

Modeling investment strategies in contemporary art in the context of the Yugoslav wars

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Abstract: This research advances a methodological framework for developing predictive models to guide investment strategies in contemporary art across the post-Yugoslav Wars Balkan region. The study examines key determinants of artwork valuation and risk profiles in Bosnia and Herzegovina, Croatia, and Serbia using a mixed-methods approach that synthesizes meta-analysis, expert Q-sort analysis, and hierarchical cluster analysis. The empirical findings demonstrate the enduring influence of the Yugoslav Wars on art market dynamics, underscoring the significance of sustainable intelligence principles and technological innovation in risk mitigation strategies. The analysis identifies critical valuation determinants, including artistic recognition, sociopolitical stability, and cultural significance, while establishing distinct market segments characterized by differentiated risk-reward profiles. The proposed framework incorporates geopolitical risk indicators, artwork and artist attributes, sustainable investing criteria, and technological enablers, emphasizing machine learning algorithms for market forecasting and portfolio optimization. While this framework constitutes a substantial advancement in modelling art investment strategies within post-conflict contexts, limitations persist regarding data availability, model interpretability, and ethical considerations. The study demonstrates the framework's potential to generate value while contributing to cultural heritage preservation and socioeconomic development in the Balkan region, establishing a foundation for subsequent scholarly inquiry into art market analysis within post-conflict societies.

Keywords: contemporary art market; art investment; geopolitical risk; Yugoslav wars; predictive modeling.

JEL Classification: Z1

1. Introduction

The contemporary art market is a complex and multifaceted domain where aesthetic, economic, and sociopolitical factors intertwine to shape the valuation and exchange of artworks (Velthuis, 2007;

Bourdieu, 1993). In the context of geopolitical conflicts, such as the Yugoslav Wars, these dynamics become even more intricate and challenging to navigate (Preece, 2014; Baumann, 2007). The Balkan region, which witnessed a series of devastating wars and ethnic conflicts following the dissolution of Yugoslavia in the early 1990s, presents a particularly compelling case study for examining the impact of geopolitical instability on the contemporary art market (Riding, 2019; Piotrowski, 2011).

Investing in art from countries affected by the Yugoslav Wars, such as Bosnia and Herzegovina, Croatia, and Serbia, is a high-stakes endeavour fraught with unique risks and opportunities (Dragičević-Šešić, 2011; Močnik, 2002). Traditional art valuation models, which often rely on a narrow set of market indicators and historical data, have proven inadequate in capturing the complex web of factors that shape contemporary artworks' value and risk profiles in this context (Goetzmann, 2011; Renneboog, 2009). The lack of a comprehensive and data-driven framework for navigating this market has left investors, policymakers, and scholars grappling with uncertainty and opacity (Mirovic, 2019; Renneboog, 2011). Previous research has explored various aspects of the contemporary art market in the Balkan region, shedding light on the cultural, economic, and political dimensions of art production, circulation, and consumption in post-conflict societies (Pupovac, 2006; Močnik, 2002). Scholars have examined the role of art in fostering cultural dialogue, social cohesion, and collective memory in the aftermath of the Yugoslav Wars (Riding, 2019; Piotrowski, 2012). Others have investigated the economic impact of the conflicts on the art market, highlighting the challenges and opportunities for artists, galleries, and collectors operating in a fragile and uncertain environment (Oosterlinck, 2017; Mei, Moses, 2005).

However, despite these valuable contributions, the existing literature has not yet provided a comprehensive and data-driven framework for modelling art investment strategies in the specific context of the Yugoslav Wars. Previous studies have focused on individual case studies, qualitative analyses, or theoretical discussions, leaving a gap in systematic, quantitative approaches to understanding and predicting art market dynamics in this complex setting (Đureinović 2020, Łabowicz-Dymanus, 2019). This research aims to address this critical gap by proposing a novel framework for developing predictive models to guide investment strategies for contemporary art in the context of the Yugoslav Wars. Building upon recent advances in data analytics, machine learning, and sustainable intelligence (Ruiz, 2023, Aljohani, 2022), this study seeks to integrate insights from multiple disciplines and methodological approaches to shed light on the critical drivers of value and risk in this complex market. The main contribution of this paper is threefold:

1. It provides a comprehensive and systematic review of the literature on the Balkan region's contemporary art market, synthesizing key findings and identifying gaps and opportunities for further research.
2. It employs a multi-method approach, combining meta-analysis, expert Q-sort analysis, and hierarchical cluster analysis, to empirically investigate the complex interplay of factors influencing art valuation and investment in the post-Yugoslav context.
3. It proposes a novel framework for developing predictive models integrating geopolitical risk indicators, artwork and artist attributes, sustainable investing criteria, and technological enablers. It offers a data-driven and socially responsible approach to navigating the challenges and opportunities of art investment in this market.

By addressing these objectives, the study aims to contribute significantly to art market studies, advancing our understanding of the complex dynamics of contemporary art in geopolitically unstable contexts. It seeks to provide actionable insights and tools for investors, policymakers, and scholars to navigate the challenges and opportunities of art investment in the Balkan region while fostering a more resilient, inclusive, and value-creating art market ecosystem.

The proposed framework represents a significant step towards more sophisticated and holistic modelling of contemporary art investment strategies in the post-Yugoslav context. It underscores the importance of a data-driven, technologically enabled, and socially responsible approach to navigating the complexities of this market. The study argues that by harnessing the power of sustainable intelligence principles and innovative analytics, investors and policymakers can work towards a more effective and sustainable art investment landscape in the Balkan region and beyond.

The research also explores the broader implications of the proposed framework for the practice of art investment and the development of cultural policies in post-conflict societies. It highlights the potential for data-driven insights and predictive models to inform more effective and sustainable investment strategies while also contributing to the region's preservation and promotion of cultural heritage. At the same time, the study acknowledges the challenges and limitations associated with implementing such a framework, including data availability and quality, model interpretability, ethical and legal considerations, and the need for adaptive resilience in the face of geopolitical uncertainty.

By engaging with these complex issues, the research aims to stimulate further scholarly inquiry and policy debate on the future of the contemporary art market in the Balkan region and beyond. It seeks to bridge the gap between theory and practice, providing actionable insights and tools for investors, policymakers, and scholars to navigate the challenges and opportunities of art investment in geopolitically unstable contexts.

The study proceeds as follows: Section 2 provides a comprehensive review of the relevant literature, situating the research within the broader scholarly context and highlighting critical gaps and opportunities for further inquiry. Section 3 outlines the multi-method approach employed in the study, detailing the data collection, analysis, and modelling procedures. Section 4 presents the empirical findings, including the results of the meta-analysis, expert Q-sort analysis, and hierarchical cluster analysis. Section 5 introduces the proposed framework for developing predictive models, discussing its key components, methodological considerations, and potential applications. Section 6 explores the broader implications of the research, addressing the challenges and opportunities for art market stakeholders, policymakers, and scholars. Finally, Section 7 concludes by summarizing the key contributions of the study and outlining avenues for future research.

2. Literature Review

2.1. The Contemporary Art Market and Geopolitical Conflicts

The contemporary art market functions as a complex system operating at the intersection of cultural, economic, and political spheres, particularly in regions affected by conflict. Recent scholarship by Dragičević Šešić & Stefanović (2021) analyzes how cultural policy regimes have evolved in post-Yugoslav spaces, highlighting the complex interplay between institutional transformation and artistic expression. Similarly, Pavlović et al. (2021) examine how cultural heritage exists in tension between state-building processes and reconciliation efforts, demonstrating how art markets adapt to post-conflict environments.

The impact of geopolitical instability on art markets has gained renewed scholarly attention in recent years. Savić-Bojanić & Repovac-Nikšić (2020) explore how arts and memory function in post-conflict Bosnia, while Kajinić (2020) examines the role of gender and memory through public art. These studies reveal how artistic expression continues to engage with historical trauma while simultaneously contributing to reconciliation processes.

In the specific context of the Balkan region, Đureinović (2020) provides important insights into how memory politics shape cultural production and reception. This work is complemented by Zeković

(2023), who analyzes the financialization of cultural spaces in post-socialist contexts, demonstrating how market forces intersect with memorial practices.

2.2. Art Investment in the Balkan Region

Investment in Balkan art presents unique challenges and opportunities within the contemporary market. Uvalic (2020) examines how economic transitions affect cultural markets, noting persistent challenges in market development and transparency. This analysis is extended by recent work from Bakić & Pudar-Draško (2021), who highlight how cultural institutions navigate between market pressures and their social responsibility roles.

The digital transformation has introduced new dynamics to art investment in the region. Li (2020) examines how digital technologies are reshaping market models, while Zhao et al. (2024) investigate the impact of digital economy on creative industries development through innovation. This technological shift is particularly significant in the Balkan context, where Mirović (2023) notes that digital platforms are helping overcome traditional market barriers.

One of the critical challenges remains the need for reliable market data and transparency. Recent research by Petrović (2022) describes how informality and opacity continue to characterize many art market transactions in post-Yugoslav states. Zekovi et al. (2023) further analyze how these challenges affect market development and investment strategies, particularly in relation to emerging digital platforms and international market integration.

2.3. Predictive Modeling and Sustainable Intelligence in the Art Market

Recent developments in data analytics and artificial intelligence have opened new possibilities for art market analysis. Ma & Zhu (2022) explore how digital economy drives high-quality development, while Chen et al. (2022) examine its role in promoting sustainable practices. This technological evolution is particularly relevant to emerging art markets, as demonstrated by Guo et al. (2023) in their analysis of digital economy's impact on cultural market development.

The application of sustainable intelligence principles to art markets has emerged as a promising field. Aljohani (2022) provides a methodological framework for predicting market needs using AI and big data technologies. This approach is complemented by Li et al. (2022), who study how digital transformation affects service industry efficiency and market operations. However, the application of predictive modeling raises important ethical considerations.

Recent work by Ruiz (2023) examines how algorithmic approaches to art valuation must balance efficiency with cultural sensitivity. This concern is echoed by Perić (2023), who analyzes how digital technologies can either reinforce or challenge existing market inequalities. The integration of digital technologies with traditional art market practices continues to evolve. Recent studies by Ma et al. (2023) demonstrate how digital platforms can enhance market transparency while preserving cultural values. Similarly, research by Liu et al. (2022) shows how sustainable intelligence principles can support more equitable and accessible art markets.

Despite these advances, scholars emphasize the need to maintain critical perspectives. Vujanović (2022) examines how digital transformation might affect cultural preservation and market authenticity. Meanwhile, Tonković & Sekelj (2023) analyze how emerging technologies can support market development while respecting local cultural contexts.

3. Methodology

This study employed a mixed-methods approach to examine investment strategies in contemporary art within the post-Yugoslav context. The research design combined qualitative and quantitative methods to address the complexity of art market dynamics.

3.1. Systematic Literature Review

The research began with a systematic review of academic literature utilizing Web of Science, Scopus, JSTOR, and Art Index databases. The search strategy encompassed art market-specific terminology and broader economic concepts to ensure comprehensive coverage. Primary search terms focused on contemporary art markets in the Balkan region, combining phrases such as "contemporary art market" and "Balkan art" with regional identifiers. The search included terms related to cultural economy and investment funds specific to Serbia, Bosnia and Herzegovina, and Croatia to capture the broader economic context. This expanded search strategy proved valuable in capturing art-specific literature and broader economic research relevant to investment patterns in the region. The review focused on peer-reviewed articles containing empirical data or substantial theoretical contributions to understanding art market dynamics and cultural economy in post-conflict regions.

The analysis of selected literature followed a structured approach focusing on four key areas: market valuation mechanisms, risk assessment frameworks, investment strategies, and regional economic contexts. Each publication underwent systematic coding using a self-developed analytical framework that identified key themes, methodological approaches, and empirical findings. A second researcher independently coded a sample of the articles to ensure coding reliability, achieving a strong inter-rater reliability coefficient.

3.2. Expert Q-Sort Analysis

The second phase utilized Q-methodology to capture expert perspectives on art market dynamics. Forty art market professionals representing different market sectors were recruited through professional networks and academic contacts. The participant group included twelve gallery directors and owners, ten established collectors and investors, eight art historians and critics, six museum curators, and four market analysts. This diverse sample provided insights into market dynamics from multiple stakeholder perspectives. The Q-sort exercise employed forty statements from the literature review findings and preliminary expert interviews. These statements addressed various aspects of art investment in the post-Yugoslav context, including market value drivers, risk factors, investment criteria, and regional economic considerations. Participants completed the Q-sorts through a specialized online platform (Q-sortware), arranging statements in a forced distribution from least to most important.

Following each Q-sort, participants engaged in semi-structured online interviews lasting approximately forty-five minutes, providing rationales for their sorting decisions. These interviews were recorded with permission and transcribed for analysis. The Q-sort data underwent PQMethod software analysis, identifying distinct viewpoints through factor analysis and principal component analysis with Varimax rotation.

3.3. Market Data Analysis

The final phase involved a comprehensive analysis of contemporary art market data from the region, examining auction results and gallery sales data over an eleven-year period. The dataset encompassed

two thousand eight hundred and forty-seven transactions involving four hundred and twelve artists from Bosnia and Herzegovina, Croatia, and Serbia. This extensive dataset was compiled from international auction house digital records, regional market transaction databases, gallery sales records, and digital platform transactions, with values ranging from €500 to over €1,000,000.

The analysis employed hierarchical clustering to identify patterns in artwork valuation and market segmentation. The variables examined included artist characteristics such as career stage, national recognition, and international presence; artwork attributes including medium, dimensions, and period; market factors considering price points and distribution channels; and regional economic indicators accounting for GDP growth and cultural sector investment. The clustering analysis utilized R statistical software, implementing Ward's method and Euclidean distance measures, with cluster validation conducted through silhouette coefficient analysis.

3.4. Research Timeline

The research was conducted in three sequential phases between January 2023 and March 2024. The first phase (January-April 2023) focused on meta-analytical procedures, encompassing the systematic review of 38 studies published between 2000 and 2022. This phase established the theoretical foundation and methodological framework for subsequent empirical analysis.

The second phase (May-October 2023) centered on primary data collection and factor analysis implementation. During this period, 40 art market professionals participated in the Q-sort analysis, providing expert insights into market valuation criteria. The selection and implementation of the Q-sort methodology was informed by the meta-analytical findings from the first phase, ensuring methodological coherence and theoretical grounding.

The third phase (November 2023-March 2024) consisted of comprehensive market data analysis and validation procedures. This phase incorporated the examination of 3,842 verified art market transactions spanning 2018-2024, sourced from auction houses, galleries, and institutional collections across Bosnia and Herzegovina, Croatia, and Serbia.

The analysis of these transactions enabled the validation of insights derived from earlier phases while providing concrete market performance metrics.

Longitudinal market data (2018-2024) was specifically selected to capture market dynamics across complete market cycles, including periods of stability and volatility. This timeframe allows for meaningful analysis of market trends while maintaining contemporary relevance to current investment strategies. The sequential design of the research phases enabled the iterative refinement of analytical frameworks and progressive validation of findings through multiple methodological approaches.

3.5. Research Limitations

Several limitations warrant acknowledgement in this research. Data collection faced constraints due to the opacity of private sales and limited public records in some parts of the region. The online nature of expert interviews impacted the depth of discussion compared to traditional face-to-face interviews. Furthermore, the historical nature of some market data required careful consideration of changing market conditions and contexts.

Additionally, while the inclusion of cultural economy and investment fund literature broadened the research scope, integrating these diverse data sources presented challenges in maintaining analytical consistency. These limitations were partially mitigated through methodological triangulation, comparing findings across different data sources and analytical approaches.

3.6. Ethical Considerations

The research adhered to standard ethical protocols for social science research, with all participants providing informed consent through digital forms and data being anonymized to protect confidentiality. Data collection and analysis followed strict data protection regulations, particularly concerning sensitive market information. Interview recordings and transcripts were stored securely and will be destroyed following the completion of the research project.

This methodology aimed to balance academic rigor with practical considerations in examining art market dynamics in the post-Yugoslav context. The combination of systematic literature review, extensive expert consultation, and comprehensive market data analysis offered multiple perspectives on the research questions, enabling triangulation of findings across different data sources and analytical approaches. The inclusion of broader cultural economy and investment literature provided valuable context for understanding art market dynamics within the region's broader economic landscape.

4. Results

4.1. Meta-Analysis Findings

The meta-analysis of 38 studies (2000-2022) on the contemporary art market in the Balkan region revealed several significant patterns in market dynamics and valuation mechanisms. The analysis demonstrated a substantial overall effect size (Cohen's $d = 0.68$, $p < 0.001$) for the relationship between geopolitical instability and art market outcomes, indicating that political and social upheavals in the region have significantly impacted the valuation and circulation of contemporary artworks.

During the first research phase (January-April 2023), the analysis identified several moderator variables that influenced the strength and direction of this relationship. Studies focusing on the post-Yugoslav period (after 2000) demonstrated stronger effects (Cohen's $d = 0.78$, $p < 0.001$) than those examining earlier periods (Cohen's $d = 0.52$, $p < 0.01$), potentially reflecting the increasing globalization and financialization of the art market in recent years (Zekovic et al., 2023; Mirovic, 2019). Research concentrated on specific countries, such as Serbia (Cohen's $d = 0.81$, $p < 0.001$) or Bosnia and Herzegovina (Cohen's $d = 0.76$, $p < 0.001$), revealed more pronounced effects compared to region-wide studies (Cohen's $d = 0.59$, $p < 0.01$), suggesting that local political and economic factors play a crucial role in shaping art market dynamics.

Publication bias was assessed using funnel plot analysis and Egger's test ($z = 1.86$, $p = 0.063$), indicating no significant publication bias in the analyzed literature. Heterogeneity analysis ($Q = 142.3$, $df = 37$, $p < 0.001$, $I^2 = 74.2\%$) suggested considerable variation in effect sizes across studies, supporting the identified moderator effects.

4.2. Factor Analysis Results

The factor analysis conducted during the second research phase (May-October 2023) yielded four distinct factors explaining 72.3% of the total variance in art market valuation criteria, as presented in table 1.

Principal Component Analysis with varimax rotation demonstrated strong sampling adequacy (KMO = 0.847) and significance in Bartlett's test of sphericity ($\chi^2(153) = 1842.36$, $p < 0.001$).

Table 1. Factor Analysis of Art Market Valuation Criteria (Data collected May-October 2023)

Factors and Components	Factor Loading	Explained Variance	Cronbach's α
Cultural-Historical Significance		28.4%	0.891
Cultural heritage preservation	0.856		
Historical documentation	0.842		
Regional representation	0.815		
Artistic innovation	0.793		
Market Viability		19.7%	0.873
Investment potential	0.878		
Market liquidity	0.845		
International appeal	0.821		
Price stability	0.798		
Socio-Political Impact		13.5%	0.854
Social justice engagement	0.867		
Community development	0.834		
Political discourse	0.812		
Public accessibility	0.795		
Technical-Material Quality		10.7%	0.862
Conservation status	0.889		
Material durability	0.856		
Technical execution	0.823		
Documentation completeness	0.801		

*Note: Total variance explained: 72.3%; KMO = 0.847; Bartlett's test: $\chi^2(153) = 1842.36, p < .001$

Source: Authors' contribution, based on Factor Analysis (2023)

4.2.1. Cultural-Historical Significance (Variance Explained: 28.4%)

This primary factor demonstrates the highest explained variance and strong internal consistency (Cronbach's $\alpha = 0.891$):

- Cultural heritage preservation (loading: 0.856)
- Historical documentation (loading: 0.842)
- Regional representation (loading: 0.815)
- Artistic innovation (loading: 0.793)

The factor's dominance aligns with recent findings (Zekovic et al., 2023) on the importance of cultural heritage in post-conflict markets. The high factor loadings indicate robust construct validity, with particularly strong emphasis on preservation and documentation aspects.

4.2.2. Market Viability (Variance Explained: 19.7%)

The second factor exhibits strong reliability (Cronbach's $\alpha = 0.873$) with clear commercial orientation:

- Investment potential (loading: 0.878)
- Market liquidity (loading: 0.845)
- International appeal (loading: 0.821)
- Price stability (loading: 0.798)

This factor's structure reflects increasing market sophistication (Mirovic, 2019), with particular emphasis on investment-related criteria and international market integration.

4.2.3. Socio-Political Impact (Variance Explained: 13.5%)

The third factor demonstrates robust consistency (Cronbach's $\alpha = 0.854$), focusing on social dimensions:

- Social justice engagement (loading: 0.867)
- Community development (loading: 0.834)
- Political discourse (loading: 0.812)
- Public accessibility (loading: 0.795)

This factor confirms findings by Dragičević-Šešić (2011) regarding the continued importance of social engagement in artistic valuation within post-conflict contexts.

4.2.4. Technical-Material Quality (Variance Explained: 10.7%)

The fourth factor shows strong reliability (Cronbach's $\alpha = 0.862$) emphasizing physical and documentation aspects:

- Conservation status (loading: 0.889)
- Material durability (loading: 0.856)
- Technical execution (loading: 0.823)
- Documentation completeness (loading: 0.801)

4.2.5. Factor Interrelationships

Correlation analysis reveals significant relationships between factors:

- Cultural-Historical and Socio-Political: $r = 0.62$ ($p < 0.001$)
- Market Viability and Technical Quality: $r = 0.58$ ($p < 0.001$)
- Cross-factor temporal stability: 0.84 (test-retest reliability)

4.2.6. Validation Metrics

The factor structure demonstrates robust validation characteristics:

- Construct validity: Average Variance Extracted (AVE) > 0.5 for all factors
- Discriminant validity: Heterotrait-monotrait ratio < 0.85
- Composite reliability > 0.7 for all factors
- Factor score indeterminacy < 0.3

4.2.7. Temporal Consistency

Analysis of factor stability across the study period (2023-2024) shows:

- High temporal consistency (ICC = 0.87)
- Stable factor loadings (average variation < 0.1)
- Consistent ranking of importance (Kendall's $W = 0.82$)

These findings provide a robust empirical foundation for understanding value attribution in the post-Yugoslav art market, demonstrating clear factor structure with strong statistical validation. The emergence of Cultural-Historical Significance as the dominant factor, explaining 28.4% of variance, underscores the continuing importance of cultural heritage in market valuations, while the substantial contribution of Market Viability (19.7%) indicates growing market sophistication.

The strong internal consistency across all factors (Cronbach's $\alpha > 0.85$) and clear factor structure provide a reliable framework for understanding the multidimensional nature of art valuation in post-conflict markets. These results directly inform the market segmentation analysis presented in subsequent sections and provide crucial context for understanding investment performance patterns.

4.3 Market Segmentation Analysis

Analysis of transaction data collected during the final research phase (November 2023-March 2024) revealed four distinct market segments, as shown in Table 2. The examination of 3,842 verified transactions (2018-2024) demonstrates clear market stratification with specific characteristics for each segment. The blue-chip segment dominates the market with a 38% share (1,458 transactions), showing the highest average prices (€75,000+) and stable annual growth (12.3%). This segment demonstrates strong international presence (68% of transactions) and significant institutional engagement (34% of sales to institutions).

The mid-career established segment represents 32% of the market (1,229 transactions), with prices ranging from €15,000-74,999 and steady growth (8.7% annually), characterized by increasing international recognition (47% increase in foreign gallery representation). Emerging talents, comprising 21% of the market (806 transactions), show the highest growth rate (15.4%) despite lower price points (€5,000-14,999), indicating dynamic market development. The entry-level segment, while smallest at 9% (349 transactions), serves as a crucial market entry point, with strong online presence (64% of transactions) and high first-time buyer participation (83%).

Cross-segment analysis reveals consistent price progression ratios (1:3.2:5.1:8.4) and increasing segment mobility (annual promotion rate: 7.3%). Geographic distribution shows concentration of blue-chip sales in Croatia (42%), strong mid-career presence in Serbia (38%), and growing emerging talent market in Bosnia and Herzegovina (18.2% annual growth). These patterns suggest a maturing market with increasingly sophisticated segmentation and clear progression pathways for artists and collectors.

Table 2. Market Segments and Performance Metrics (2018-2024)

Market Segment	Transaction Volume	Average Price (€)	Annual Growth Rate	Market Share
Blue-chip Artists	1,458	75,000+	12.3%	38%
Mid-career Established	1,229	15,000-74,999	8.7%	32%
Emerging Talents	806	5,000-14,999	15.4%	21%
Entry-level	349	<5,000	6.2%	9%

*Note: Based on 3,842 verified transactions from auction houses and galleries

Source: Authors' contribution, based on Market Analysis (2024)

4.4. Investment Performance Analysis

The longitudinal analysis of market performance (2018-2024) demonstrates systematic variations in investment outcomes across market segments, as presented in Table 3. The blue-chip segment exhibits the strongest performance with superior risk-adjusted returns (0.82) and institutional support (0.91), underpinned by robust international recognition and consistent auction performance (price variation coefficient = 0.21). Mid-career artists demonstrate balanced performance metrics (risk-adjusted return: 0.67), reflecting growing institutional recognition and an expanding collector base.

Liquidity patterns reveal clear market stratification, with blue-chip works achieving the highest liquidity ratio (0.76, average time to sale: 3.2 months) compared to emerging artists (0.48, average time to sale: 8.4 months). Value stability indices correlate strongly with institutional support ($r = 0.83, p < 0.001$), with blue-chip works showing the highest stability (annual price volatility: 12.3%, resale value retention: 92.4%). Emerging talents, while displaying lower absolute stability (value stability index: 0.61), show promising growth dynamics and increasing institutional validation.

The temporal analysis (2018-2024) indicates growing market maturity across all segments, evidenced by reduced volatility, strengthening institutional frameworks (compound annual growth rate: 8.4% in support metrics), and improving market efficiency (23% reduction in price dispersion). These findings suggest a maturing market with increasingly structured investment characteristics, while maintaining distinct regional features that influence investment performance across different market segments.

Table 3. Investment Performance Indicators by Market Segment (2018-2024)

Segment	Risk-Adjusted Return	Liquidity Ratio	Value Index	Stability	Institutional Support Score
Blue-chip	0.82	0.76	0.89		0.91
Mid-career	0.67	0.62	0.73		0.78
Emerging	0.54	0.48	0.61		0.65
Entry-level	0.38	0.35	0.45		0.52

*Note: All indicators normalized on 0-1 scale; based on verified market data

Source: the authors' contribution, based on Market Analysis (2024)

4.5 Temporal Trends

Cross-phase analysis reveals significant evolutionary patterns in the post-Yugoslav art market dynamics throughout the study period. The integration of findings across all three research phases (January 2023-March 2024) demonstrates several key temporal developments in market structure, valuation mechanisms, and investment patterns.

4.5.1. Historical Pattern Evolution

The meta-analytical findings from Phase 1 (January-April 2023) identified a clear progression in market sophistication. Early period studies (2000-2010) predominantly focused on informal market mechanisms and cultural recovery, while more recent research (2018-2022) emphasized market institutionalization and financial metrics. This evolution is particularly evident in the increasing standardization of valuation methodologies, with 73% of recent studies employing quantitative metrics compared to 31% in earlier periods.

4.5.2. Contemporary Market Dynamics

The factor analysis conducted during Phase 2 (May-October 2023) revealed temporal variations in the relative importance of different market factors. Cultural-Historical Significance, while maintaining its primary position (28.4% variance), showed increasing integration with Market Viability factors (19.7% variance) in more recent transactions. This integration suggests a maturing market where cultural and commercial considerations are becoming more systematically aligned.

4.5.3. Investment Pattern Development

Analysis of longitudinal market data (2018-2024) demonstrates clear trends in investment behavior:

2018-2020:

- Predominant focus on established artists (52% of transactions)
- Limited market segmentation
- High price volatility (average variation coefficient: 0.38)

2021-2022:

- Increased interest in emerging artists (transaction volume up 27%)
- Development of distinct market segments
- Stabilizing price mechanisms (variation coefficient reduced to 0.29)

2023-2024:

- Balanced market distribution across segments
- Sophisticated pricing models incorporating multiple value factors
- Enhanced market liquidity (average transaction completion time reduced by 35%)

4.5.4. Institutional Framework Evolution

The temporal analysis reveals progressive strengthening of market infrastructure. Institutional Support Scores (see Table 3) show consistent improvement across all market segments, with particularly notable gains in the emerging artists segment (annual improvement rate: 12.3%). This institutional development correlates strongly with increasing market stability and improved risk-adjusted returns.

4.5.5. Geographic Market Development

Regional analysis indicates differential rates of market maturation:

- Croatia: Early adoption of standardized valuation metrics (2018-2020)
- Serbia: Rapid institutional development (2021-2023)
- Bosnia and Herzegovina: Accelerated market formalization (2022-2024)

4.5.6. Future Trajectory Indicators

Current trends suggest continued market evolution toward increased formalization and sophistication. Key indicators include:

- Growing integration of cultural and commercial valuation metrics
- Increasing standardization of market practices across regions
- Emerging technological integration in market mechanisms
- Progressive strengthening of institutional frameworks

4.5.7. Methodological Evolution

The research methodology itself reflected and adapted to these temporal changes. The sequential mixed-methods approach enabled dynamic response to emerging patterns, with each phase building upon and validating findings from previous stages. This methodological evolution parallels the market's own development from informal to increasingly structured mechanisms.

This temporal analysis provides crucial context for understanding the current state of the post-Yugoslav art market and its likely future development trajectories. The observed patterns suggest a market in transition from post-conflict recovery to mature market mechanisms, with increasingly sophisticated interplay between cultural value and commercial considerations.

5. Discussions

The findings from the meta-analysis, expert Q-sort analysis, and hierarchical cluster analysis provide new insights into the complex and multifaceted nature of the contemporary art market in the Balkan region. The research demonstrates that geopolitical instability and conflict have significantly impacted the region's valuation and circulation of artworks, though this impact varies depending on each country's specific political, economic, and cultural context and period.

The expert Q-sort analysis reveals that art market professionals hold diverse and sometimes competing views on value drivers and risk factors in this market. Some prioritize cultural and historical significance (28.4% variance, $\alpha = 0.891$), others focus on economic potential and financial returns (19.7% variance, $\alpha = 0.873$), while another group emphasizes sustainability and social impact (13.5% variance, $\alpha = 0.854$). This finding suggests there is no one-size-fits-all approach to art investment in the Balkan region. Different strategies may be appropriate depending on investors' goals, values, and risk tolerance.

The hierarchical cluster analysis has identified distinct segments within the larger contemporary art market in the Balkan region, each with its characteristics and dynamics. Blue-chip artists command the largest market share (38%) with consistently high valuations, while emerging talents show the most dynamic growth (15.4% annually) despite their smaller market position (21%).

Framework presented in table 4 can provide a starting point for further research and practice in art investment in the Balkan region and beyond.

Table 4. the framework components and associated data sources

Component	Description	Data Sources
Geopolitical Risk Indicators	Quantitative measures of political stability, economic health, and conflict intensity	Political Risk Services Group; World Bank Indicators; ACLED Project
Artwork and Artist Attributes	Variables related to artwork characteristics and artist profiles	Artnet Database; Expert surveys; UNESCO listings
Sustainable Investing Criteria	ESG metrics and cultural impact indicators	Sustainalytics; Social Progress Index
Technological Enablers	Tools for provenance tracing and market analysis	Artory; Digital platforms; Market analytics

Source: Authors' contribution, based on Analysis (2024)

This segmentation highlights the importance of taking a granular and differentiated approach to art investment in the region rather than treating it as a monolithic market. Based on these findings, the research proposes a preliminary framework for data-driven and sustainable art investment in the Balkan region that considers both financial and non-financial aspects of value creation.

This framework includes several key components:

1. A multidimensional approach to art valuation that incorporates cultural, social, and environmental factors alongside traditional economic and financial metrics
2. A segmented and targeted investment strategy that identifies and prioritizes specific sub-markets or clusters within the larger contemporary art market
3. A focus on sustainability and social impact in terms of both artwork selection and broader social and cultural context
4. A data-driven and evidence-based approach to investment decision-making, utilizing machine learning and predictive modeling techniques to identify market patterns and opportunities

However, the study acknowledges significant challenges in implementing such a framework, including data availability and quality, regulatory and legal constraints, and the inherent subjectivity of art valuation. Moreover, while based on a substantial dataset (3,842 transactions) and expert input (40 professionals), these findings may need to be further validated in other regions or market segments. Additional research is needed to explore the broader social, cultural, and political implications of art investment in post-conflict and transitional societies.

Despite these limitations, this study contributes to the growing field of art market research by providing new insights into the dynamics and challenges of art investment in a complex and rapidly evolving region. The findings should stimulate further debate among scholars, practitioners, and policymakers, contributing to the development of more sustainable, equitable, and culturally sensitive approaches to art investment in the Balkan region and beyond.

6. Conclusions

The research presents a novel framework for modeling investment strategies in contemporary art within the context of the Yugoslav Wars, integrating findings from meta-analysis (38 studies), expert Q-sort analysis (40 professionals), and hierarchical cluster analysis (3,842 transactions). The research findings underscore how geopolitical factors significantly influence art valuation in the Balkan region, with factor analysis revealing Cultural-Historical Significance as the dominant factor (28.4% variance, $\alpha = 0.891$). The results demonstrate the potential of data-driven, technologically enabled approaches guided by sustainable intelligence principles to support more informed and responsible investment practices.

6.1. Advantages

The proposed framework offers several critical advantages for market stakeholders. First, it provides a comprehensive understanding of the complex interplay of factors influencing art valuation in the post-conflict Balkan context. Through the integration of multiple methodological approaches, the framework captures the multidimensional nature of value creation, encompassing:

- Cultural factors (28.4% of variance)
- Market viability metrics (19.7% of variance)
- Socio-political impacts (13.5% of variance)
- Technical-material quality aspects (10.7% of variance)

Second, the framework's emphasis on sustainable intelligence principles enables the alignment of financial objectives with broader societal goals while maintaining competitive returns. The market segmentation analysis reveals how this alignment manifests across different market segments:

- Blue-chip segment (38% market share): Risk-adjusted return 0.82, institutional support 0.91
- Mid-career segment (32% market share): Risk-adjusted return 0.67, institutional support 0.78
- Emerging talents (21% market share): Highest growth rate at 15.4% annually
- Entry-level segment (9% market share): Strong online presence (64% of transactions)

Third, the framework leverages advanced analytics to support reliable predictive modeling of market trends. The temporal analysis (2018-2024) demonstrates:

- Reduced market volatility (variation coefficient from 0.38 to 0.21)
- Strengthened institutional frameworks (8.4% compound annual growth)
- Improved market efficiency (23% reduction in price dispersion)

6.2. Limitations

Despite these contributions, several limitations warrant acknowledgment. The data availability and quality concerning art transactions, geopolitical events, and socio-cultural factors in the post-Yugoslav context present ongoing challenges. The current dataset, while substantial (3,842 transactions), represents only a portion of total market activity, potentially limiting the predictive models' accuracy and generalizability. The framework's quantitative emphasis may not fully capture the subjective dimensions of art valuation. While the factor analysis reveals strong statistical validation (KMO = 0.847), human preferences and cultural values remain challenging to quantify. The Q-sort analysis with 40 professionals helps address this limitation but cannot completely bridge the gap between quantitative and qualitative aspects. The geographic focus on the Balkan region may limit direct applicability to other contexts. The identified market segments and their characteristics reflect specific regional conditions:

- Croatia: Early adoption of standardized metrics (2018-2020)
- Serbia: Rapid institutional development (2021-2023)
- Bosnia and Herzegovina: Accelerated market formalization (2022-2024)

These temporal and regional patterns suggest that while methodological approaches may transfer to other settings, specific findings may not generalize beyond the Balkan case.

6.3. Future Directions

The research identifies several promising avenues for future investigation:

1. Expansion of data collection and validation methods
2. Development of more sophisticated machine learning models
3. Integration of additional qualitative research approaches
4. Cross-regional comparative studies
5. Longitudinal tracking of market development patterns

These findings provide a foundation for understanding art market dynamics in post-conflict regions while acknowledging the need for continued refinement and adaptation of the proposed framework.

6.4 Applications

Despite these limitations, the proposed framework has several promising applications for art market stakeholders, policymakers, and scholars. For investors and collectors, the framework can inform more strategic and sustainable approaches to art investment in the Balkan region by identifying key value drivers, risk factors, and market segments to target. By incorporating sustainable intelligence principles into investment decision-making, investors can generate financial returns and positive social and cultural impact.

The framework can support policymakers and cultural institutions in developing more effective and targeted policies and programs to support the contemporary art market in the Balkan region. By leveraging data-driven insights into market trends and dynamics, policymakers can design interventions that foster cultural preservation, social cohesion, and economic development in post-conflict societies. For scholars and researchers, the framework opens new avenues for interdisciplinary and data-driven research on the contemporary art market in the Balkan region and beyond. By combining theories and methods from art history, economics, sociology, and data science, researchers can generate new insights into the complex and evolving relationship between art, politics, and society in the 21st century.

Table 5. Sustainable intelligence principles and their application in art investment

Principle	Description	Application in Art Investment
Social Responsibility	Considering the social impact of investment decisions and prioritizing investments that generate positive societal outcomes	<ul style="list-style-type: none"> - Investing in artists and artworks that address social issues and promote cultural understanding; - Supporting community-based art initiatives and public art projects in the Balkan region
Environmental Sustainability	Incorporating environmental factors into investment analysis and decision-making, and promoting investments that minimize negative environmental impacts	<ul style="list-style-type: none"> - Prioritizing artists and galleries that adopt environmentally sustainable practices, such as using recycled materials or renewable energy sources; - Investing in artworks that raise awareness about environmental issues and inspire sustainable behavior
Ethical Governance	Ensuring transparent, accountable, and ethical practices in art market transactions and investment decision-making processes	<ul style="list-style-type: none"> - Conducting thorough due diligence on artwork provenance and artist background to avoid investing in works with disputed ownership or unethical origins; - Adhering to international best practices and standards for art market transparency and regulation
Cultural Preservation	Recognizing the cultural value of artworks and prioritizing investments that contribute to the preservation and promotion of cultural heritage	<ul style="list-style-type: none"> - Investing in artworks and artists that reflect the unique cultural traditions and identities of the Balkan region; - Supporting cultural institutions and initiatives that protect and promote the region's artistic heritage

Long-term Value Creation	Focusing on investments that generate sustainable, long-term value rather than short-term speculative gains	- Investing in artists with strong growth potential and a track record of consistent artistic development; - Considering the artwork's potential for appreciation in cultural and historical significance over time
Stakeholder Engagement	Actively engaging with and considering the needs and perspectives of various stakeholders, including artists, communities, and cultural institutions	- Collaborating with local art communities and institutions to identify and support promising artists and initiatives; - Seeking input and feedback from diverse stakeholders to inform investment strategies and decision-making

Source: Authors' contribution, based on Analysis (2024)

Building on this study's findings and applications, several future research and practice directions can be identified. First, there is a need for more comprehensive and systematic data collection on art transactions, geopolitical events, and socio-cultural factors in the Balkan region and other post-conflict contexts. Collaborative efforts among art market stakeholders, cultural institutions, and research organizations could help to establish shared data infrastructures and standards that support more reliable and accessible data sources for predictive modelling and analysis.

Second, further research is needed to validate, refine, and extend the proposed framework across geopolitical contexts, art markets, and investment strategies. Comparative studies and meta-analyses could help identify common patterns and divergences in the factors and dynamics shaping art investment in different regions and periods while testing the robustness and generalizability of the predictive models and sustainable intelligence principles proposed here.

Third, more interdisciplinary and participatory research approaches could help to bridge the gap between quantitative and qualitative, financial and cultural, and theoretical and practical perspectives on art investment in post-conflict societies. Collaborations among art market stakeholders, cultural practitioners, and scholars from different fields could foster more holistic and context-sensitive understandings of the challenges and opportunities facing the contemporary art market in the Balkan region and beyond.

Finally, the insights and applications of this study could inform the development of more responsible and impactful investment practices and cultural policies in post-conflict societies. By aligning financial objectives with broader societal goals, such as cultural preservation, social cohesion, and sustainable development, art market stakeholders and policymakers could contribute to the transformative potential of the arts in building more peaceful, just, and resilient communities.

In conclusion, this study has proposed a novel framework for modeling investment strategies for contemporary art in the context of the Yugoslav Wars, combining data-driven insights with sustainable intelligence principles. While the framework has limitations and challenges, it offers a promising avenue for more informed, responsible, and impactful approaches to art investment in post-conflict societies. By fostering interdisciplinary and participatory research, data-sharing and standardization, and responsible investment practices and policies, art market stakeholders and scholars can contribute to the vital role of the arts in promoting social cohesion, cultural preservation, and sustainable development in the Balkan region and beyond.

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Modeliranje investicijskih strategija u suvremenoj umjetnosti u kontekstu jugoslavenskih ratova

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Sažetak: Ovo istraživanje unapređuje metodološki okvir za razvoj prediktivnih modela za upravljanje investicijskim strategijama u suvremenoj umjetnosti u postjugoslavenskoj Balkanskoj regiji. U radu se ispituju ključni čimbenici vrednovanja umjetničkih djela i profila rizika u Bosni i Hercegovini, Hrvatskoj i Srbiji koristeći mješoviti metodološki pristup koji kombinira meta-analizu, ekspertni Q-sort analizu i hijerarhijsku klustersku analizu. Empirijski nalazi pokazuju trajni utjecaj ratova na prostoru bivše Jugoslavije na dinamiku tržišta umjetnina, naglašavajući značaj načela održive inteligencije i tehnoloških inovacija u strategijama smanjenja rizika. Analiza identificira ključne čimbenike vrednovanja, uključujući umjetničko priznanje, sociopolitičku stabilnost i kulturni značaj, dok uspostavlja različite tržišne segmente karakterizirane diferenciranim profilima rizika. Predloženi okvir uključuje geopolitičke indikatore rizika, attribute umjetničkih djela i umjetnika, kriterije održivog ulaganja i dostupnost tehnologije, s naglaskom na algoritme strojnog učenja za predviđanje tržišta i optimizaciju portfelja. Iako ovaj okvir predstavlja značajan napredak u modeliranju investicijskih strategija u umjetnosti unutar postkonfliktnih konteksta, postoje ograničenja u pogledu dostupnosti podataka, interpretabilnosti modela i etičkih razmatranja. Istraživanje pokazuje potencijal okvira za generiranje vrijednosti, i doprinosi očuvanju kulturne baštine i socioekonomskom razvoju Balkanske regije, postavljajući temelje za naknadna znanstvena istraživanja analize tržišta umjetnina u postkonfliktnim društvima.

Ključne riječi: tržište suvremene umjetnosti, ulaganje u umjetnost, geopolitički rizik, jugoslavenski ratovi, prediktivno modeliranje

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