after\_covid + \beta 2 * Stringency90 + \beta 3 * (TreatedByLock90) + \beta i* Share\_capex(it) +\alpha i+\epsilon it$

In our regression models, we control for unobserved heterogeneity using operator, country, and time fixed effects. These account for differences in management, regulatory environments, and global trends. We also used clustered standard errors at the operator level for robust estimates.

To address time-varying factors, we included controls for 4G and 5G adoption, varying by country and time. A visual inspection of pre-treatment trends showed parallel trajectories for the treatment and control groups, supporting the validity of attributing post-treatment differences in market share to the treatment effect.

Further analysis focuses on examining investment behavior and BMI strategies implemented by telecommunication providers in three countries (USA, Thailand, and Russia), each with 3-4 key players. The aim is to 1) validate the hypotheses proposed in the empirical part; 2) delve deeper into the impact of business model strategies on operators' market positions over the medium term.

Hypothesis 3 is tested based on the qualitative analysis of case studies from three countries with operators demonstrating different strategies according to the theoretical framework (Fig. 1). This research clusters operators based on criteria such as the count of non-core services provided and the increase in revenue share from such services[2].

4 Research Results

4.1 Empirical evidence

Table 1 summarizes panel regression modelling results. The key regression model (1) is dependency of the operator market share from the share of capital expenditure in total capex of operators at the given period (quarter). The result confirms Hypothesis 1 that a large portion (35%) of the market share indeed is explained by the share of operators' investments. Models 2,3,4 are analyzed for ensuring result consistency, i.e. share of investments proves to be a significant predictor of revenue market share, while overall investment (CAPEX) is significant for subscriber base. Both conclusions are logical for the capital-intensive sector – a larger subscriber base requires larger annual investment; however, it does not necessarily provide higher revenues.

1 stringency index from the dataset - "Our World In Data"1 non-commercial entity.

2 Data from operators' public financial reports and GSMA sources spanning 2012-2022 inform the analysis, collected from annual reports, investor conferences, interviews, and press releases.

Table 1. Longitudinal panel and DiD regression modelling results[1].

Variable Name	Variable Description
MS_subs	%, market share by subscribers (dependent variable) in a country in a quarter t
Share_capex	%, share of capital investments (independent variables) for each operator in a country in a quarter t
Subs	#, number of subscribers of an operator in a quarter t
Revenue	$, revenue of an operator in a quarter t
Rev_Share	$, market share by revenue in a quarter t
CAPEX	$, capital expenditure of an operator in a quarter t
TreatedByLock90	interaction term after_covid * Stringency90

	Data set – 8456 observations, 318 operators, quarterly from 2012Q1 to 2022Q2						
N	**Dependent**	**Indep/Covariates**	**R Sq**	**Coeff**	**Std Err**	**t**	**p**
1	MS_subs	Share_capex	0.35	0.037	0.0097	3.84	0.000
		CAPEX	0.01	1.71e-11	8.54e-12	2.00	0.046
2	Subs	Share_capex	0.002	3612043	1985604	1.82	0.07
		CAPEX	0.63	0.0174	0.0065	2.67	0.008
3	Rev_Share	Share_capex	0.5595	.1947682	.0234271	8.31	0.000
		CAPEX	0.0053	3.21e-11	1.47e-11	2.18	0.030
4	Revenue	Share_capex	0.003	2.21e+08	1.33e+08	1.66	0.10
		CAPEX	0.84	1.05	0.56	1.87	0.063

N	**Dependent variable**	**Interaction variable**	**Coeff**	**Std Err**	**t**	**p**
DiD regressions to test the lockdown with Stringency > 90 impact on operators' market share						
5	MS_subs	TreatedByLock90	- 0.001	0.006	- 0.16	0.871
DiD regression to test the lockdown with Stringency > 90 impact on market share for leaders in capital investments						
6	MS_subs	TreatedByLock90	0.0017	0.0084	- 0.15	0.18
DiD regression to test the lockdown with Stringency > 90 impact on market share for underinvestors						
7	MS_subs	TreatedByLock90	-0.0093	0.0084	- 1.11	0.27

The second block of regressions aimed to test Hypothesis 2 using DiD analysis. Model 5 demonstrates results of the DiD results for Stringency Index above 90 with no significant dependency between the lockdowns at the crisis periods and the subscriber market share over the next periods ($p > 5\%$)[2]. The models 6,7 show results for two subsets: first is applied for all operators that are marked as "capex leaders" – adopted leading investment policy, second is applied for "capex laggards", those which underinvested relative to competition.

1 All DiD regressions are tested to fit the models for parallel test.

2 Same results we observe in similar models for Stringency Index above 80.

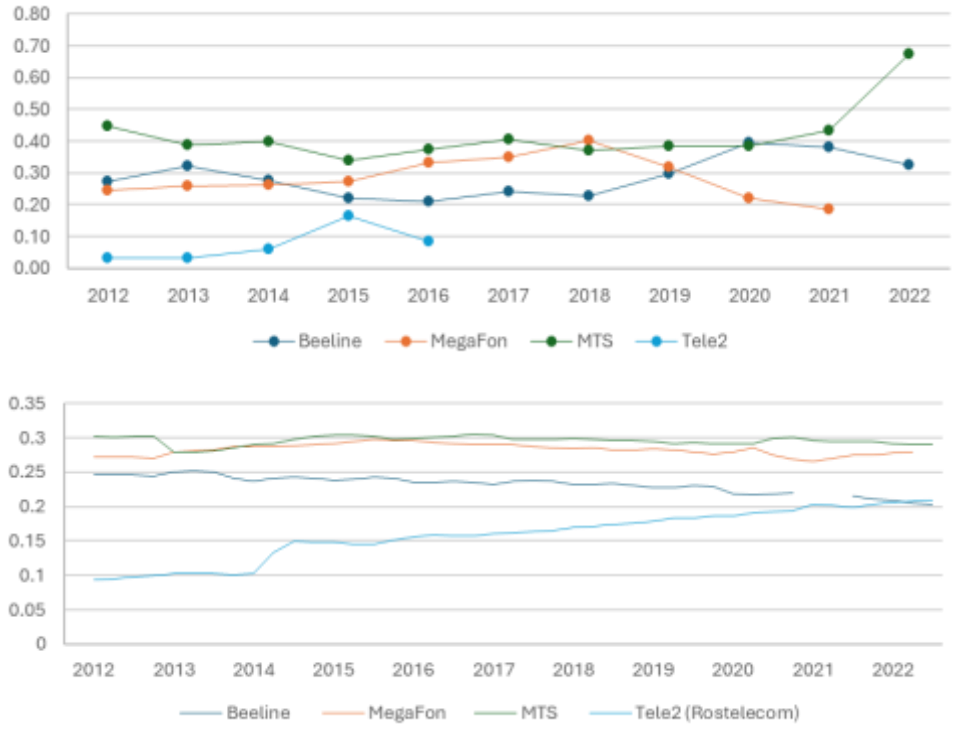
The presented analysis demonstrates that the lockdowns with different stringency do not necessarily have an impact on operators' market share at the level of statistical significancy. Neither this significance is demonstrated for operators with leading investment policies vs followers. Hypothesis 2 of this research, which posited that operators' rapid reaction to change an investment policy would exhibit enhanced economic resilience after the 2020 lockdowns by either maintaining or increasing their subscriber market share, is not conclusively supported.

4.2 Case study evidence. Case 1 Russia

In Russia, five major telecom operators dominate the industry, all offering both fixed and mobile services, but with different integration paths and distinct business strategies.

Tele2, a mobile arm of Rostelecom since 2014, pursued a core infrastructure investment strategy. The operator consistently increased investments in network rollout, prioritizing key regions and core telecommunication services. MTS, the largest private operator, recognizing limitations in traditional voice and data segments, focused on developing an ecosystem of adjacent services while continuing investments in core mobile services. MegaFon maintained a steady investment strategy in mobile network infrastructure, targeting the youth segment and data services speed. MegaFon primarily focused on core data services, following a fast-follower approach in the market. Beeline implemented a different strategy – reduction of new capital investments while enhancing customer experience and returning cash to shareholders. Beeline's infrastructure expenditure lagged competitors, reflecting a reactive approach to market investment policy.

Figure 2. Russia - annual share of investments and market share by subscribers, %



Source: GSMA database.

Figure 2 clearly shows that MTS consistently invested a larger share of total operator investments over the 10-year period. Even during periods of overall investment decline (2014-2017) and growth (2017-2022), MTS maintained the highest share of investments among its competitors. Its capital was allocated to both core communications infrastructure and new innovative services. MegaFon approached MTS's investment levels from 2012 to 2016, with slight deviations until 2019. Data for the pandemic year and the following year suggest a decrease in MegaFon's investments, primarily directed towards core telecom infrastructure and data services. Beeline significantly reduced capital expenditures from 2014 to 2019, with the difference from the leader nearly twofold during several years. Beeline's focus on minimizing growth investments suggests a strategy of prioritizing existing network and subscriber base over expansion.

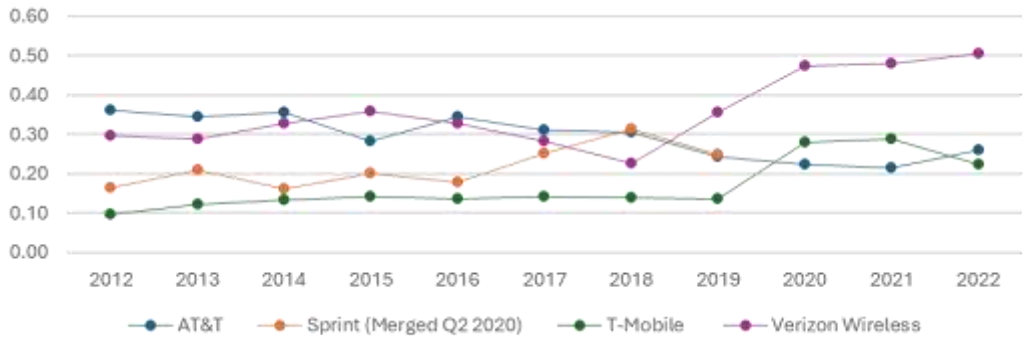
The analysis reveals that two strategies—consistent leading investments in core products and innovations—have shown long-term success, evident in the market positions of Tele2, MTS, and MegaFon until 2020. Conversely, Beeline's dynamic strategy, shifting focus between infrastructure and high-value customers, hasn't resonated well with customers. Despite a period of underinvestment, rapid increases in capital spending haven't yielded immediate improvements in customer behavior or financial results. MegaFon's experience suggests that short-term decreases in capital spending didn’t significantly impact market share or financials either, though effects may not be immediately visible within 1-2 years.

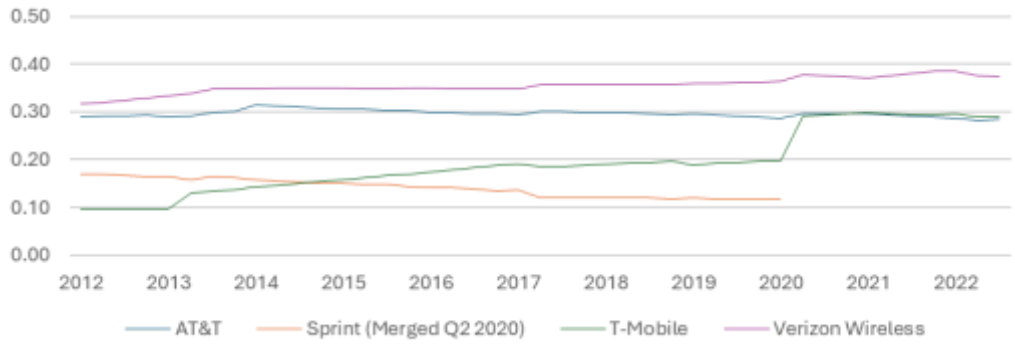
4.3 Case study evidence. Case 2 USA

In the USA there were four key players who dominated the mobile communications sector, that had already achieved maturity by 2012 and prepared for high-tech shift, driven by 5G standard.

AT&T and Verizon pursued both core service and eco-system strategies based on device innovation, leading 4-5G technology investments, bundles, exclusive content, and adjacent service offerings. T-Mobile's strategy relied on affordable core wireless services with transparent pricing, reliable network coverage, exceptional customer service, along with rapid deployment of 4G and 5G. T-Mobile acquired Sprint in 2020 and nearly surpassed AT&T in mobile subscriber base.

Figure 3. USA - annual share of investments and market share by subscribers, %





Source: GSMA database

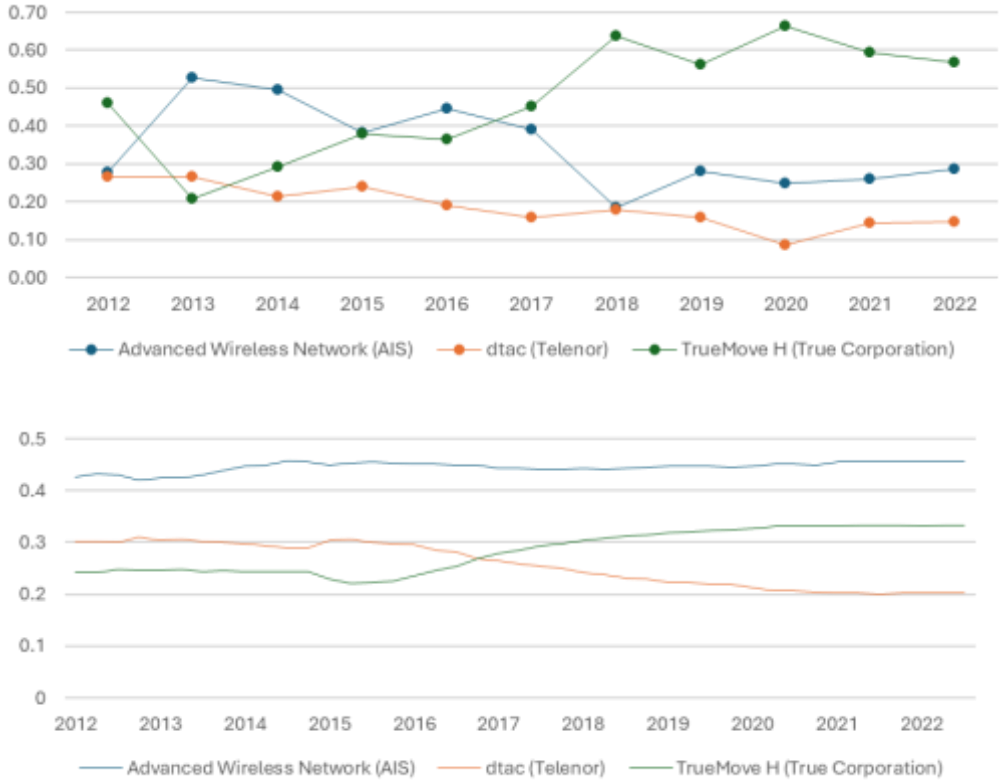
Figure 3 shows that until 2018, Verizon and AT&T had similar investment levels, reflecting the 4G LTE investment cycle. In 2019, Verizon sharply increased investments for 5G, while AT&T maintained a healthy level but didn't match Verizon's acceleration. T-Mobile consistently increased investments, reflecting its 4G LTE rollout efforts. After merging with Sprint, T-Mobile's investment share surpassed AT&T's, indicating its commitment to building a superior 5G network.

T-Mobile's focused investments in 4 and 5G led to steady improvements in market share and revenues, demonstrating the effectiveness of investment and business model strategies. AT&T's diminishing trend in market share correlates with declining capital expenditure over the years despite its eco-system strategy. The strategies and business models of two operators demonstrated long term success before and after the pandemic – Verizon and T-Mobile. Both strategies are based on leading investments into network infrastructure, core services and innovations adjacent to core. The acceleration of investments during the pandemic period, which coincides with the extensive 5G rollout proves to be an important lever to further increase the gap in market positioning.

4.4 Case study evidence. Case 3 Thailand

In Thailand, three main players dominated 99% of the mobile communications market. AIS, Thailand's largest mobile operator, historically positioned itself as a leading service provider with premium pricing, offering high-quality services, aiming to build a comprehensive ecosystem. TrueMove's business growth relied on network innovation (launching nationwide 5G coverage in 2020), strong partnerships, and a broader ecosystem business model encompassing IoT, content and media, fixed-mobile bundles, and payment services. DTAC's strategy transitioned from mass voice to mass data, aiming to address the country's low mobile data penetration. Despite competitive pressure, DTAC focused on delivering affordable 3G and 4G broadband services, albeit mainly centered around core communication services and infrastructure investments.

Figure 4. Thailand - annual share of investments and market share by subscribers, %



Source: GSMA database

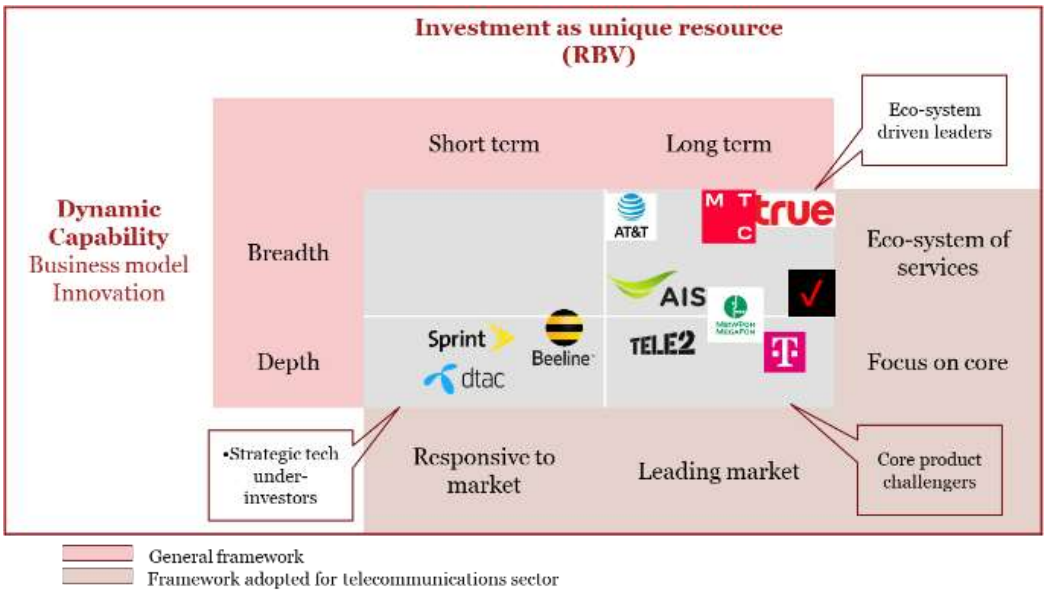
Figure 4 shows that AIS and TrueMove adopted leading investment and eco-system strategies, surpassing DTAC in investment levels. TrueMove particularly accelerated its investments, emphasizing the best mobile broadband availability strategy. Although AIS reduced its relative investments, its absolute investment numbers remained high. Meanwhile, DTAC decreased its share of investments over the years, while both competitors accumulated larger capital. AIS defends consistent market share despite competition. TrueMove's market share exceeds that of DTAC, reflecting its substantial capital investments in preceding years. The disparity in market share expands annually between TrueMove and DTAC, with TrueMove persisting in its investment acceleration while DTAC scaling back.

The successful long-term strategies of AIS and TrueMove revolve around leading investments in network infrastructure and core telecommunication services, along with the development of communication product ecosystems. TrueMove's accelerated investments during the pandemic positioned it to offer superior 5G experiences, driving further its market share growth.

5 Discussion of results and research implications

Empirical and case study findings enable us to cluster operators according to the theoretical framework into three group: Eco-system driven leaders; Core product challengers; Strategic tech under-investors.

Figure 5. Operators' clusters with resilience theoretical framework.



In the capital-intensive telecommunications industry, our findings confirm that sustained, multi-year leading investments significantly enhance market share and contribute to firms' resilience in post-crisis periods (Hypothesis 1). Conversely, short-term investment fluctuations during crises like the pandemic have little impact on long-term market positions (Hypothesis 2). Investments in telecom infrastructure typically have medium to long-term horizons, with only a small portion of the budget allocated to short-term expenditures. As such, market share is more dependent on sustained investment levels rather than reactive spending during crises.

Longitudinal analysis of global telecom operators, exemplifying capital-intensive industries, highlights the importance of maintaining leading investment levels as a unique resource per RBV theory, aligned with Keynesian and Neoclassical investment strategies.

The findings also support the role of dynamic capabilities based on BMI in enhancing resilience. However, in capital-intensive industries, this capability is complementary to leading investments. Case study analysis supports Hypothesis 3, particularly for operators adopting a leading investment strategy.

Eco-system driven leaders adhered to traditional investment theories like Keynesian or Neoclassical, responding to customer demand, especially in mobile broadband traffic. This approach proved successful pre-pandemic, helping these operators maintain or grow market share and revenues while managing CAPEX efficiently.

In contrast, **Strategic tech under-investors** pursued short-term strategies by cutting CAPEX, leading to declining market shares. Operators like Beeline, DTAC, and Sprint attempted to offset lower infrastructure investments with customer-centric innovations, but this approach failed to deliver long-term success.

Core product challengers focused on Keynesian demand-driven investments, with an even stronger emphasis on core telecom products like mobile broadband. Operators such as T-Mobile and Tele2 prioritized long-term network infrastructure investments, accepting lower immediate returns to capture larger market shares.

In summary, robust, sustained investment is crucial for resilience in capital-intensive sectors during market shocks. While dynamic capabilities and innovative business models can enhance resilience, they must be supported by substantial investment resources. Strategies that substitute investments with marketing or customer experience techniques tend to weaken market positions over time.

6 Conclusions

The paper aims to research key factors of economic resilience for capital intensive sector, exemplified by telecommunications. It proposes an innovative theoretical framework as an extension of resource-based view and dynamic capabilities theories. Findings expand our knowledge of resilience factors for capital intensive industry in the aftershock periods. Leading investments as a unique resource proves to be a primary factor of capital-intensive firms' resilience, with dynamic capability based on innovation in business model being a complementary but powerful next step for leaders to strengthen their market positions.

This research holds practical value for top management of firms in capital-intensive sectors. It highlights key strategies that proved to be successful for faster recovery from economic shocks providing guidance on decision making during uncertainty.

One of the key questions the study prompts for further inquiry is what differences in factors of economic resilience exist between capital intensive and sectors with lower capital intensity? Can dynamic capability be a primary resilience factor for sectors with low capital intensity?

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