

## ANTIFRAGILITY MODEL DEVELOPMENT FOR BUSINESSES IN THE COSMETICS INDUSTRY

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**Abstract:** *This paper explores how antifragility principles can be applied in the cosmetics industry to turn uncertainty and crises into opportunities for growth, innovation, and long-term resilience. Unlike traditional risk management, which focuses on minimizing disruption, antifragile business models thrive under volatility by embracing proactive adaptation, decentralized supply chains, sustainable innovation, and digital transformation. Drawing on case studies from leading firms such as L'Oréal, Estée Lauder, Shiseido, P&G, and Coty, the study identifies key decision-making approaches - including scenario planning, agile strategy shifts, and crisis response mechanisms - that support business agility in uncertain environments. Extending the analysis to emerging economies, particularly Moldova and Eastern Europe, the research examines how firms facing limited capital, regulatory uncertainty, and market constraints can adapt global antifragility strategies to their local contexts. The findings emphasize the importance of supply chain diversification, digitalization, and sustainability-focused consumer engagement in enhancing competitiveness. By offering a structured framework grounded in industry practices and secondary data, this study contributes to the literature on resilience, crisis management, and business strategy. Future research should validate these findings through empirical studies and comparative analyses. Ultimately, the paper argues that antifragile firms are not only more adaptive, but also better positioned for sustainable success in a complex global economy.*

**Keywords:** *antifragility, resilience, crisis management, cosmetics industry, digital transformation, sustainability, emerging markets.*

**JEL Code:** *L10, M10, O30, F61, Q56.*

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### Introduction

The cosmetics industry is one of the most competitive and rapidly evolving global markets, driven by changing consumer preferences, technological advancements, and economic fluctuations. With a market size exceeding \$300 billion in 2023 and a projected annual growth rate of 3.96% through 2030, the sector continuously adapts to economic crises, regulatory changes, and digital transformations (Euromonitor International, 2023; Statista, 2025). Traditional risk management approaches that focus solely on resilience are often insufficient, as companies that merely endure disruptions without evolving risk losing market share and stagnating in the long term.

The concept of antifragility, introduced by Taleb (2012), offers a strategic alternative by proposing that businesses can improve and expand when exposed to volatility. Rather than resisting uncertainty, antifragile companies use crises as opportunities to innovate, diversify, and strengthen their market position. The COVID-19 pandemic provided a strong example of antifragility in the cosmetics industry (Ivașenco, 2022). While some brands suffered supply

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chain disruptions and decreased in-store sales, L'Oréal, Estée Lauder, and Shiseido capitalized on the crisis by expanding e-commerce, offering virtual beauty consultations, and adopting AI-driven product personalization (Estée Lauder, 2022; L'Oréal, 2022; Shiseido, 2022). Their ability to turn disruption into opportunity underscores the necessity of antifragile strategies in today's volatile business environment.

For emerging economies, antifragility is even more critical, as businesses often operate in unstable regulatory, financial, and political environments (Ivaşenco, 2023b, 2024). Companies in India and Brazil have demonstrated that antifragile strategies - such as market diversification, digital transformation, and sustainability-driven innovation - can drive growth despite economic challenges (Hindustan Unilever Limited - Subsidiary Companies, 2022; Nykaa, 2022; O Boticário, 2022). By drawing insights from these cases, this study examines how cosmetics firms in Moldova and Eastern Europe can implement antifragility principles to navigate uncertainty and sustain long-term growth.

This research explores three key questions: first, what defines an antifragile business model in the cosmetics industry? Understanding the fundamental characteristics of antifragility can provide insights into how businesses can thrive under uncertainty (Hamel & Zanini, 2020). Second, how do leading cosmetics companies apply antifragility in practice? Global firms such as L'Oréal, Procter & Gamble, and Unilever have successfully embraced sustainability, digitalization, and portfolio diversification to manage risk and expand into new markets (L'Oréal, 2022; Procter & Gamble, 2022; Unilever, 2021). Examining their strategic responses provides a framework for decision-making under uncertainty. Lastly, this research asks how Moldovan and Eastern European firms can adapt global antifragile strategies to their unique economic conditions, where financial constraints and regulatory shifts pose additional challenges (BNP Paribas, 2025; International Monetary Fund, 2024; World Bank, 2024).

This paper contributes to both academic and business strategy discussions by combining theoretical insights with real-world industry applications. It provides a structured framework for identifying antifragile business principles, offering practical recommendations for firms operating in uncertain environments. The study is structured as follows: the second chapter outlines the research methodology, the third chapter examines the literature on antifragility and its application in business, and the fourth chapter presents key findings on antifragile strategies in the cosmetics sector. The fifth chapter extends this analysis to developing economies, and the final chapter summarizes key insights and highlights directions for future research.

By integrating antifragility theory, industry case studies, and strategic decision-making models, this research aims to demonstrate how cosmetics businesses can move beyond resilience to actively benefit from economic and market volatility.

## Methodology

This study employs a systematic literature review (SLR) methodology, following established academic protocols for transparency, reproducibility, and comprehensiveness

(Nightingale, 2009). The goal of this SLR is to synthesize existing research on antifragility in the cosmetics industry, particularly with regard to resilience, crisis management, and strategic business adaptation. The interdisciplinary nature of antifragility necessitates a diverse approach to literature and industry analysis, integrating insights from organizational theory, strategic management, digital transformation, and sustainability studies (Furr, Nathan, Harmon Furr, & Susannah, 2022).

### *Step 1: Research Design and Database Selection*

Relevant academic databases - Google Scholar, Scopus, Web of Science, and SSRN - were selected for their comprehensive coverage of peer-reviewed journals and working papers. The search strategy employed Boolean operators and combinations of keywords including: "antifragility", "resilience", "cosmetics industry", "crisis management", "business model innovation", "supply chain diversification", and "digital transformation".

### *Step 2: Inclusion and Exclusion Criteria*

Only publications from 2010–2024 were considered. Inclusion criteria focused on peer-reviewed journal articles, industry reports, and case studies that explicitly addressed antifragility-related concepts in business strategy or operations. Excluded were articles lacking empirical or theoretical rigor, and those unrelated to strategic responses to uncertainty.

### *Step 3: Source Triangulation*

To ensure a balanced view, data were triangulated using academic literature and practitioner sources such as industry whitepapers, consulting firm analyses (e.g., McKinsey & Company, Boston Consulting Group, Deloitte), and annual reports from companies operating in the cosmetics sector (e.g., L'Oréal, Estée Lauder, Shiseido, Coty, Natura & Co).

### *Step 4: Thematic Analysis*

A four-step thematic coding procedure was used to identify core themes. First, sources were imported into a spreadsheet and labeled by topic. Second, key strategies, patterns, and frameworks were extracted through content analysis. Third, codes were grouped into categories such as "digital transformation", "supply chain agility", "sustainability", and "consumer-centric resilience". Finally, these categories were synthesized into a conceptual framework for antifragile business models.

### *Step 5: Model Development*

Findings from the thematic analysis were used to construct a conceptual model presented in Table 1. This model maps ten strategic components of antifragility and links them to real-world examples from the cosmetics industry.

### **Limitations**

The study does not include primary data collection, such as interviews, surveys, or firm-level financial modeling. This limits empirical validation of the conceptual framework. Additionally, reliance on publicly available secondary data may not reflect unpublished innovations or confidential strategic responses (Euromonitor International, 2023). Future

research should address these gaps through longitudinal case studies or comparative analyses of antifragile and non-antifragile firms.

Despite these limitations, this methodology ensures a rigorous, multi-source synthesis of antifragility strategies in the global cosmetics sector, offering actionable insights for both academic and industry audiences.

## Literature Review

### 1. The Concept of Antifragility

The concept of antifragility, introduced by Nassim Nicholas Taleb (2012) in *Antifragile: Things That Gain from Disorder*, extends his earlier work on risk, uncertainty, and randomness. Unlike traditional risk management, which focuses on resilience - the ability to withstand crises without fundamental change - antifragility suggests that some systems improve and strengthen when exposed to volatility, stress, and uncertainty. This idea challenges conventional business strategies by proposing that companies should not only endure instability but also use it as a mechanism for growth and innovation.

A fundamental distinction Taleb makes is between fragility, resilience, and antifragility. A fragile system is vulnerable to shocks, such as a business that collapses under financial crisis or supply chain disruptions. Resilience, while an improvement, merely allows a system to absorb shocks and return to its previous state without significant evolution. Antifragility, however, enables an organization to gain strength from challenges, much like muscles growing through resistance training or biological systems adapting to environmental stressors (Taleb, 2012).

In business, antifragility is reflected in companies that use uncertainty as a driver of innovation and market expansion. Unlike firms that avoid risk, antifragile companies actively engage with volatility to refine their strategies, enhance operational efficiency, and develop new competitive advantages. This is particularly relevant in industries with high competition and rapid shifts, such as the cosmetics sector, where firms must navigate changing consumer preferences, regulatory updates, and technological disruptions. Businesses that embrace antifragility view uncertainty as an opportunity for transformation rather than a threat.

Historical evidence supports this approach. During the 2008 financial crisis, companies that prioritized adaptability and diversification outperformed those with rigid, risk-averse strategies. Similarly, in the cosmetics industry, firms that leveraged e-commerce and digital transformation during the COVID-19 pandemic rebounded quickly, while brands reliant on brick-and-mortar retail struggled to recover (Estée Lauder, 2022; Euromonitor International, 2023; L'Oréal, 2022; Shiseido, 2022).

Antifragility is increasingly relevant in today's global economy, where digital disruption, supply chain instability, and economic uncertainty demand flexible and responsive business models. Research highlights that organizations fostering a culture of experimentation, decentralization, and redundancy are better equipped to adapt swiftly to market fluctuations (Hamel & Zanini, 2020). This distinction between resilience and antifragility is crucial for

strategic decision-making. While resilient firms prepare for crises by maintaining financial reserves and diversifying supply chains, antifragile companies seek asymmetric opportunities that allow them to benefit from volatility (Ramezani & Camarinha-Matos, 2020).

For example, leading cosmetics brands are investing in AI-driven personalization, blockchain for supply chain transparency, and sustainability initiatives, positioning themselves for long-term success despite market instability. By understanding the core principles of antifragility, businesses can develop strategic frameworks that transform uncertainty into a competitive advantage.

## **2. Business Applications of Antifragility**

The concept of antifragility has become increasingly relevant in business strategy, particularly as organizations seek to navigate uncertainty and volatility in competitive markets. Unlike traditional approaches that emphasize stability and risk minimization, antifragility proposes that companies can benefit from disorder, using crises as opportunities for innovation and transformation. Management literature highlights key antifragile principles, such as decentralization, redundancy, and optionality, which improve an organization's ability to adapt to unpredictable challenges (Taleb, 2012). While conventional risk management focuses on mitigating negative impacts, antifragility-oriented strategies actively leverage crises to drive growth.

Theoretical models suggest that uncertainty can serve as a catalyst for strategic evolution. Research indicates that antifragile firms embrace experimentation and adaptability, enabling them to develop competitive advantages in volatile environments (Hamel & Zanini, 2020). This perspective aligns with real options theory, which argues that businesses maintaining flexibility in decision-making are better prepared for market shifts (Settembre-Blundo, González-Sánchez, Medina-Salgado, & García-Muiña, 2021). Many antifragile firms structure themselves modularly and decentral, allowing them to respond rapidly to changes without overhauling their entire business model. These organizations focus on continuous innovation, ensuring they evolve in response to market disruptions rather than merely recovering from them.

The difference between resilience and antifragility is crucial in understanding how firms react to crises. Resilient companies withstand shocks and recover, often returning to pre-crisis conditions. They emphasize risk mitigation strategies, such as financial reserves, supply chain diversification, and crisis management protocols. However, resilience does not inherently lead to long-term improvement. Antifragile companies, by contrast, emerge stronger from volatility, treating market shocks as triggers for transformation and expansion (Estée Lauder, 2022; L'Oréal, 2022; Shiseido, 2022).

Case studies illustrate how different industries have successfully applied antifragile principles. The technology sector is a notable example, where companies like Amazon, Google, and Tesla leverage uncertainty to refine their business models and expand aggressively. Rather than adopting defensive postures, these firms thrive by iterating products, decentralizing decision-making, and embracing rapid innovation cycles. Similarly, the financial sector,



particularly hedge funds using barbell strategies, balances low-risk assets with high-reward opportunities, ensuring adaptability in volatile markets (Taleb, 2012).

The cosmetics industry has also demonstrated antifragility, particularly during the COVID-19 pandemic, when traditional retail models faced severe disruption. L'Oréal, Estée Lauder, and Shiseido rapidly accelerated digital transformation efforts, using AI-driven personalization, virtual consultations, and direct-to-consumer e-commerce to compensate for declining in-store sales (Estée Lauder, 2022; Euromonitor International, 2023; L'Oréal, 2022; Shiseido, 2022). Instead of merely surviving the downturn, these firms expanded their digital presence and redefined consumer engagement, strengthening their market positions. The shift toward omnichannel retailing and supply chain diversification illustrates how antifragile businesses capitalize on volatility rather than simply endure it.

A similar pattern can be observed in the automotive industry, where firms that embraced electric vehicle (EV) innovation during market downturns positioned themselves as long-term industry leaders. Companies like Tesla and BYD used regulatory changes, supply chain crises, and shifting consumer preferences to expand market share, rather than seeing these challenges as obstacles. Their ability to exploit market uncertainties to drive industry-wide transformations is a hallmark of antifragile strategy.

Antifragility is also evident in healthcare and biotechnology, where R&D-driven firms have leveraged crisis-driven demand shifts. The rapid development of mRNA vaccines by Pfizer and Moderna during the COVID-19 pandemic exemplifies how businesses that integrate adaptive innovation and decentralized production into their core strategies thrive under extreme uncertainty (Groth, 2023). By investing in pre-existing research and flexible production networks, these firms did not just recover from the crisis but strengthened their long-term market dominance.

While resilience remains a critical aspect of business strategy, today's economic landscape increasingly rewards organizations that move beyond resilience and leverage uncertainty as a competitive advantage. Companies fostering an antifragile culture invest in decentralized decision-making, flexible systems, and adaptive innovation. Understanding how different industries have successfully integrated antifragility allows businesses in the cosmetics sector to adopt similar approaches, ensuring they do not merely withstand disruptions but emerge stronger and more competitive in the process.

### ***3. Antifragility in the Cosmetics Industry***

The cosmetics industry is highly dynamic, shaped by changing consumer preferences, technological advancements, regulatory shifts, and macroeconomic fluctuations. Companies in this sector must navigate instability while maintaining a competitive edge, making antifragility a crucial factor for long-term success. Unlike businesses that focus solely on resilience, antifragile firms leverage crises and volatility as catalysts for innovation and expansion. Leading global brands such as L'Oréal, Estée Lauder, Shiseido, Procter & Gamble, and Coty have successfully incorporated digital transformation, diversification, and sustainable

innovation into their business models, allowing them to emerge stronger from crises such as the COVID-19 pandemic and economic downturns (Coty, 2022; Estée Lauder, 2022; L'Oréal, 2022; Procter & Gamble, 2022; Shiseido, 2022).

The COVID-19 crisis significantly disrupted traditional brick-and-mortar retail, forcing cosmetics companies to accelerate their digital transformation. L'Oréal expanded its direct-to-consumer (DTC) platforms, integrating AI-powered virtual beauty consultations, AR makeup try-on tools, and AI-driven skin diagnostics to maintain customer engagement despite store closures (L'Oréal, 2022). Estée Lauder adopted a similar strategy, enhancing its online sales channels and AI-driven personalization while adjusting its product offerings to reflect growing demand for skincare and self-care during lockdowns (Estée Lauder, 2022; Euromonitor International, 2023). Shiseido, a leader in the Asian beauty market, strengthened its e-commerce capabilities and expanded into health and wellness products, recognizing the increasing consumer preference for holistic beauty solutions (Shiseido, 2022).

Procter & Gamble leveraged its diversified portfolio and supply chain resilience to navigate economic downturns. Its broad range of beauty, skincare, and household products provided a natural hedge against market fluctuations. By utilizing real-time consumer analytics, Procter & Gamble optimized production and marketing strategies, ensuring it could rapidly adapt to shifting consumer demands while maintaining supply chain agility (Procter & Gamble, 2022). Coty, which faced significant declines in fragrance sales during the pandemic, pivoted towards digital commerce and influencer marketing, forming strategic partnerships with high-profile influencers and celebrities to engage younger consumers on social media platforms like Instagram and TikTok (Coty, 2023).

The antifragility of these companies is evident in three key strategic initiatives: digital transformation, diversification, and sustainability-driven innovation. The integration of AI, AR, and machine learning has allowed brands to enhance customer experiences, optimize supply chains, and improve demand forecasting. Companies that had already adopted omnichannel retailing and direct-to-consumer models capitalized on changing consumer behaviors during economic disruptions.

Diversification also played a pivotal role in antifragility. Firms reliant on a single product category or distribution channel faced greater risks during crises. In contrast, L'Oréal, Estée Lauder, and Shiseido expanded into skincare, haircare, fragrances, and wellness products, mitigating risks associated with shifts in individual product segments (L'Oréal, 2022; Shiseido, 2022). This ability to expand into adjacent markets allowed them to capture new revenue streams and strengthen their resilience.

Sustainability has emerged as another pillar of antifragility. Companies that proactively adopt eco-friendly formulations, ethical sourcing, and carbon-neutral initiatives strengthen their long-term market positioning while meeting rising consumer expectations and regulatory standards. L'Oréal aims to achieve carbon neutrality across all its production sites by 2025, while Shiseido continues investing in biodegradable and cruelty-free cosmetics (Coty, 2022;

L'Oréal, 2022). Sustainability-driven innovation enhances brand loyalty and ensures compliance with evolving environmental regulations.

The cosmetics industry illustrates that antifragility is not just about survival but about strategic evolution. By embracing digital transformation, product diversification, and sustainability, leading brands have transformed crises into opportunities for growth. These strategic shifts not only enabled companies to navigate short-term disruptions but also positioned them for long-term success in an increasingly volatile global market.

#### **4. Antifragility in Emerging Markets**

Emerging markets pose distinct challenges and opportunities for businesses navigating economic instability, regulatory fluctuations, and evolving consumer preferences. Unlike developed economies, where institutional support provides stability, companies in emerging markets must adopt antifragile strategies to ensure long-term growth. The cosmetics industries in India and Brazil provide compelling examples of how businesses leverage uncertainty, transform operations, and capitalize on market dynamics to strengthen their market position.

The Indian cosmetics industry has experienced rapid growth, driven by rising consumer spending, digitalization, and demand for locally produced beauty products. Despite economic disruptions, brands such as Nykaa, Lakmé, and Himalaya Herbals have demonstrated remarkable adaptability. Nykaa, an e-commerce beauty retailer, exemplifies antifragility by integrating digital innovation and consumer-centric marketing. When COVID-19 lockdowns disrupted traditional retail, Nykaa accelerated its investment in online platforms, expanded its in-house beauty brands, and leveraged influencer marketing, securing a larger market share despite economic downturns (Euromonitor International, 2023; Nykaa, 2022).

Similarly, Lakmé, a dominant domestic brand, has strengthened its antifragility through multi-channel distribution, direct-to-consumer models, and exclusive brand stores (Hindustan Unilever Limited - Subsidiary Companies, 2022). This strategy allowed it to remain competitive during economic downturns while investing in sustainable beauty innovation. The brand's ability to anticipate consumer trends and quickly adjust its product offerings underscores the importance of strategic flexibility in antifragile business models.

The Brazilian cosmetics industry, one of Latin America's largest, also demonstrates antifragility through sustainability and omnichannel retailing. Companies such as Natura & Co, O Boticário, and Grupo Boticário have turned economic volatility into opportunities for innovation. Natura & Co, for example, leveraged crises to reinforce its commitment to sustainability and ethical sourcing. By integrating eco-friendly practices and expanding direct sales, it built a business model resilient to market disruptions and supply chain volatility (Natura & Co, 2022).

O Boticário, facing declining in-store traffic during economic slowdowns, enhanced its online presence, introduced virtual consultations, and invested in AI-driven personalization. These initiatives strengthened customer engagement and brand loyalty despite economic contractions (O Boticário, 2022). Similarly, Grupo Boticário has



capitalized on Brazil's biodiversity and consumer preference for natural beauty, investing in sustainable sourcing of Amazonian ingredients. This differentiation not only bolstered its brand positioning but also insulated it from economic volatility, aligning with the global shift toward ethical and organic beauty products.

The strategies of Indian and Brazilian cosmetics firms demonstrate that antifragility is a practical necessity in volatile environments. By embracing digital transformation, revenue diversification, and sustainability, these companies turned market disruptions into growth opportunities. Their approaches offer valuable insights for businesses in other emerging markets, including Eastern Europe, where similar adaptive strategies can ensure resilience and long-term success.

### **5. Antifragility in Moldova and Eastern Europe**

The concept of antifragility is particularly relevant in small-market economies such as Moldova and Eastern Europe, where businesses face economic volatility, political uncertainty, and supply chain disruptions. Unlike larger, diversified economies, these countries are more vulnerable to global financial instability due to limited industrial capacity, reliance on external markets, and dependence on remittances. While resilience focuses on recovery, antifragility emphasizes leveraging crises for growth and innovation, making it a more effective long-term strategy.

A major challenge in Moldova is restricted access to capital, which limits SMEs' ability to invest in innovation, technology, and expansion (World Bank, 2024). Many firms operate in import-dependent industries, making them highly susceptible to currency fluctuations and trade restrictions. To counteract this, companies can adopt antifragile strategies such as revenue diversification, digital transformation, and flexible supply chain models to mitigate external risks.

Another critical issue is brain drain, where skilled professionals migrate to Western Europe for better opportunities. This talent shortage hinders business scalability and competitiveness. However, antifragile companies adapt by implementing remote work models, automation, and workforce upskilling programs to retain talent. Businesses that embrace flexible working conditions and digital solutions are better positioned to attract and retain professionals despite demographic challenges (Boc, 2020).

Several strategic adaptations can enhance antifragility for Moldovan firms. Digital transformation and e-commerce allow businesses to reduce dependence on physical infrastructure and access international markets. AI-driven marketing, online marketplaces, and digital payments help companies expand beyond domestic limitations. In the cosmetics sector, brands leveraging direct-to-consumer platforms and personalized digital marketing are more resilient than those dependent on traditional retail channels (Ivașenco, 2023a).

Another critical factor is market diversification, ensuring businesses do not over-rely on a single sector or export market. Many Moldovan firms remain highly concentrated in specific trade relationships, increasing their exposure to regional economic fluctuations. Companies that establish cross-industry partnerships, alternative revenue streams, and flexible product lines can

better absorb shocks. Expanding regional trade networks and value-added services creates additional buffers against economic crises while unlocking growth potential (Otarinia, 2024).

Sustainability-driven business models are also crucial for antifragility. The global shift toward green technologies, ethical sourcing, and circular economies presents opportunities for Moldovan businesses. With a strong agricultural sector, companies can adopt eco-friendly production, renewable energy, and ethical sourcing to align with EU sustainability trends, strengthening competitiveness in export markets. The demand for sustainable cosmetics and personal care products continues to grow, making it a viable strategy for long-term success (Statista, 2025).

Agile supply chain strategies further reinforce antifragility in Moldova and Eastern Europe. Many companies face logistical constraints due to geographic isolation and import dependency. Firms that develop local supplier networks, nearshoring opportunities, and AI-powered logistics solutions gain flexibility in managing disruptions. Blockchain transparency and real-time supply chain analytics provide businesses with adaptive capabilities to respond to trade and transportation challenges (Ezzat & Aiman, 2023).

Ultimately, embracing antifragility in Moldova requires a shift in mindset, moving from crisis avoidance to leveraging uncertainty as a strategic advantage. Companies that integrate digitalization, diversified revenue models, sustainability initiatives, and supply chain agility will thrive despite economic instability. As Moldova strengthens its economic ties with European and global markets, businesses that proactively adopt antifragile strategies will be well-positioned for sustained growth and market expansion.

## Findings: The Antifragility Model for the Cosmetics Industry

### 1. Key Principles of an Antifragile Business Model

The cosmetics industry operates in a highly volatile environment, shaped by consumer trends, regulatory shifts, and technological advancements. Companies that adopt an antifragile approach do not merely withstand disruptions but use them as opportunities for growth. The development of an antifragile business model relies on *proactive adaptation, decentralized supply chains, sustainable innovation, and digital transformation*. These principles help firms capitalize on uncertainty, minimize risks, and gain a competitive edge in an industry where agility is crucial for long-term success (Estée Lauder, 2022; L'Oréal, 2022; Shiseido, 2022).

Proactive adaptation allows businesses to anticipate disruptions rather than react to them. Cosmetics companies that monitor emerging trends and regulatory shifts can quickly adapt, turning potential threats into opportunities. For instance, L'Oréal and Estée Lauder incorporated sustainable packaging and clean beauty formulations in response to rising consumer demand for eco-friendly products. By acting before regulatory mandates, these firms gained an early-mover advantage and strengthened their market position (Estée Lauder, 2022; Euromonitor International, 2023; L'Oréal, 2022). Dynamic pricing, agile marketing,

and diversified sourcing strategies further enhance flexibility, enabling firms to respond swiftly to market fluctuations.

Decentralization and redundancy are critical for supply chain resilience. The cosmetics industry relies on global supply networks, making companies vulnerable to trade restrictions, geopolitical risks, and pandemics. Traditional cost-efficient supply chains have proven fragile, as seen during COVID-19 disruptions. Companies like Shiseido have diversified production across multiple regions, ensuring that local disruptions do not cripple global operations (Shiseido, 2022). Multi-supplier sourcing and regional manufacturing hubs further reduce dependency on single supply chains, enabling firms to adapt when primary suppliers face constraints.

Sustainable innovation is another pillar of antifragility. As regulatory requirements and consumer preferences evolve, investing in green chemistry, bio-based formulations, and ethical sourcing helps future-proof businesses. Companies such as Natura & Co and The Body Shop have incorporated biodegradable packaging and carbon-neutral production, aligning with global sustainability trends (Natura & Co, 2022; Warsita & Indriastuti, 2021). Beyond risk mitigation, these initiatives create new revenue streams, appeal to eco-conscious consumers, and reduce exposure to volatile commodity markets. Sustainability also enhances brand equity, as consumers increasingly prioritize ethical business practices (Ezzat & Aiman, 2023).

Digital transformation is essential for consumer engagement, operational efficiency, and market expansion. AI, AR, blockchain, and big data analytics enhance antifragility by allowing companies to personalize consumer experiences and optimize supply chains. AI-driven personalization enables brands to offer customized product recommendations, predictive trend analysis, and targeted marketing, strengthening customer loyalty. Companies like Estée Lauder and Sephora use AI-powered skincare diagnostics and virtual makeup try-on tools, allowing consumers to shop despite physical store closures (Estée Lauder, 2022; Sephora, 2021).

Blockchain technology further enhances antifragility by ensuring supply chain transparency and counterfeit prevention. Counterfeit cosmetics pose significant brand risks, especially in markets with high fraud levels. Blockchain-based authentication helps trace raw material origins, verify ethical sourcing, and prevent counterfeit sales, reinforcing consumer trust (Bai & Sarkis, 2020).

Augmented reality strengthens antifragility by offering immersive digital shopping experiences. With the decline of in-store testing during COVID-19, AR-powered tools allowed customers to virtually apply makeup, experiment with shades, and receive online beauty consultations. This shift redefined omnichannel retail strategies, ensuring brands remain resilient to evolving consumer behavior (Euromonitor International, 2023).

Building on the theoretical framework discussed, Table 1 presents a structured conceptual model outlining the key components of antifragile business models in the cosmetics industry, integrating insights from existing research and industry practices.

**Table 1. Conceptual Model of Antifragility in the Cosmetics Industry**

Key component	Function	Implementation Strategies	Examples from the Cosmetics Industry
<b>Proactive adaptation</b>	Anticipating and responding to consumer trends, regulatory changes, and market disruptions before they occur.	<ul style="list-style-type: none"> <li>- Continuous market research and trend forecasting</li> <li>- Agile product innovation</li> <li>- Regulatory foresight and compliance planning</li> </ul>	<ul style="list-style-type: none"> <li>- L'Oréal's early adoption of clean beauty trends before regulatory mandates</li> <li>- Estée Lauder's pivot to skincare-focused products during COVID-19 lockdowns</li> </ul>
<b>Decentralized supply chains</b>	Reducing reliance on a single supplier or region, increasing flexibility to respond to disruptions.	<ul style="list-style-type: none"> <li>- Multi-supplier sourcing strategies</li> <li>- Regional manufacturing hubs</li> <li>- AI-powered supply chain analytics</li> </ul>	<ul style="list-style-type: none"> <li>- Shiseido's regionalized production hubs to minimize global supply chain risks</li> <li>- P&amp;G's nearshoring approach to reduce logistics disruptions</li> </ul>
<b>Sustainability-driven innovation</b>	Ensuring long-term business resilience by integrating environmental and ethical considerations into core business models.	<ul style="list-style-type: none"> <li>- Investment in biodegradable and eco-friendly packaging</li> <li>- Carbon-neutral production initiatives</li> <li>- Ethical sourcing and cruelty-free certification</li> </ul>	<ul style="list-style-type: none"> <li>- Natura &amp; Co's investment in carbon-neutral operations and biodegradable packaging</li> <li>- The Body Shop's commitment to cruelty-free formulations</li> </ul>
<b>Digital transformation</b>	Enhancing operational efficiency and consumer engagement through technology adoption.	<ul style="list-style-type: none"> <li>- AI-driven product personalization</li> <li>- Blockchain for supply chain transparency</li> <li>- Augmented reality for virtual product trials</li> </ul>	<ul style="list-style-type: none"> <li>- Estée Lauder's AI-driven personalization and virtual beauty consultations</li> <li>- Sephora's AR-powered Virtual Artist tool for makeup try-ons</li> </ul>
<b>Decision-making under uncertainty</b>	Developing agility in business strategy through scenario planning and risk management.	<ul style="list-style-type: none"> <li>- AI-powered predictive analytics for demand forecasting</li> <li>- Dynamic pricing models</li> <li>- Crisis management playbooks</li> </ul>	<ul style="list-style-type: none"> <li>- P&amp;G's scenario-based forecasting for adapting to economic downturns</li> <li>- L'Oréal's dynamic pricing model based on consumer demand fluctuations</li> </ul>
<b>Revenue diversification</b>	Reducing dependence on a single product line or market segment to ensure financial stability.	<ul style="list-style-type: none"> <li>- Expansion into adjacent product categories</li> <li>- Omnichannel sales approach (physical and digital retail)</li> <li>- Subscription-based business models</li> </ul>	<ul style="list-style-type: none"> <li>- Coty's expansion into digital commerce and influencer-driven marketing</li> <li>- L'Oréal's entry into dermatological skincare and active cosmetics</li> </ul>
<b>Consumer-centric resilience</b>	Strengthening brand loyalty and market adaptability through direct consumer engagement and community-driven strategies.	<ul style="list-style-type: none"> <li>- Direct-to-consumer (DTC) sales models</li> <li>- Data-driven customer segmentation</li> <li>- Personalized loyalty programs and digital engagement</li> </ul>	<ul style="list-style-type: none"> <li>- Sephora's Beauty Insider loyalty program enhancing repeat purchases</li> <li>- Estée Lauder's AI-driven consumer behavior analysis for targeted marketing</li> </ul>
<b>Financial agility and risk mitigation</b>	Ensuring liquidity and operational flexibility during economic downturns.	<ul style="list-style-type: none"> <li>- Maintaining financial reserves and low debt ratios</li> <li>- Flexible budgeting for crisis response</li> <li>- Strategic M&amp;A to</li> </ul>	<ul style="list-style-type: none"> <li>- L'Oréal's acquisition of emerging clean beauty brands to strengthen market position</li> <li>- P&amp;G's diversified portfolio balancing premium and mass-market segments</li> </ul>

Key component	Function	Implementation Strategies	Examples from the Cosmetics Industry
		capitalize on distressed assets	
<b>Market expansion and global adaptation</b>	Adapting business models for emerging markets and new consumer segments to mitigate risk exposure.	<ul style="list-style-type: none"> <li>- Localization of product offerings</li> <li>- Strategic partnerships with regional retailers</li> <li>- Influencer marketing tailored to cultural preferences</li> </ul>	<ul style="list-style-type: none"> <li>- Shiseido's expansion into Southeast Asia with region-specific product formulations</li> <li>- Nykaa's use of local influencers in India to drive online beauty sales</li> </ul>
<b>Crisis response and recovery mechanisms</b>	Turning disruptions into opportunities for market repositioning and innovation.	<ul style="list-style-type: none"> <li>- Rapid shifts to digital-first business models</li> <li>- Agile workforce and remote operations strategies</li> <li>- Investment in crisis-proof supply chains</li> </ul>	<ul style="list-style-type: none"> <li>- Estée Lauder's digital pivot and virtual consultations during COVID-19</li> <li>- Sephora's ability to quickly shift marketing to self-care trends during lockdowns</li> </ul>

Source: elaborated by the author.

The antifragility model in cosmetics relies on proactive adaptation, decentralized supply chains, sustainable R&D, and digital innovation. Companies that integrate these principles do not merely survive crises but emerge stronger and more competitive. Future-proofing the cosmetics sector requires continuous investment in innovation and agility, ensuring businesses remain adaptable amid uncertainty.

## 2. Decision-Making Under Uncertainty

In the cosmetics industry, decision-making under uncertainty is crucial for long-term success. Global supply chain disruptions, shifting consumer preferences, and economic crises have shown that traditional risk mitigation is insufficient. Instead, antifragile decision-making - which enables businesses to improve through disruptions - offers a more effective strategy. The key components of this approach include *risk management and scenario planning*, *agile strategy adjustments*, and *crisis response mechanisms*. These elements help companies proactively navigate volatility and turn challenges into growth opportunities.

Risk management and scenario planning form the foundation of antifragile decision-making. Unlike conventional strategies that focus on minimizing damage, antifragile firms identify strategic opportunities in volatile markets. Leading brands such as L'Oréal, Estée Lauder, and Shiseido use data analytics, AI-driven forecasting, and scenario modeling to anticipate economic downturns, supply chain risks, and changes in consumer demand (Estée Lauder, 2022; L'Oréal, 2022; Shiseido, 2022). The COVID-19 pandemic underscored the value of scenario planning, as companies that had invested in digital infrastructure and e-commerce quickly pivoted to online sales, while brands reliant on traditional retail suffered losses (Euromonitor International, 2023).

Agile strategy adjustments are another essential element of antifragile decision-making. Unlike rigid long-term planning, agile organizations continuously adapt to market changes. This flexibility is evident in product innovation, where companies that rapidly adjust formulations, packaging, and marketing stay ahead of trends. Natura & Co and Coty, for



example, swiftly embraced clean beauty and sustainability, realigning their supply chains and R&D to meet evolving consumer expectations (Coty, 2022; Natura & Co, 2022). Their ability to fast-track product development and streamline manufacturing helped them gain market share while competitors struggled with slow adaptation.

Crisis response mechanisms further strengthen antifragile decision-making. While many companies prepare contingency plans, true antifragility involves transforming crises into opportunities. This is particularly relevant in supply chain management, where firms that decentralized supplier networks and built redundancy were better equipped to handle geopolitical tensions, shipping delays, and material shortages. The adoption of blockchain technology and real-time logistics tracking has enhanced crisis response, ensuring supply chain visibility and optimized distribution channels (Ezzat & Aiman, 2023).

Consumer engagement is another critical aspect of crisis response. The way a company communicates and adapts to disruptions impacts brand trust and loyalty. During COVID-19, Sephora and Estée Lauder launched virtual beauty consultations and AI-powered personalization tools to maintain consumer engagement despite store closures (Estée Lauder, 2022; Sephora, 2021). These digital innovations not only prevented revenue loss but expanded customer bases by offering tailored online experiences.

Ultimately, decision-making under uncertainty must be driven by risk intelligence, strategic agility, and proactive crisis management. Businesses that view uncertainty as an opportunity rather than a threat are more likely to adapt, innovate, and grow. By continuously investing in data-driven insights, digital transformation, and consumer engagement, companies can ensure long-term success in an unpredictable industry.

### **3. Long-Term Strategies for Antifragility**

In the fast-changing cosmetics industry, companies that adopt long-term antifragility strategies ensure sustained growth and adaptability in uncertain conditions. Unlike firms that rely on short-term crisis management, antifragile companies proactively position themselves for resilience and expansion. Key strategies include *diversified revenue streams*, *sustainability-driven consumer engagement*, and *market expansion through digitalization*. These elements reduce exposure to economic volatility while enabling continuous evolution in response to external shocks.

A diversified revenue model ensures stability across product categories, markets, and sales channels. Leading firms like L'Oréal mitigate risk by expanding beyond traditional skincare and makeup into dermatological treatments, haircare, and active cosmetics, creating a balanced revenue structure that buffers against downturns in any one sector (Euromonitor International, 2023). Estée Lauder similarly hedges risks by maintaining a presence in both luxury and mass-market segments, ensuring financial resilience despite changing consumer behaviors (Estée Lauder, 2022). This approach allows brands to sustain growth despite economic instability or regional regulatory shifts.

Sustainability and consumer-centric business models further enhance antifragility. As environmental and ethical concerns shape purchasing decisions, brands that integrate sustainability into core strategies position themselves for long-term success. Natura & Co and The Body Shop, for example, invest in biodegradable packaging, carbon-neutral operations, and cruelty-free formulations, aligning with rising consumer expectations and regulatory trends (Ezzat & Aiman, 2023; Natura & Co, 2022; Warsita & Indriastuti, 2021). Sustainability-driven models enhance brand loyalty, reduce reputational risks, and future-proof businesses as younger generations prioritize ethical consumption.

Market expansion and digitalization offer another pillar of antifragility. The growth of e-commerce, direct-to-consumer platforms, and AI-driven personalization has transformed consumer engagement. Brands like Sephora and Estée Lauder have used AR and AI-powered skincare consultations to maintain engagement, even as physical retail declined (Estée Lauder, 2022; Sephora, 2021). Shiseido has successfully expanded into Southeast Asia and Latin America, localizing product formulations, marketing, and distribution to match regional preferences and climate conditions (Shiseido, 2022). This reduces overdependence on mature Western markets, distributing risks across diverse economies and ensuring long-term stability.

By integrating diversified revenue models, sustainability-driven engagement, and digital expansion, cosmetics firms move beyond mere survival to long-term growth. Instead of reacting to industry disruptions, brands that embed antifragility into their strategic vision create self-reinforcing cycles of innovation and market expansion. The ability to operate across multiple revenue streams, align with ethical consumption trends, and scale digitally ensures beauty brands remain competitive and thrive in an unpredictable global market.

#### **4. Building Antifragile Business Models in Moldova and Eastern Europe**

While much of the focus has been on large multinational corporations, the Antifragility concept is equally critical for small-market economies such as Moldova and other Eastern European nations. Businesses in these regions face persistent challenges, including limited access to capital, dependence on external markets, and workforce migration. Unlike firms in developed economies, businesses in Eastern Europe must operate with heightened uncertainty, making antifragility not just an advantage but a necessity (International Monetary Fund, 2024). Drawing on global case studies, it is possible to identify how companies in Moldova and the broader region can develop strategies to navigate economic volatility and ensure long-term sustainability.

The global cosmetics industry has provided valuable insights into how firms successfully integrate antifragile principles. Companies like L'Oréal, Estée Lauder, and Shiseido have used economic crises, supply chain disruptions, and shifting consumer preferences as catalysts for transformation rather than obstacles. *One of the most significant lessons from these firms is the importance of digital transformation.* Businesses that embraced e-commerce, AI-driven marketing, and virtual consultation services were far better positioned to maintain consumer engagement despite disruptions to traditional retail channels (Estée Lauder, 2022; L'Oréal, 2022; Shiseido, 2022). This approach offers a model for companies in Moldova, where reliance

on physical retail can be a limitation. A digital-first strategy can allow businesses to reach international markets, circumventing domestic economic constraints.

*Another key lesson from international case studies is the role of supply chain resilience in mitigating risks.* Firms that diversified their supplier base, regionalized manufacturing, and built agile distribution networks fared better during periods of crisis. Natura & Co in Brazil and Coty in the United States provide examples of how businesses can develop robust supply chains by strengthening relationships with local suppliers, investing in flexible logistics, and using real-time data analytics to track production risks (Coty, 2022; Natura & Co, 2022). This model is particularly relevant for Moldova, where heavy reliance on imported raw materials exposes businesses to fluctuations in currency values, trade restrictions, and geopolitical instability (World Bank, 2024). Establishing regional partnerships with suppliers in Romania, Poland, and across the European Union could enhance supply chain resilience and mitigate disruptions.

*Sustainability has also emerged as a core element of antifragility.* Companies such as The Body Shop and Lush have successfully positioned themselves as leaders in ethical and environmentally responsible business practices. Their commitment to biodegradable packaging, cruelty-free formulations, and sustainable sourcing has not only differentiated their brands but also ensured long-term viability in a market increasingly shaped by regulatory changes and shifting consumer expectations (Ezzat & Aiman, 2023).

For Moldova and other Eastern European economies, where regulatory frameworks are aligning with EU sustainability policies, integrating environmentally responsible practices can serve both as a compliance mechanism and as a competitive advantage in export markets. Businesses that emphasize sustainable production, organic ingredients, and environmentally conscious branding can carve out a niche within the growing demand for ethical beauty products.

During the COVID-19 pandemic, the cosmetics company *Viorica* demonstrated notable antifragility (Ivaşenco, 2022). Rather than halting operations, the firm transformed its business model by scaling up disinfectant production, launching an e-commerce platform, and investing in R&D to develop new product lines like *Viorica Vie*. The company leveraged its own eco-plantation (*VioPark*) and collaborated with international research laboratories to innovate sustainably. As a result, Viorica increased its sales volume by 181% in 2020 compared to 2019 and returned to profitability after several years of loss. This case illustrates how a Moldovan firm used digital tools, sustainability, and strategic agility to thrive during crisis conditions.

Adopting antifragility principles in Moldova requires more than simply copying global best practices; strategies must be adapted to the realities of local economic structures and market conditions. Digital transformation is an essential component of this adaptation, particularly in enabling businesses to reduce their reliance on physical retail and expand internationally. While multinational corporations already have established omnichannel strategies, Moldovan firms can leapfrog certain traditional barriers to entry by investing in direct-to-consumer models and leveraging cross-border e-commerce platforms (Ivaşenco, 2023a). The increasing availability of digital payment solutions, third-party logistics providers,

and AI-powered marketing tools presents a significant opportunity for local businesses to modernize without requiring extensive capital investment.

Supply chain diversification is another critical factor in enhancing antifragility in Moldova. Unlike multinational companies that can operate multiple manufacturing plants across different regions, Moldovan businesses need to focus on regional collaboration to build supply chain resilience. Strengthening trade relationships with neighboring countries such as Romania and Poland can reduce dependency on a single market and create alternative sourcing options. This approach would not only mitigate supply risks but also allow firms to scale production more efficiently and align with EU trade regulations (World Bank, 2024).

Sustainability-driven innovation provides a competitive advantage for Moldovan cosmetics companies seeking to differentiate themselves in an increasingly crowded market. Unlike mass-market brands that compete on cost and volume, Moldovan firms can focus on producing niche, eco-friendly beauty products using locally sourced ingredients. Moldova's strong agricultural sector offers opportunities for developing organic skincare lines, herbal formulations, and sustainable packaging solutions. Aligning with European consumer preferences for ethical and sustainable beauty products can open doors to broader export opportunities while fostering long-term resilience (Euromonitor International, 2023).

For businesses in Moldova and other Eastern European economies to build antifragility, they must integrate multiple strategies, combining digitalization, supply chain optimization, sustainability, and market expansion. Digital infrastructure is one of the most immediate opportunities, allowing local brands to compete beyond national borders and establish stronger brand identities through direct-to-consumer sales. Companies that invest in strong brand narratives, influencer marketing, and AI-driven consumer insights will be better positioned to compete on global e-commerce platforms.

Another crucial step for Moldovan firms is developing export-oriented business models that align with European market standards. Many companies in Eastern Europe struggle to integrate into global value chains due to regulatory misalignment. Investing in EU-compliant certifications, sustainable sourcing practices, and transparent supply chains will facilitate long-term access to Western consumer markets. This shift will not only make Moldovan products more attractive to international buyers but will also enhance resilience by reducing dependence on a limited domestic market.

Local production capabilities and circular economy initiatives should also be prioritized. As global supply chains continue to face disruptions, businesses that shorten their supply chains, develop in-house production capabilities, and establish regional collaborations will be better equipped to withstand future crises. The incorporation of recycling programs, zero-waste initiatives, and eco-friendly formulations will not only reduce operational risks but also strengthen consumer trust and brand value among sustainability-conscious demographics (Ezzat & Aiman, 2023).

While Moldova and other Eastern European economies face structural challenges, businesses that embrace antifragility strategies will be better positioned to navigate

uncertainty and drive long-term growth. By focusing on digital transformation, regional supply chain cooperation, sustainability, and export expansion, companies in the cosmetics sector can transform economic volatility into a strategic advantage. Rather than merely surviving market fluctuations, firms that integrate antifragile business models can thrive in an increasingly unpredictable global landscape.

## Conclusions

This study underscores that in an increasingly volatile global economy, firms in the cosmetics industry must go beyond resilience. Antifragile businesses actively use disruption as a catalyst for growth, innovation, and competitive advantage. Drawing on global case studies, the research identifies four core principles of antifragility: proactive adaptation, supply chain decentralization, sustainability-driven innovation, and digital transformation. Companies such as L'Oréal, Estée Lauder, and Shiseido illustrate how these strategies help navigate economic shocks, shifting consumer preferences, and operational uncertainties.

For emerging economies like Moldova and those in Eastern Europe, the findings are especially relevant. Limited access to capital, supply chain vulnerabilities, and regulatory shifts require tailored antifragile strategies. The Moldovan case study shows that digitalization, sustainability, and market diversification can turn structural limitations into growth opportunities. Firms that prioritize ethical production, export readiness, and omnichannel distribution are better positioned to align with EU standards and integrate into global value chains.

Theoretically, this research extends Taleb's concept of antifragility from financial systems to corporate operations and consumer-driven markets. It also examines decision-making under uncertainty, emphasizing the role of scenario planning, dynamic pricing, and agile strategies. However, no empirical decision-making model was applied - an area that presents a valuable direction for future studies. Similarly, while comparative analysis of antifragile and non-antifragile firms is discussed conceptually, it was not conducted and should be pursued in future longitudinal research.

Despite its contributions, the study is limited by its reliance on secondary data. Future research could benefit from primary data collection, empirical model testing, and industry-specific comparative analyses. Expanding the scope to include sectors like fashion, food, or luxury goods, or exploring supportive government policies - such as investment in digital infrastructure and sustainability incentives - would further deepen understanding of antifragility.

Ultimately, this study demonstrates that uncertainty can be transformed into strategic advantage. Firms that embrace innovation, sustainability, and agility are not only more likely to survive crises but to thrive through them. For companies in Moldova and beyond, embedding antifragile principles into core business models may be the key to enduring success in an unpredictable world.



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