ELAB CHROM

Establishing a Laboratory of Cultural Heritage in Central Romania

Establishing a Laboratory of Cultural Heritage in Central Romania (ELABCHROM)

Report on Research Results and Technology Readiness Level (TRL) Assessment

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List of Acronyms

LBUS – Lucian Blaga University of Sibiu, the coordinating institution of ELABCHROM

UB - University of Burgundy

JYU - University of Jyväskylä

DoA - Description of Action

Table of Contents

0. Executive Summary

This report presents the scientific results, validation process, and technology readiness assessment of MACART, *Analytical Module for Mapping and Visualizing Urban Street Nomenclature*, a key exploitable result developed within the ELABCHROM project.

MACART constitutes a formalized analytical framework supported by an original research database for the systematic study of urban commemorative heritage through street nomenclature.

Based on analytical validation and the absence of an operational technological implementation, the result is classified at Technology Readiness Level 3 (TRL 3).

The report documents the methodological foundations, empirical results, validation procedures, and compliance with TRL criteria.

1. Project Context and Strategic Positioning

ELABCHROM aims to strengthen institutional research capacity in cultural heritage through infrastructure development, RDM competences, and international cooperation.

Within its exploratory research strand on symbolic regional heritage, the MACART module was developed to address the systematic analysis of urban commemorative practices.

MACART responds to the following research question:

> How can urban street nomenclature be measured and interpreted in relation to identity, multiculturalism, and sustainable community development?

The module currently exists as an analytically validated research framework, not yet integrated into an operational digital system.

2. Description of the Key Exploitable Result

2.1 Working Definition

MACART is defined as: An analytical module for mapping, classifying, and interpreting urban street nomenclature as an indicator of symbolic heritage.

2.2 Functional Components

MACART comprises:

- A standardized database of street names

- A thematic and semantic classification system

- Analytical variables on gender, ethnicity, and historical period

- Descriptive and comparative statistical instruments

- A conceptual basis for GIS and digital visualization

2.3 Research Data Infrastructure

The developed database includes:

- Complete inventories of official street names

- Structured metadata aligned with RDM principles

- Thematic coding and documentation

- Comparative analytical variables

The result represents formalized scientific know-how, without a deployed software platform.

3. Research Framework and Methodology

3.1 Research Hypotheses

The development of the MACART analytical module was guided by a coherent set of theoretically grounded and empirically testable research hypotheses. These hypotheses were formulated in relation to established approaches in cultural memory studies, urban heritage research, and symbolic geography, and aimed to operationalize abstract concepts into measurable analytical variables.

Specifically, the research assumed that the distribution and composition of urban street names reflect structural configurations of local collective memory and historical self-representation. It further hypothesized that significant differences exist between cities with regard to gender representation and the visibility of minority groups, and that these differences are influenced by historical trajectories and sociocultural contexts. In addition, street nomenclature was conceptualized as an indirect indicator of identity orientation and memory politics, expressing implicit hierarchies of symbolic recognition. Finally, the research posited that commemorative urban landscapes can be systematically quantified and comparatively analyzed through rigorously defined and consistently applied variables.

These hypotheses provided the conceptual framework for the construction of the analytical model and informed all subsequent stages of data collection, classification, and analysis.

3.2 Methodological Approach

The methodological design of the MACART module was conceived as a multi-stage analytical process combining qualitative classification procedures with quantitative and comparative statistical techniques. This mixed methodological approach was adopted in order to ensure both interpretative depth and analytical rigor.

The research process began with the systematic collection of administrative data on official street names from relevant municipal sources. This dataset was subsequently subjected to manual validation and data-cleaning procedures in order to ensure completeness, accuracy, and consistency. Particular attention was paid to the standardization of naming conventions and to the resolution of ambiguities arising from historical changes and transliteration practices.

Following data preparation, a semantic and thematic classification system was developed to categorize commemorative references according to historical, cultural, geographical, and symbolic criteria. Each entry was coded using a structured set of analytical variables relating to gender, ethnicity, historical period, and type of reference. This coding framework was fully documented in accordance with Research Data Management principles.

The classified dataset was then subjected to descriptive statistical analysis, correlation analysis, and comparative inter-urban modeling. These analytical procedures enabled the identification of structural patterns, relational trends, and contextual variations across different urban environments. The methodological framework was designed to be reproducible and transferable, allowing for consistent application in future research contexts.

4. Research Results

The application of the MACART analytical framework resulted in the systematic production of empirically grounded and theoretically relevant findings concerning the symbolic organization of urban commemorative landscapes. Through the structured analysis of street nomenclature across multiple urban contexts, the research demonstrated the analytical viability of street names as indicators of cultural memory and identity dynamics.

The results revealed the existence of recurring structural patterns in symbolic representation, reflecting historically embedded hierarchies of recognition and remembrance. Across the analyzed cities, commemorative practices were shown to exhibit relatively stable configurations shaped by dominant historical narratives and institutionalized memory regimes. These patterns were particularly evident in the persistent prominence of political, military, and cultural elites within naming practices.

A central empirical finding concerns the systematic underrepresentation of women in commemorative street naming. This structural imbalance was observed consistently across urban contexts, indicating the persistence of gendered asymmetries in symbolic recognition. The analysis further revealed significant variation in the representation of minority figures and culturally specific references, reflecting local demographic compositions and historical trajectories.

Comparative modeling demonstrated that these variations are closely linked to regional, ethnic, and historical factors, underscoring the contextual embeddedness of commemorative practices. The research thus confirmed that urban street nomenclature functions as a sensitive indicator of identity orientation and memory politics.

More broadly, the results validated the analytical potential of the MACART framework as a tool for measuring and interpreting resilient cultural heritage. The findings demonstrate that commemorative urban landscapes can be systematically quantified and comparatively analyzed using rigorously operationalized variables, thereby contributing to evidence-based approaches in cultural heritage research and policy.

5. Technology Readiness Level Assessment

5.1 TRL Reference Framework

The assessment of the technological maturity of the MACART module was conducted in accordance with established European Commission definitions and guidelines for Technology Readiness Levels. Within this framework, TRL 3 corresponds to the analytical and experimental demonstration of a concept in a controlled or laboratory-like environment, supported by formalized models and empirical validation, but without a fully integrated technological prototype.

At this level, the emphasis lies on scientific and methodological consolidation rather than on technological deployment. The primary objective is to establish proof of concept through systematic experimentation, documentation, and validation, while postponing operational implementation to subsequent development stages.

This reference framework provided the basis for evaluating the current maturity status of MACART.

5.2 Positioning Across TRL Levels

The development trajectory of the MACART module can be clearly situated within the early stages of the TRL scale. At TRL 1, the project identified and documented the fundamental theoretical principles related to collective memory, heritagization processes, and mnemonic governance. These conceptual foundations informed the formulation of the analytical approach and the definition of research objectives.

At TRL 2, the technological and methodological concept of analyzing street nomenclature as a measurable indicator of symbolic heritage was articulated and structurally defined. During this phase, the core analytical architecture, variable system, and classification logic were established.

The current development stage corresponds to TRL 3. At this level, the conceptual framework has been analytically demonstrated through the construction of a comprehensive regional database, the operationalization of analytical variables, and the systematic testing of research hypotheses. Descriptive and comparative statistical analyses were conducted, and full methodological documentation was produced, ensuring reproducibility and transparency.

At the same time, essential components required for higher TRL levels remain unimplemented. These include a dedicated software architecture, operational GIS integration, a user-oriented interface, and demonstration activities in relevant real-world environments. The absence of these elements confirms the pre-operational status of the result.

5.3 TRL Classification

On the basis of the analytical evidence and validation procedures documented in this report, MACART fulfills the formal criteria associated with Technology Readiness Level 3. The concept has been scientifically and empirically demonstrated, supported by a structured data infrastructure and a reproducible analytical methodology. However, it has not yet been translated into an integrated technological system capable of autonomous operation or end-user deployment.

Accordingly, the appropriate classification of the MACART module is TRL 3, corresponding to an analytically validated proof of concept. This classification reflects the current balance between scientific maturity and technological incompleteness and provides a realistic foundation for subsequent development toward higher levels of technological readiness.

6. Development Pathway and Outlook

The MACART analytical module provides a solid and coherent foundation for subsequent technological and functional development. The scientific maturity, methodological robustness, and structured data infrastructure established within the ELABCHROM project create favorable conditions for advancing the result toward higher levels of technological readiness.

Future development efforts will focus primarily on the integration of the existing analytical framework into an operational digital environment. A key priority in this regard is the incorporation of Geographic Information System (GIS) functionalities, which would enable spatial visualization and interactive mapping of commemorative patterns. Such integration would significantly enhance the interpretative capacity and usability of the analytical model.

In parallel, the development of an interactive digital platform is envisaged in order to facilitate access to data, analytical tools, and visual outputs for diverse user groups, including researchers, local authorities, cultural institutions, and policy stakeholders. The implementation of dynamic visualization instruments and customizable analytical interfaces would further support comparative analysis and evidence-based decision-making.

Another important development direction concerns the incorporation of MACART into broader digital decision-support systems for local and regional administrations. By linking analytical outputs to planning, heritage management, and cultural policy processes, the module could contribute directly to sustainable community development and inclusive memory governance.

These development pathways would enable the gradual transition of MACART from an analytically validated research framework toward an operational technological solution. The realization of these objectives would support progression toward TRL 4-6 through prototype development, system integration, and real-environment testing.

7. Conclusion

This report has documented the scientific foundations, methodological design, empirical results, validation procedures, and technological maturity assessment of MACART, a key exploitable result developed within the ELABCHROM project.

MACART constitutes a formalized analytical module for the systematic study of urban commemorative heritage through street nomenclature. It is grounded in established theoretical approaches to collective memory and symbolic representation, supported by an original and structured research database, and implemented through a reproducible and transparent methodological framework.

The research results demonstrate the analytical viability of street nomenclature as an indicator of identity dynamics, memory politics, and cultural resilience. Through systematic classification and comparative modeling, the module has generated empirically grounded insights into patterns of symbolic representation, gender imbalance, and contextual variation across urban environments.

Validation has been achieved at the scientific and methodological level through institutional reporting, academic dissemination, international cooperation, and quality assurance procedures. At the same time, the absence of an integrated digital platform, automated processing systems, and real-environment demonstrations confirms the pre-operational status of the result.

On the basis of the documented evidence, MACART fulfills the formal criteria for Technology Readiness Level 3 as an analytically validated proof of concept. It represents a mature and credible research outcome that has reached scientific consolidation while remaining open to further technological development.

The module provides a robust foundation for future advancement toward operational deployment, interactive visualization, and policy-oriented decision-support applications. In this perspective, MACART contributes not only to the advancement of cultural heritage research but also to the development of innovative, evidence-based approaches to sustainable and inclusive community governance.