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## A Qualitative NVivo-Based Exploration of Weather, Climate, and Seasonal Rainfall Variations and Their Socio-Economic Consequences on Sales Volume and Revenue Among Micro, Small, and Medium Enterprises (MSMEs): A Case Study of Kulit Lumpia Bunga Terate in Kasihan, Bantul, Yogyakarta

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### Abstract

*This study examines how weather patterns, climate shifts, and seasonal rainfall variations shape the sales volume and revenue stability of micro, small, and medium enterprises (MSMEs), with a focused case on Kulit Lumpia Bunga Terate in Kasihan, Bantul, Yogyakarta. The inquiry departs from the premise that small food-based enterprises operate within fragile ecological and market environments, where fluctuating humidity, temperature, and rainfall subtly influence production quality, consumer traffic, and operational continuity. A qualitative approach was chosen to capture these lived realities in a manner that quantitative measures alone cannot express. Data were collected through in-depth interviews with owners, production workers, and local suppliers, supported by field observations during both dry and rainy periods. All qualitative materials were processed and analyzed using NVivo, allowing systematic coding and thematic patterning. The NVivo outputs highlighted three interlinked thematic domains: moisture-sensitive production challenge, where humidity and rainfall affected dough consistency, drying time, and defect rates; consumer flow fluctuations, driven by changes in foot traffic, weather-related mobility, and shifting consumption habits during prolonged rains; and adaptive economic responses, including informal inventory strategies, flexible pricing, and selective product diversification to buffer revenue drops. The synthesis of these themes suggests that the enterprise's economic resilience is strongly tied to its capacity to anticipate and adapt to environmental variability. The findings underscore that climate-responsive production practices, paired with context-specific marketing adjustments, play a crucial role in sustaining MSME performance amid increasingly unpredictable weather conditions.*

*Keywords: Climate Impact, MSMEs, Rainfall Variation, Qualitative Analysis, NVivo.*

### 1. Introduction

Micro, small, and medium enterprises (MSMEs) occupy a vital position in Indonesia's local economies, particularly in regions where traditional craft production supports household income and community resilience. In rural and semi-urban settings, the continuity of these small enterprises depends not only on managerial capability or marketing strategy but also on the stability of environmental conditions. Weather patterns, seasonal transitions, and variations in rainfall often shape production cycles and consumer movement, thereby influencing sales performance in subtle yet substantial ways. This dynamic is especially observable in the case of Kulit Lumpia Bunga Terate in Kasihan, Bantul, where daily business operations remain closely tied to the rhythm of nature and local climate variability. Research across different contexts has consistently demonstrated that weather affects both consumer behavior and business operations. Studies on retail expenditure show that rainfall, extreme temperatures, and sudden weather shifts may alter consumer mobility, spending motivations, and purchasing patterns (Murray et al., 2010). Insights from local Indonesian cases further indicate that rainfall disrupts traditional traders' capacity to secure raw materials and maintain stable income. Other investigations show that heavy rain reduces customer visits, while prolonged dry seasons affect production quality for certain food-based MSMEs. These patterns affirm that climate-related challenges are not only environmental but also economic deeply linked to the sustainability of small enterprises.

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In light of these realities, this research becomes urgent. Despite the recurring effect of weather and seasonal changes on MSMEs, systematic qualitative analyses remain limited, especially those employing structured coding tools such as NVivo. Most available studies in Indonesia focus on descriptive impacts of weather on traders or simple associations between climate and consumer behavior (Abdurrahim & Hartono, 2022; Tian et al., 2021). What remains underexplored is the deeper, lived experience of small business owners as they navigate economic vulnerabilities brought about by environmental instability. There is a lack of studies examining how local craft-based MSMEs adjust their production, pricing, and distribution practices in response to unpredictable weather cycles. This gap calls for a grounded, qualitative investigation that captures both economic consequences and adaptive strategies shaped by community knowledge and experience. The research gap becomes more pronounced when considering MSMEs like Kulit Lumpia Bunga Terate, where production depends heavily on weather-sensitive drying processes. Existing literature has not fully explored how such enterprises respond to shifting climate patterns or how their income volatility is linked to rainfall patterns and seasonal transitions. While research on marketing strategies for increasing sales volume exists for other MSMEs (Rahayu, 2023; Prasetyo, 2016), the interaction between environmental constraints and economic outcomes remains insufficiently documented. Thus, this study addresses a specific yet neglected domain: the socio-economic vulnerability of small craft-based enterprises to environmental fluctuation.

Based on these gaps, the central problem of this research is formulated as follows: How do weather, climate, and seasonal rainfall variations influence sales volume and revenue for Kulit Lumpia Bunga Terate in Kasihan, Bantul, and what socio-economic consequences emerge from these conditions? This question guides the study to explore environmental, economic, and behavioral dimensions simultaneously. It also encourages a deeper look into how MSMEs negotiate uncertainty and maintain production continuity despite unfavorable conditions. The primary objective of this research is to understand, through a qualitative lens, the specific ways weather and climate patterns affect business performance in this case-study setting. Using NVivo as an analytical tool allows themes to emerge naturally from field data, reflecting the interpretive depth emphasized in qualitative methodologies (Bungin, 2020; Moleong, 2005; Rijali, 2018). NVivo supports the systematic coding of interviews, observations, and supporting documentation, enabling clearer interpretation of the relationships between weather variation and economic outcomes. Through this approach, the study seeks to identify core themes such as production disruption, fluctuating customer demand, constraints on mobility, and adaptive strategies developed by the enterprise.

The research is expected to provide significant benefits. Academically, the study contributes to a more nuanced understanding of the intersection between climate variability and MSME economic resilience, a topic that remains underrepresented in local scholarly literature. It enriches qualitative research practices by demonstrating the utility of NVivo in examining environmental economic interactions in small business contexts. Practically, the findings may assist local MSMEs in identifying strategic responses to climate-related challenges whether through production adjustments, inventory management, diversification of sales channels, or cost leadership approaches similar to those adopted in other sectors under economic pressure (Septyaningrum & Handayani, 2022). For policymakers, this research offers insights into the types of support needed by environmentally vulnerable MSMEs, including access to early climate information, infrastructure for weather-resilient production, and targeted guidance to stabilize income across seasons. It also highlights the importance of local knowledge in shaping effective and context-sensitive solutions. Overall, this study brings forward the lived experiences of small enterprise actors in navigating weather-induced uncertainty. By grounding the analysis in field realities and interpreting them through structured qualitative methods, the research aims to bridge empirical observation with conceptual understanding offering a meaningful contribution to both academic discourse and practical decision-making.

## 2. Research Methods

### 2.1. Qualitative Research Paradigm

This research is grounded in the belief that reality is not singular or fixed, but layered, contextual, and shaped by human experience. The daily economic life of a small enterprise such as Kulit Lumpia Bunga Terate is influenced by weather shifts, rainfall variability, and seasonal changes—conditions that traders interpret based on lived encounters rather than predetermined models. Weather and climate are experienced differently by each actor, and these interpretations construct multiple, coexisting realities. This ontological stance aligns with the naturalistic view that phenomena must be understood from the perspective of the individuals living within them (Moleong, 2005; Bungin, 2020).

### 2.1.1. Epistemology: Nature of Knowledge

Knowledge in this study is viewed as something that emerges through interaction, dialogue, and observation within the field. Insights into how climate affects sales volume and income are not treated as objective measurements alone, but as collective understandings shaped by cultural practices, routines, and economic pressures. Qualitative epistemology recognizes that knowledge is co-produced between researcher and participant, relying on trust, prolonged engagement, and interpretive depth (Rijali, 2018; Rianto, 2020).

### 2.1.2. Methodology: Qualitative Research Approach

A qualitative case study approach was employed to explore how weather patterns influence socio-economic outcomes for the MSME. This methodology allows the researcher to trace meaning, analyze context, and capture nuances that quantitative designs often overlook. Techniques from ethnographic inquiry support this approach, particularly the emphasis on understanding cultural patterns and local interpretations (Spradley, n.d.). NVivo was used to organize thematic structures and support analytic rigor.

## 2.2. Population, Sample, Sampling Technique, and Sample Size

### 2.2.1. Population in Qualitative Inquiry

The population of this research includes individuals who directly experience the economic effects of fluctuating weather business owners, workers involved in production, and community members familiar with the MSME's market conditions. In qualitative research, the population is not large or statistical; it is defined by relevance and depth (Murdiyanto, 2020).

### 2.2.2. Sampling and Participant Selection Criteria

Purposive sampling was used to identify participants capable of providing information-rich insights (Moleong, 2005). Criteria included (a) Active involvement in production or sales for at least two years. (b) Direct experience with climate-related disruptions. (c) Willingness to articulate challenges, adjustments, and perceptions related to environmental shifts. This approach aligns with previous studies on climate and retail behavior, which also relied on targeted participants familiar with weather impacts (Murray et al., 2010; Abdurrahim & Hartono, 2022).

### 2.2.3. Sample Size and Data Saturation

Data collection continued until analytical saturation occurred that is, when additional interviews no longer introduced new themes or insights (Firman, 2015). Saturation was achieved after interviewing key MSME actors and validating findings through observation and document analysis.

## 2.3. Types of Data

### 2.3.1. Primary Data: Information-Rich Sources

Primary data consisted of In-depth interviews: capturing narratives about seasonal disruptions, production challenges, and strategies used to manage economic uncertainty. Field observations: documenting patterns of daily activity, environmental conditions, and adaptive behaviors. These methods follow established qualitative standards emphasizing firsthand, experience-based accounts (Moleong, 2005; Bungin, 2020).

### 2.3.2. Secondary Data: Contextual Sources

Secondary data included company notes, historical sales records, national climate bulletins, academic literature, and local regulations related to MSME operations and weather patterns. Documents on rainfall, humidity, and seasonal cycles (Dan & Atmosfer, n.d.) supported contextual interpretation.

### 2.3.3. Nature of Data and Analysis

The data were descriptive, narrative, and interpretive in nature, suited for thematic coding and pattern-seeking analysis in NVivo (Rijali, 2018; Saleh, 2017).

## 2.4. Data Collection Techniques

### 2.4.1. In-Depth Interviews

Semi-structured interviews guided participants through themes such as production delays during rainy seasons, reduced mobility due to heavy rainfall, or fluctuations in customer demand. The interview guide remained flexible to allow spontaneous insights.

### 2.4.2. Limited Participant Observation

Observations focused on operational routines, drying processes heavily dependent on sunlight, and business activities during rainy or extreme weather days. This technique supported deeper understanding of behaviors that participants might not verbalize.

### 2.4.3. Document Analysis

Weather bulletins, business logs, and product inventory notes were examined to support triangulation and strengthen contextual understanding.

### 2.4.4. Data Triangulation

Triangulation combined interviews, observations, and documents to ensure validity and consistency across sources, following qualitative trustworthiness principles.

## 2.5. Qualitative Measurement Scale

### 2.5.1. Nature of Qualitative Measurement

Measurement relied on narrative interpretation instead of numerical scaling. Themes such as production disruption, sales decline, or weather uncertainty emerged from participant accounts.

### 2.5.2. Connection to Data Credibility

Credibility was reinforced through member checking, triangulation, and prolonged engagement, ensuring that interpretations reflected participant realities (Bungin, 2020).

## 2.6. Operational Definitions (Qualitative)

### 2.6.1. Independent Variables: Weather, Climate, and Rainfall

NVivo nodes represented conceptual categories such as (a) Weather impact: limited sun exposure, drying delays. Seasonal patterns: rainy season disruptions, prolonged drought. (b) Economic consequences: decreased sales, unstable revenue. Exploratory questions included: How does rainfall affect your production capacity? What changes during long dry periods?

### 2.6.2. Dependent Variables

Sales volume, income stability, and operational continuity, interpreted through narrative accounts.

### 2.6.3. Role of Nvivo

NVivo facilitated axial coding, theme clustering, and visualization of relationships between climate variations and economic outcomes.

## 2.7. Trustworthiness Criteria (Instrument Testing)

### 2.7.1. Credibility

Ensured through triangulation, peer debriefing, and participant confirmation.

### 2.7.2. Transferability

Achieved by providing rich descriptions of context, enabling applicability to similar MSMEs.

### 2.7.3. Dependability

Supported through systematic documentation of analytic procedures.

### 2.7.4. Confirmability

Maintained by ensuring interpretations were grounded in participant narratives rather than researcher bias.

## 2.8. Hypothesis Testing in Qualitative Inquiry

### 2.8.1. Proposition Verification Using NVivo

Although qualitative research does not test hypotheses statistically, propositions were examined through: a. Axial coding: linking categories (e.g., rainfall, production delay, reduced sales). b. Matrix coding queries: cross-analyzing themes across participants. c. Network visualization: mapping causal pathways.

### 2.8.2. Criteria for Verification Success

A proposition is considered supported when multiple data sources consistently point to the same thematic pattern.

## 3. Results and Discussions

### 3.1. Overview of Findings

The analysis of interviews, field observations, and supporting documents reveals that the MSME Kulit Lumpia Bunga Terate experiences clear socio-economic consequences as weather, climate, and rainfall patterns shift. Through NVivo coding, three major thematic clusters emerged: operational disruptions, market and mobility constraints, and income instability accompanied by adaptive responses. These themes are consistent across participants, triangulated by observational notes on production activities during varying weather conditions. The following tables summarize key NVivo-derived findings.

**Table 1. Major Themes and Supporting Indicators**

Theme	Key Indicators (NVivo Nodes)	Illustrative Participant Insight
Operational Disruptions	Drying delays, inconsistent sunlight, moisture affecting texture	If the rain lasts all day, the sheets cannot dry at all
Market & Mobility Constraints	Reduced foot traffic, logistical delays, limited raw materials	People don't come out when the rain is heavy; our sales fall instantly
Income Instability	Declining weekly revenue, unpredictable cash flow	Some weeks we earn half of what we usually make

Theme	Key Indicators (NVivo Nodes)	Illustrative Participant Insight
Adaptive Strategies	Adjusted production hours, alternative drying methods, community sharing	We combine what little sunlight we get, drying twice on short intervals

### 3.2. Patterns of Weather-Induced Operational Disruptions

All participants described weather as a determining factor in the production of kulit lumpia. Because the production process requires natural drying, prolonged rainfall frequently leads to incomplete or failed batches. Field observation confirmed that on cloudy or humid days, the texture of the product becomes inconsistent, forcing producers to discard or reprocess the materials. These findings align with earlier studies showing that traditional food traders are among the most vulnerable to disruptions during rainy seasons. Similar patterns were also reported in convenience-store contexts, where rainfall reduces operational efficiency and customer purchasing time (Tian et al., 2021). From an economic perspective, such interruptions accumulate into weekly and monthly production losses, shrinking supply and limiting sales potential.

**Table 2. Observed Production Constraints by Weather Type**

Weather Condition	Observed Effect on Production	Resulting Economic Impact
Continuous Rainfall	No outdoor drying possible	Full production halt; zero output
High Humidity	Sheets fail to harden; increased spoilage	Loss of raw materials and labor time
Prolonged Dry Season	Excessive brittleness; cracking	Increased defect rate, reduced sellable units

### 3.3. Market Access and Consumer Behavior Under Weather Variability

The results suggest a clear pattern: heavy rainfall reduces customer mobility. Sellers frequently noted a sharp drop in visitors to the local market and surrounding food stalls whenever weather deteriorated. This is consistent with research indicating that weather can modify shopping motivations, emotional states, and mobility patterns (Murray et al., 2010; Abdurrahim & Hartono, 2022). Observational data show that during rainy days, even indispensable household purchases decline, let alone non-essential traditional snacks. Consequently, MSMEs like Kulit Lumpia Bunga Terate experience immediate and significant reductions in daily revenue. This pattern mirrors prior findings in Chinese retail settings, where weather changes notably reduce foot traffic and sales (Tian et al., 2021).

**Table 3. Market and Mobility Conditions**

Condition	Observed Consumer Response	Seller Interpretation
Heavy Rain	Minimal customer visits	People choose to stay home
Intermittent Showers	Short, urgent purchases only	Customers come only for essentials
Clear Weather	Normal to high foot traffic	We can rely on sales again

### 3.4. Income Instability and Socio-Economic Implications

The financial implications appear substantial. Participants repeatedly explained that extended rainy seasons cut weekly earnings by up to 40–50%. Income instability affects not only day-to-day operations but also purchasing power for raw materials, household spending, and long-term business planning. The absence of predictable revenue forces MSMEs to adopt short-term survival strategies rather than structured growth planning, confirming insights from qualitative research emphasizing vulnerability among informal-sector traders during environmental disruptions (Nurfajriani et al., 2024). These findings are consistent with broader marketing and business literature showing that uncontrollable external forces such as weather can destabilize sales volume and revenue, requiring strategic adaptation (Tjiptono et al., 2020).

### 3.5. Adaptive Practices: Resourcefulness Under Environmental Uncertainty

Participants described multiple adaptive behaviors, ranging from: rearranging production times, using partial-drying techniques, utilizing shared drying areas within the community, exploring limited digital promotion to compensate for slow physical sales. These behaviors reflect the cost leadership and efficiency strategies identified in MSMEs under economic pressures (Septyaningrum & Handayani, 2022), although in this context, adaptation is oriented more toward survival than competitive positioning. One notable finding was the effort to integrate weather forecasts informally into production planning. Participants frequently consult mobile weather apps an emerging practice not documented in earlier rural MSME..

#### Discussion

The sets of findings that emerged from interviews, field notes, and document reviews converge toward a coherent explanation of how weather, climate, and seasonal rainfall variations shape the daily realities of Kulit Lumpia Bunga Terate. Rather than functioning as external disturbances, weather patterns are woven into the fabric of production, demand, and revenue cycles. The discussion elaborates the pathways identified through NVivo coding and connects them with broader scholarly conversations, while grounding the interpretations in the lived experiences voiced by participants.

(a) **Weather Patterns and Their Direct Influence on Production Capacity.** The strongest narrative thread concerns the delicate connection between weather variability and the production of kulit lumpia, a product that depends heavily on controlled drying conditions. Interviews repeatedly describe how prolonged rain, high humidity, or even short, irregular showers disrupt drying, diminish texture consistency, or force producers to discard batches altogether. These disruptions are not merely operational; they reshape labor routines, cost structures, and the rhythm of supply. Such patterns reinforce earlier observations in the literature that weather influences consumer-facing sectors (Murray et al., 2010), yet the present study adds nuance by showing that environmental pressures penetrate upstream micro-production processes long before they affect consumption. In this context, the weather becomes a determinant of output quality and supply reliability. The NVivo network reveals a dense cluster linking Rainfall Intensity, Drying Delays, and Product Loss, indicating that production is the first and most sensitive point of vulnerability. This aligns with Indonesian studies documenting how rainy seasons disrupt traders' access to good, especially in traditional markets with similar dependency on weather-exposed production stages.

(b) **Mobility Constraints and Their Revenue Consequences.** Beyond production, rainfall exerts strong influence over mobility. The interviews portray a consistent pattern: footfall decreases sharply during heavy rain, and even loyal customers minimize outdoor movement when streets flood or become slippery. These constraints translate directly into reduced purchasing opportunities, a relationship also identified by Abdurrahim & Hartono (2022) in the context of minimarket shopping. The decline in consumer movement is even more acute in rural and semi-rural settings, where market access often depends on short-distance walking, local motorcycle routes, and informal roadside stalls. NVivo coding displays frequent co-occurrence between nodes such as Market Access, Customer Footfall, and Revenue Volatility. These semantic links reflect how mobility limitations accumulate atop production challenges, intensifying economic pressure on the MSME. The study affirms Tian et al. (2021), who demonstrated similar relationships in China's convenience-store performance, though the present findings show more severe consequences because MSMEs like Kulit Lumpia Bunga Terate lack the buffering infrastructure covered storefronts, stable logistics, or formalized delivery systems that insulate larger retailers from weather-induced demand shocks.

(c) **Economic Vulnerability and the Cycles of Income Volatility.** The economic consequences of these interconnected processes appear prominently across transcripts. Declines in output capacity and dips in customer traffic manifest almost immediately in fluctuating sales and unpredictable revenue cycles. Participants describe weeks of reduced income during heavy rainfall periods, occasionally jeopardizing household needs or short-term debt obligations. These findings reflect the broader reality that weather-sensitive microenterprises often operate without financial buffers or formal mechanisms for risk absorption. The study deepens the understanding of vulnerability by illustrating how weather variability pushes the enterprise into a reactive mode of decision-making. Choices about supply purchases, price adjustments, and market participation become strongly tied to daily environmental assessments rather than long-term planning. This supports qualitative insights from Indonesian MSME studies (Rijali, 2018; Saleh, 2017), which often emphasize how micro-entrepreneurs develop flexible,

highly adaptive but fragile business routines. Interestingly, the emotional texture of the interviews suggests that income instability is experienced not only as economic strain but also as psychological uncertainty. This dimension is often understated in weather-behavior literature but becomes evident when examining NVivo memos participants associate prolonged rain with anxiety indicating that climate-driven fluctuations also shape mental well-being.

(d) Adaptive Practices, Local Knowledge, and Collective Resilience. Despite clear vulnerabilities, the findings highlight resilience strategies grounded in practicality and local knowledge. Rather than employing formal risk-management frameworks, participants rely on improvisational adjustments and community-based cooperation. Several informants explain how they shift production hours to early morning when sunlight is more reliable, or how neighborhood residents share sheltered drying areas during prolonged wet days. Such practices echo Bungin's (2020) view that small enterprises draw on highly contextual knowledge systems shaped by daily interaction with their environment. Likewise, the narratives resonate with Moleong's (2005) emphasis on the importance of lived experience as a primary source of meaning-making in qualitative inquiry. In this sense, adaptation is not merely a technical response but a social practice, negotiated collectively and sustained through mutual support. NVivo's network coding shows that nodes tied to Adaptation frequently co-occur with Community Support and Household Decision-Making, suggesting that resilience emerges from social embeddedness rather than individual strategies alone. This is an important distinction, as it indicates that strengthening MSME resilience may require supporting local networks rather than only providing technical tools.

(e) Linking Empirical Patterns to the Central Research Question. The combined patterns examined above provide a clear answer to the study's central research question: weather, climate, and rainfall variations significantly shape both operational and economic conditions of the MSME. The relationship is neither linear nor singular; instead, it passed through several interdependent layers includes Weather disrupts production to limiting output; Weather restricts mobility to shrinking purchasing opportunities; Both mechanisms reduce sales volume to producing income volatility. Local adaptation strategies soften, but do not eliminate, these impacts. This chain is consistent with the conceptual model generated in NVivo network visualization, where environmental factors appear as upstream forces that cascade into economic outcomes through several mediating nodes.

(f) Significance of Findings in the Broader Field. The discussion contributes to two broader conversations. First, it enriches empirical understanding of weather-sensitive MSMEs in Indonesia a topic that has received far less attention compared with studies on retail or industrial sectors. Second, it demonstrates the usefulness of qualitative NVivo-based analysis in tracing causal pathways that might be obscured in quantitative modelling. While weather-sales relationships have been quantified in past studies (e.g., Murray et al., 2010; Tian et al., 2021), the present study provides a narrative-rich lens that illustrates how and why these relationships manifest at ground level.

#### 4. Conclusion

The qualitative investigation of Kulit Lumpia Bunga Terate demonstrates that weather and seasonal rainfall patterns are not peripheral nuisances but central determinants of this MSME's operational viability and income stability. Empirical evidence from interviews, observations, and business documents shows a repeated causal chain: adverse weather conditions impede drying-dependent production, constrict market access by reducing customer mobility, and thereby precipitate measurable declines in sales volume and revenue. These dynamics are compounded by limited access to capital and storage, which reduce the firm's capacity to smooth production over unfavorable periods. Nevertheless, the enterprise exhibits pragmatic resilience. Local adaptive strategies time-shifting production, community-based shared drying, and tentative exploration of alternative sales channels partially mitigate losses. The efficacy of these measures, however, varies with the severity and predictability of weather events. Where community coordination and timely weather information are present, outcomes are less severe. From a policy and managerial perspective, findings point to three priorities (a) provide MSMEs with access to simple climate-adaptive infrastructure (covered drying areas, solar dryers), (b) strengthen local early-warning and micro-credit mechanisms to buffer cash-flow shocks, and (c) support digital literacy and low-cost channels for demand diversification (pre-orders, neighborhood delivery) so that sales do not depend solely on market footfall. Academically, this case enriches the literature on the intersection of environment and micro-economics and shows the value of NVivo-enabled, narrative-rich analysis for tracing causal processes in climate-sensitive production systems.

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