Monitoring Colour Usage in Italian Municipal Web Interfaces

Enea Ahmedhodzic, Beatrice Sarti, Andrea Mario Trentini

Department of Computer Science, University of Milan, Milan, Italy

Corresponding author: Enea Ahmedhodzic (enea.ahmedhodzic@unimi.it)

ABSTRACT

We present a national, measurement-based characterisation of header background colours in Italian municipal websites. Using a corpus of 7,896 municipalities built by aligning ISTAT and IPA registries and by linking beneficiaries of PNRR Measure 1.4.1, we audited homepages with a headless browser to capture the computed background colours of the two header sections (centre and slim). Colours were retained as exact hexadecimal values for reference checks and counts, and were also converted from sRGB to CIE L*a*b*. Within-site differences between the two headers were quantified using the CIEDE2000 metric (ΔE00). We report distributions of header colour categories, regional patterns in header palettes, the exact header hex values and the share of the institutional Blu Italia (#0066cc) in headers. Findings show that the blue family dominates nationwide, the exact reference #0066cc is comparatively rare, centre and slim headers usually match, and funding status is associated with higher measurability. The study is descriptive and exploratory and provides a documented snapshot together with a compact set of transparent measures that future research can reuse, extend and integrate into broader studies.

KEYWORDS Web standardisation; Italian municipalities; chromatic identity; municipal headers; Bootstrap Italia; PNRR 1.4.1; institutional blue (Blu Italia)

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1. Introduction

Public-sector websites are a primary interface between institutions and citizens. Within this interface, headers provide a sense of identity and support global navigation, typically including search functions and utility elements. Building on evidence that website colour appeal predicts perceived trust and satisfaction, including cross-cultural effects (Cyr, Head and Larios, 2010), and on psychological findings that link colour to affect and preference (Palmer and Schloss, 2010), we treat header colour as a measurable design signal at national scale. Although technical implementations and structural layouts may vary across websites, headers generally follow a relatively consistent design model and act as a visual point of reference for users, reinforcing the perception of the site as a coherent and unified entity (Lynch and Horton, 2009).

In Italy, the visual and functional design of municipal websites has been increasingly standardised through Designers Italia [1], a government initiative led by the Department for Digital Transformation and AgID (Agenzia per l'Italia Digitale). Launched in 2015, the initiative progressively steered public administration websites toward common design guidelines and accessibility practices, later consolidating into a mature design system and operational resources for administrations. Today, Designers Italia provides model websites for municipalities, documentation, and an official front-end (Bootstrap Italia [2]) to implement the design guidelines in practice. An official desktop model-evaluation app [3] exists for conformity checks on municipal sites; our study does not use its outputs and remains a descriptive colour characterisation. Within this framework, the institutional *Blu Italia* (hex #0066cc) was introduced to provide a representative and cohesive visual style for public-administration websites. The cultural lineage of blue in Italy predates digital guidelines: during the Renaissance, ultramarine from lapis lazuli elevated blue to a prestigious pigment, frequently associated with sacred iconography (Falcinelli, 2017). Its institutional adoption is also linked to the *azzurro* worn by Italian teams for sport competitions since 1911, a choice historically tied to the House of Savoy and to the "Blu Savoia", which became a national symbol (Benelli, 2015; Acri, 2024). In contemporary digital contexts, predominantly blue interfaces have been reported to engage neural patterns associated with pleasant aesthetic processing (Nissen, 2020). Taken together, these strands motivate the use of Blu Italia as a reference point for assessing chromatic alignment in municipal headers.

Against this policy background, we assemble a country-wide corpus of 7,896 municipalities by integrating official registries from ISTAT [4] and IPA [5], reconciling identifiers and normalising institutional URLs. We then link this corpus to open data from PNRR Measure 1.4.1 (Citizen Experience in Public Services) [6] to identify financed municipalities. In this study, header colour serves as a tractable proxy for institutional identity to assess convergence toward the institutional *Blu Italia* and to characterise chromatic patterns across regions and administrative contexts.

The aim of this study is to quantify, at national scale, the chromatic identity of Italian municipal website headers and their alignment with the institutional Blu Italia (#0066cc). We focus on colours as rendered by the browser and on the internal coherence between the centre and slim header bands, relating measurability to funding under PNRR Measure 1.4.1. The scope is descriptive: we characterise distributions, regional patterns and header-to-header differences (ΔE00) without assessing usability, accessibility, or full model compliance.

While national guidance has encouraged convergence toward a shared visual language, most notably through the institutional Blu Italia, implementation across municipalities remains heterogeneous. In practice, components can be renamed or partially embedded; legacy templates persist, and the presence of Bootstrap Italia does not necessarily entail structural adherence to the municipal model. This gap between the intended standard and the realised interface motivates our enquiry and frames the scope of this paper: a nationwide, policy-aware descriptive characterisation of municipal header colours grounded in official registries and open data, together with interpretable summaries (choropleth maps, regional compositions, and hue distributions) that render large-scale patterns legible and useful for oversight of model adoption.

Our contribution is twofold:

1) We provide a national-scale, policy-aware characterisation of municipal header colours grounded in official registries (ISTAT, IPA) and the open datasets released under PA Digitale 2026. To our knowledge, this is the first measurement-based overview of the colours actually rendered in municipal headers and their relation to the institutional colour scheme promoted by Designers Italia.
2) We present interpretable summaries, including choropleth maps, regional compositions and hue distributions, which make large-scale patterns legible without presupposing specialist knowledge.

The remainder of the paper proceeds as follows. We first situate the study within Italian public-sector design

standards and the policy programme behind Designers Italia and Bootstrap Italia, together with the open-data context of PNRR Measure 1.4.1, to clarify the operational setting in which municipal websites are developed. We then present a nationwide characterisation built from official registries (ISTAT and IPA) linked to PNRR open data, reporting the distribution of header colours, the prevalence of the institutional blue, regional regularities and divergences, and the consistency between slim and center header sections.

Although blue emerges as the prevailing family at national scale, we also observe visible heterogeneity across municipalities, including provincial capitals. In several capitals the header background is green, red or white rather than blue, while others remain blue; this variety does not change the aggregate dominance of blue reported in our results. For clarity, throughout the paper "colour" refers to the computed background of the two header bands as rendered by the browser, not to hero images or other content that may influence the overall page impression.

2. Methodology

The unit of analysis is the municipality. We assembled a national corpus of 7,896 records by aligning the official statistical register (Elenco dei comuni italiani) [7] with the national administrative index ("Enti") [8], restricting the latter to entities classified as municipalities. The two registers were merged using the **ISTAT municipal code** as the unique key and a left join, so that every municipality in the statistical register remains in scope even if no matching record is present in the administrative index. All data processing, web automation and analyses were implemented in Python (3.12.2): headless browsing with Selenium WebDriver [9], HTTP resolution and HTML parsing of computed styles, CIE L*a*b* conversions and CIEDE2000 calculations, geospatial joins for mapping, and figure generation.

2.1. *Institutional websites*

Institutional website addresses drawn from the administrative index were processed in two stages. First, an automated pass parsed each entry as a web address and normalised it to an HTTPS base URL, retaining only the scheme and host and discarding paths and query strings. During this step the parser also flagged obvious anomalies such as email strings, raw IP addresses, or generic provider placeholders that point to a platform rather than to a municipal hostname. Second, a manual review corrected only those flagged cases for which a reliable institutional domain could be verified. In practice, provider placeholders (e.g., halleyweb.com) were replaced with the corresponding municipal host when identifiable; emails (e.g., anagrafesquillace@libero.it, serra.segreteria@gmail.com) and raw IPs (e.g., 62.77.55.13) were replaced with the municipality's official domain. After curation, each municipality was associated with a single institutional website URL. This yielded a single institutional base URL for each municipality, totalling 7,896 municipalities (ISTAT; as of 30 June 2025).

2.2. *Association between funding and colour availability*

We merged the municipal list from §2.1 with the beneficiary lists of Measure 1.4.1– Citizen Experience in Public Services [10] to mark each municipality as financed or not financed. The merge used the IPA institutional code shared by both sources and ran automatically under the same rules for all records. Because the beneficiary lists were compiled before January 2024, we aligned them to the current municipal map [11] (for example, Alano di Piave, listed as funded in September 2022, was suppressed on 22 January 2024 to form Quero Vas; Moransengo was mapped to Moransengo-Tonengo, created on 1 January 2023). We then removed exact duplicates where the same municipality and the same CUP code [12] appeared in more than one row, keeping only a single entry for that municipality CUP pair. After these steps, 6,593 municipalities are marked as financed, corresponding to 83.5% of the national corpus. The financed label is descriptive and does not by itself demonstrate structural adherence to the municipal website model.

2.3. *HTML audit and header colour capture*

Starting from the consolidated municipal list, each homepage was loaded in a headless browser via Selenium WebDriver. A headless browser is just a browser with no visible window. It still follows redirects, runs JavaScript, and applies CSS, but code controls it, so we can repeat the same steps on thousands of sites. [13]. Redirects were followed to the terminal URL, which we logged together with the final HTTP status. Reachability was assessed only at the terminal URL and required HTTP 200. Use of the national municipal template based on Bootstrap Italia was assessed by scanning the HTML and the loaded stylesheets for unambiguous identifiers unique to Bootstrap Italia. A site was marked "Bootstrap Italia present" only if at least one of the following was found: the literal string bootstrap-italia in markup or CSS, or the CSS custom property --bootstrap-italia-version in a loaded stylesheet. This check indicates practical adoption of the design system and does not certify full structural conformity. As illustrated in the template screenshot (Figure 1a), the two header bands are visually distinct and correspond to the slim and centre headers.

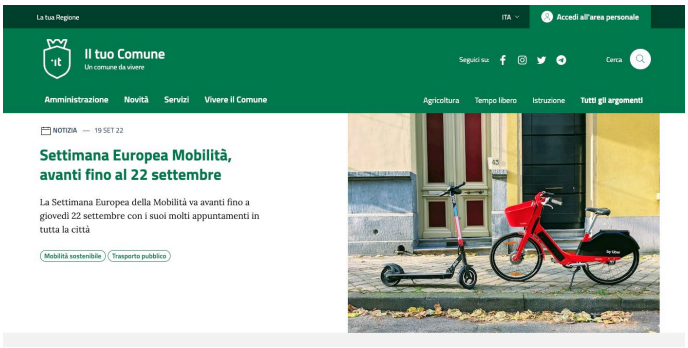

Fig. 1a - Example of a municipal website template (https://comuni.designers.italia.it)

For colour capture, we targeted the two canonical containers of the Designers Italia municipal model, .it-header-slim-wrapper and .it-header-center-wrapper (see Fig. 1b).

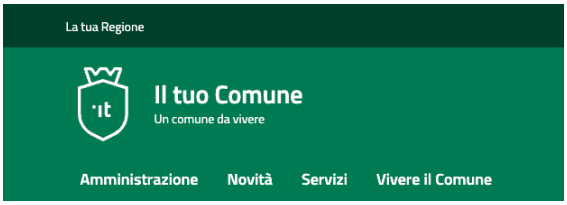

*Fig. **1**b- Header bands highlighted (slim and center).*

We chose these selectors because they uniquely map to the slim and centre header [14] bands and are stable across releases. After the page and stylesheets had loaded, the script read each container's computed background-color. This returns the value after the CSS cascade, with variables, theme rules and overrides resolved at page load. We did not sample pixels or screenshots. If a header section was absent or its value could not be parsed, we recorded "No color information". According to the Bootstrap Italia documentation on custom colours, the primary palette for municipalities is rooted in Blu Italia (#0066cc) and white; Blu Italia is explicitly described as the identifying colour of the brand identity and the root for the primary palette [2]. Other hues (e.g., green) exist as theme variants for specific templates, so our measurement reports the colours actually rendered on live sites, capturing both strict adherence to the institutional primary and the presence of alternative theme choices.

For colour analyses, we included only municipalities with a terminal HTTP 200 and computable RGB values in both the slim and centre headers. The Bootstrap Italia flag was recorded descriptively and not used as an inclusion criterion.

2.3.1. *Coverage and capture rates*

Sites were considered reachable when, after redirects, the terminal URL returned HTTP 200 (OK); capture was recorded when the computed CSS background colour was obtained for both headers. Requests were subject to time limits: HTTP requests had a 10 s timeout (also applied to linked stylesheets), the headless browser used a 20 s page-load and script timeout with an additional 3 s wait for the body element, and we inserted a 50 ms pause between records to avoid saturating hosts. The sample comprises **7,896** municipalities (**6,593** financed; **1,303** not financed). Overall, **89.3%** were reachable and **73.0%** had both header colours captured. Among financed municipalities (n = 6,593), **90.9%** were reachable and **84.2%** had a captured header colour (5,551/6,593). Among not financed municipalities (n = 1,303), **81.0%** were reachable and **16.6%** had a captured header colour (216/1,303). When reachability fails, the crawler typically encounters timeouts, DNS resolution problems, TLS/SSL handshake errors, connection resets, or automated blocking at the edge; in a small minority of cases the server returns explicit client/server errors (4xx/5xx).

2.3.2. *Statistical association between funding status and colour availability*

We tested whether funding status (financed vs not financed) was independent of having a captured header colour (computable in at least one header section) using a chi-square test; we report Cramér's V as the effect size (Cramér, 1946).

2.4. *Colour parsing and categorisation*

Achromatic tones were identified in the CIE L*a*b* colour space near the neutral axis of the ab plane (about 10 units around the origin) and split by lightness: Black (L* < 10), Gray (10–90), and White (> 90). All remaining colours were assigned to one of eight chromatic groups by their angular position in the ab plane, with the hue angle H° obtained from the arctangent of a* and b*. Fixed ranges were Pink (0°–27°), Red (27°–45°), Orange (45°–58°), Brown (58°–78°), Yellow (78°–90°), Green (90°–200°), Blue (200°–320°), and Violet (320°–360°). In addition to these categories, the original colour values were retained to enable case-specific checks of institutional choices, notably the reference Blu Italia (#0066cc) and pure white (#ffffff).

Since each municipal header comprises two adjacent sections (center and slim), we assessed their internal coherence by computing the CIEDE2000 perceptual distance (ΔE_{00}) between the two backgrounds for each municipality. Distances were grouped into four interpretive buckets: Same (≤2), Close (2–10), Different (10–30), and Contrasted (≥30). Visual evidence is presented as categorical distributions of header colours: a national two-bar stacked chart reports, for each section, the share of municipalities in each canonical colour class. Figures depict categories, not exact colour codes.

2.4.1. *Conversion and white point*

We loaded each homepage in a headless browser and read the computed CSS background-color of the two header wrappers via window.getComputedStyle, which serialises channels as rgb (r, g, b) with integer values in 0–255; we therefore treated colours as 8-bit sRGB. For distance analyses (ΔE00), these sRGB values were scaled to [0,1] and converted to CIE L*a*b* (D65 white) using scikit-image rgb2lab [15], without chromatic adaptation. For the maps (Fig. 6 and Fig. 7), we converted each RGB value to a six-digit hex code in lowercase (#rrggbb) and considered two colours equal only if the hex codes were identical; the Bootstrap Italia blue was counted only when the code was exactly #0066cc.

2.5. *Geographic layers and mapping*

For cartographic views, municipalities were linked to ISTAT's official administrative boundaries [16] for statistical purposes, updated to 1 January 2025. The join used the ISTAT municipal code; regional aggregates follow the same 2025 series. All maps in the Results use the same set of 7,896 municipalities defined in §2.1, after the updates and reconciliations described there.

2.6. *Visual analytics and outputs*

From the consolidated dataset we aggregated header colours into the canonical categories (§2.4) and computed category shares (municipality weight = 1). We visualise (i) the national composition with two 100% stacked bars (CENTER and SLIM) and (ii) territorial patterns with a region×category heatmap plus a single choropleth for the reference colour (Blu Italia, #0066cc) and a choropleth of the most-common exact HEX per region. Internal consistency between headers is analysed via the distribution of ΔE_{00} buckets (Same/Close/Different/Contrasted) and reported in the text without a dedicated graphic. Diagnostic plots (a*–b* scatter and hue histograms) are shown in the Results as supporting evidence.

2.7. *Data quality, limitations, and mitigations*

The upstream open-data sources required non-trivial cleaning and exhibit inconsistencies typical of administrative datasets (as already noted in §§2.1–2.2): outdated hostnames, provider placeholders, email addresses in URL fields, raw IPs, suppressed/merged municipalities, and duplicate CUP entries. On the web side, some homepages were unreachable or served incomplete assets; a minority applied overrides that temporarily hid template sections.

We mitigated data issues with automated normalisation and anomaly detection, light manual review of flagged rows, deduplication of municipality–CUP pairs, and by reading computed styles after assets loaded to capture the effective theme. Unless stated otherwise, colour comparisons (e.g., ΔE00) use the subset with a captured colour in both headers (BOTH: 5,765 of 7,896; 73.0%). For "has a colour" tallies we also report BOTH by default; using the "at least one header" definition (ANY: 5,767; 73.0%) adds only two rows and does not change one-decimal percentages. The two financed discordant cases are: (i) Ravenna, centre only (slim header absent); (ii) Fondi, slim only (the centre header element is not present in the HTML, e.g., .it-header-center).

3. Results

To test whether PNRR 1.4.1 funding is associated with the presence of a computable header color, we constructed a 2 × 2 contingency table (Table 1). A municipality is counted as captured when at least one of the two header sections (centre or slim) has a computable colour value.

	Captured	Not Captured	Total
Financed	5,551	1,042	6,593
Not Financed	216	1,087	1,303
Total	5,767	2,129	7,896

Table 1 Association between PNRR 1.4.1 funding and header colour capture (N = 7,896)

From these counts, the capture rates is **84.2%** for financed municipalities (5,551 ÷ 6,593) and **16.6%** for non-financed (216 ÷ 1,303). The association was tested with the Pearson chi-square statistic:

$$x^2 = \sum \frac{(O - E)^2}{E}$$

where O are the observed frequencies and E the expected frequencies under independence.

For this table, the result was:

$x^2(1) = 2526.0$, $p < 0.001$

Effect size was estimated with Cramér's V:

$$V = \sqrt{\frac{x^2}{n(k-1)}}$$

with n = 7,896 and k = 2, giving V = 0.566.

Funded implementations more often expose standard templates and stable CSS, making colours retrievable. Among non-funded municipalities this condition is uncommon and uneven. Overall, support under PNRR Measure 1.4.1 aligns with tangible adoption of the Designers Italia model and improved measurability.

3.1. *Colour-space diagnostics (CIE Lab*)*

Projecting validated centre-header colours onto the CIE L*a*b* a–b plane (Fig. 2) yields a broad arc with b* below

zero and a* around zero to mildly positive, indicating a dominance of blues/teals. A smaller cluster at high positive a* and moderately positive b* corresponds to reds/red-oranges. Greens occupy negative a* and positive b*. A compact cloud near the origin reflects near-neutral whites/greys, and there are few points at high b* with low |a*|, confirming the scarcity of yellows.

Category shares for the centre header (N = 5,766) are: Blue 65.4%, Green 15.7%, Red 7.5%, White 7.2%; all other families are <3% each.

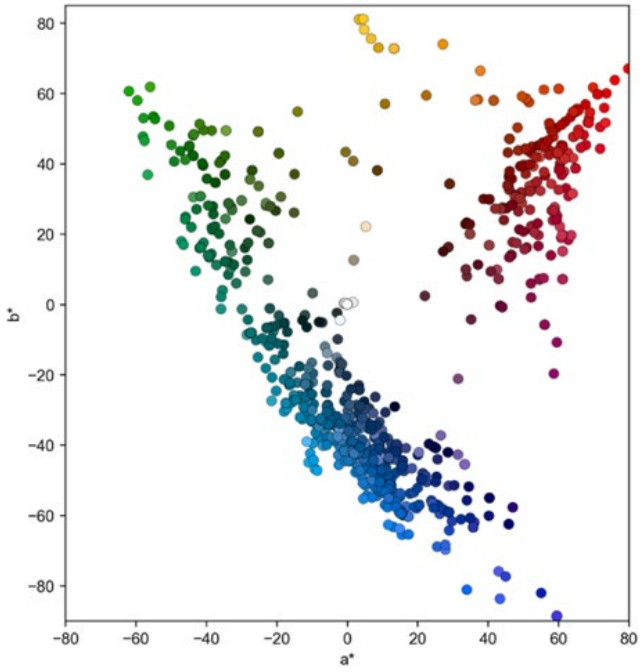

Fig. 2 - Centre-header colours in CIE Lab. The a–b projection suffices to show the dominance of blues; a histogram is omitted.*

The ab projection suffices to show the dominance of blues and the relative shares of greens and reds, so we omit the histogram.

3.2. *National composition (Center vs Slim)*

At national scale, **blue** dominates in both headers, followed by **green**; **red** ranks third and is comparatively minor. The notable difference lies in the neutrals: the slim header shows less white and more grey/black than the centre. Apart from this shift, the ranking by share is similar across the two headers, indicating a stable chromatic identity across components. Aside from the neutral shift, the family ranking by share is similar in the centre and slim headers. Minor families (pink, orange, yellow, violet, brown) are sporadic and do not materially affect the national picture. Complementing the national composition, we note visible heterogeneity across municipalities, including provincial capitals. Several inspected capitals display green, red or white header backgrounds, while others remain blue; these cases show that blue is widespread rather than universal.

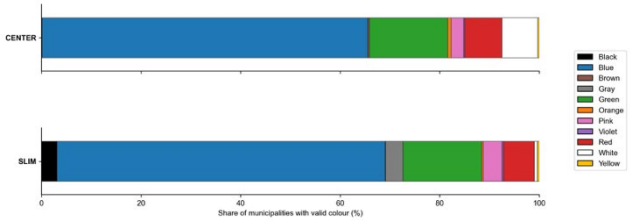

Fig. 3 - National composition of header colours by category for the centre and slim headers.

3.2.1. *Colour difference between headers (ΔE00)*

To give a sense of scale, we show example colour pairs (slim above, centre below) taken from the median ΔE00 in each band; these are illustrative only and do not define a canonical colour (Fig. 4). We quantify the per-municipality difference between the centre and slim headers with CIEDE2000 (ΔE00) in CIE Lab*.

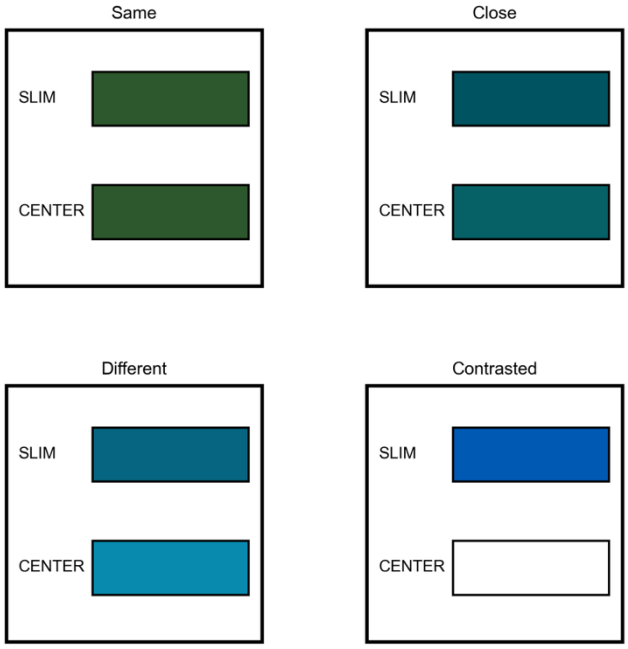

Fig. 4 - Examples of "Same", "Close", "Different" and "Contrasted" colour differences between the slim and centre headers.

The analysis includes all sites with both colours parsed **(N = 5,765)** and partitions ΔE00 into four bands: Same (≤2), Close (2–10), Different (10–30), and Contrasted (≥30). Counts and shares are: **Same = 76 (1.3%)**, **Close = 2,845 (49.3%)**, Different = **2,312 (40.1%)**, **Contrasted = 532 (9.2%)**. Thus, about half of the pairs (50.6%) fall in the Same/Close range; however, exact matches are rare (1.3%), so "consistency" is mostly close rather than identical. The remainder show a noticeable (40.1%) or strong (9.2%) change. The distribution centres around a

median ΔE00 ≈ 9.96, indicating a mild-to-moderate change overall.

3.3. *Regional colour categories (heatmap)*

Fig. 5 represents the heatmap of the abundance of each category of colour for each region. Blue is the main category nationwide. It peaks in Friuli Venezia Giulia (≈75%) and is also high in Sicilia and Trentino Alto Adige, while Piemonte and Valle d'Aosta show the lowest blue shares. Green clusters in the South (Molise, Calabria, Sardegna). White is a visible secondary option in the centre–north (Emilia–Romagna, Toscana, Veneto). Red is limited to a few regions, especially Valle d'Aosta and Emilia–Romagna. Data availability varies: "No color information" is highest in Basilicata (≈51%) and Piemonte, and low in Friuli–Venezia Giulia, Lombardia, and Sicilia. To complement the heatmap, the regional share of blue averages 47.2% with a standard deviation of 12.6% (range 24.6–75.3%).

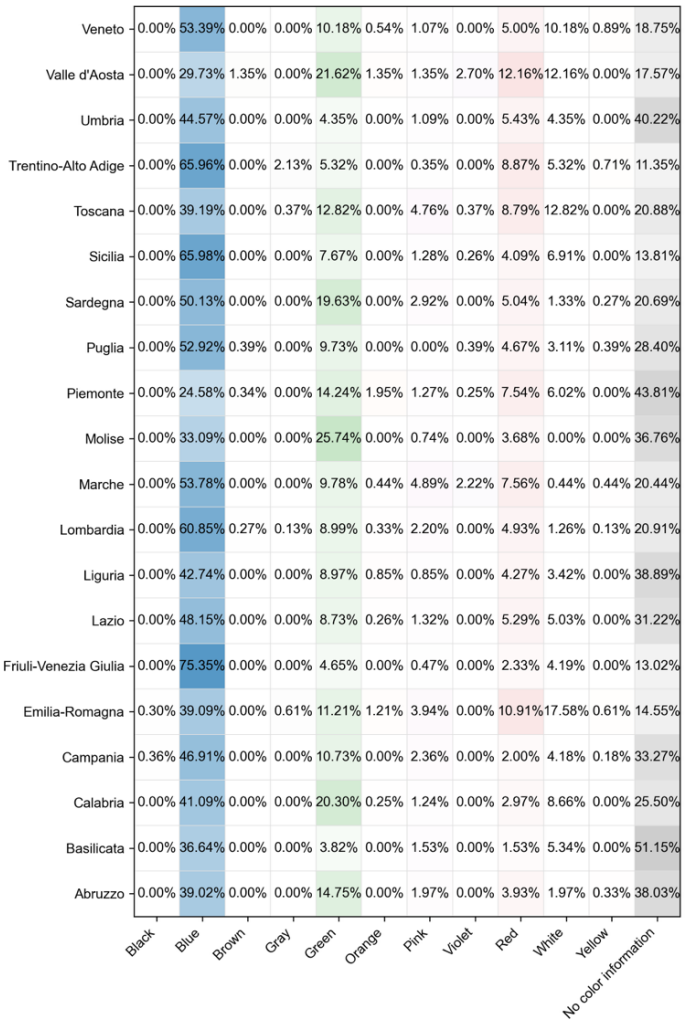

*Fig. 5 - Region × category heatmap (*it-header-center-wrapper*). Percentages are calculated over all municipalities in each region. "No color information" is shown as a dedicated column.*

3.4. *Regional share of the most common exact header colour (HEX)*

At the regional level, we report the share of municipalities that use the single exact HEX code (#rrggbb) that occurs most often as the header background in that region. A single code rarely dominates; in most regions the top code covers about 10–20% of municipalities. Clear concentrations occur in **Trentino-Alto Adige (~56%, #003882)** and **Friuli Venezia Giulia (~54%, #003274)**, while Veneto is intermediate at ~30% (#003399). The **Bootstrap Italia primary blue (#0066cc)** appears chiefly in Lazio (~15%) and Sicilia (~10%). White (#ffffff) leads in Emilia-Romagna (~17%), Toscana (~13%), and Valle d'Aosta (~12%), and green (#007a52) in Molise (~26%), Calabria (~17%), and Sardegna (~13%). Overall, **dark blues prevail** among regional leaders, and convergence on a single exact HEX is uncommon.

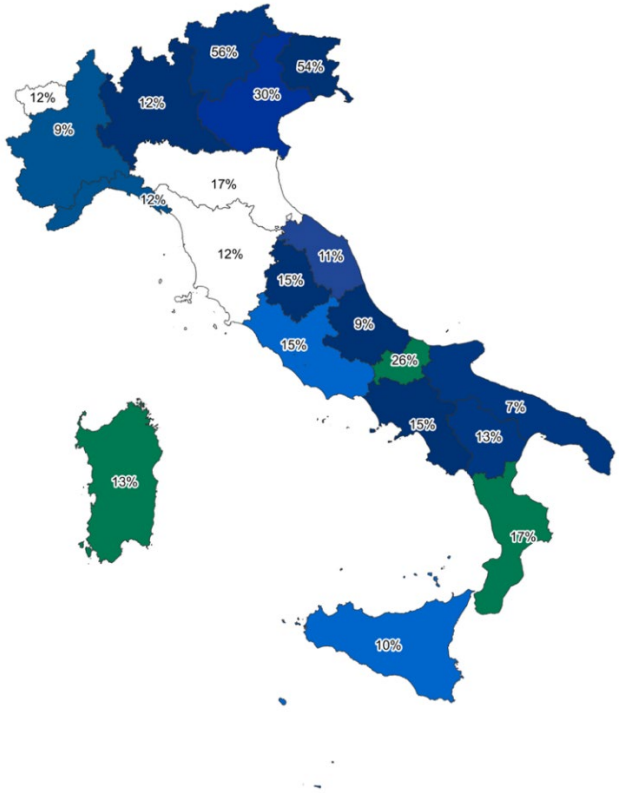

Fig. 6 - Most common exact header colour (HEX) by region - it-header-center-wrapper

3.5. *Share of municipalities using Blu Italia (#0066cc)*

In Fig. 7, Italian regions are visualized as a heatmap, with colour intensity reflecting the relative frequency of municipalities adopting Blu Italia in their slim website headers. As it can be seen, the use of the exact guideline colour is limited. Most regions lie between 0 and 10 percent, with the highest shares in Sicilia ~10% and Lazio ~10%. Next are Sardegna ~8%, Campania ~6%, Marche ~6%, Basilicata ~6%, Puglia ~5%, and Calabria ~4%;

northern regions are mostly 0 to 3 percent. This pattern aligns with the regional map of exact HEX leaders, where #0066cc is the most frequent exact header colour only in Lazio and Sicilia.

Friuli–Venezia Giulia is informative: #0066cc is 0% in the center header, the blue category in the heatmap is 75.3%, and the most common exact colour is the darker #003274 at about 54%. This shows that blue is widespread as a category, while convergence on the precise #0066cc remains rare.

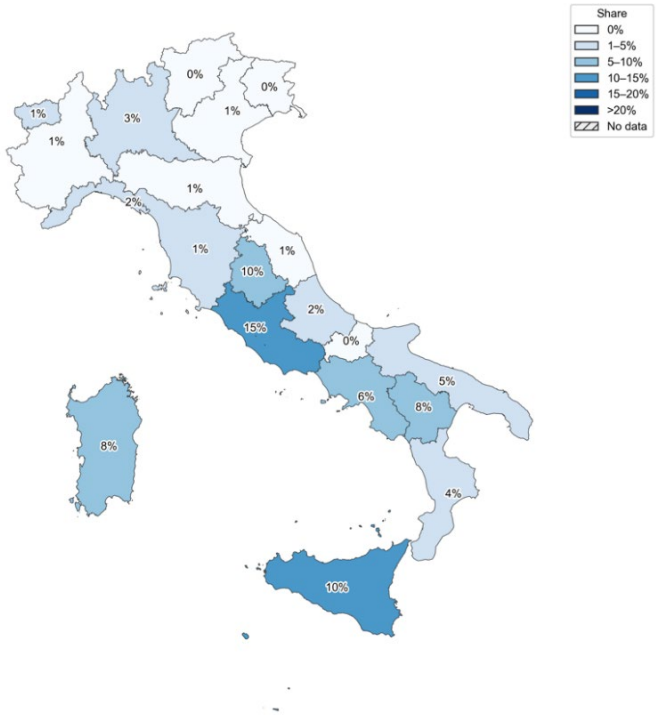

Fig. 7 - Share of municipalities using Blu Italia (#0066cc) by region – it-header-center-wrapper

4. Discussion

At national scale, municipal headers converge on the blue family. The exact institutional blue #0066cc is uncommon, while darker blues are often the predominant choices within regions. This points to alignment at the hue-family level rather than strict convergence on a single reference colour. Alongside the national prevalence of blue, our measurements also register a substantial share of non-blue headers; this observation is descriptive and does not alter the aggregate patterns reported above.

Within sites, the centre and slim bands are usually consistent: about half of pairs fall in the Same or Close ΔE_{00} range, the remainder show noticeable differences, and roughly one tenth is strongly contrasted. We refrain from functional interpretations and simply report these measured differences. Qualitatively, slim bands often appear darker; we note this without quantifying lightness.

Funding under PNRR 1.4.1 is associated with higher measurability. Financed municipalities more often expose stable, parsable front ends from which colours can be captured reliably. This is not evidence of formal compliance with the municipal model; it indicates that funded implementations are easier to audit.

From a policy perspective, the results can be read as lightweight indicators of progress. High measurability rates suggest that financed rebuilds expose stable front ends. The presence of Bootstrap Italia in markup signals practical adoption of the national model; the prevalence of blue in headers shows convergence at the chromatic level; and coherence between centre and slim bands reflects internal consistency. Together these indicators let municipalities benchmark against regional or national patterns and help agencies identify where additional support may be needed.

Standardisation turns a dispersed civic web into measurable public infrastructure, improving transparency and enabling lightweight, explainable indicators that non-specialists can read. Because many administrations now build with the same model, interfaces become comparable data; this regularity lowers the cost of oversight and lets researchers and civic groups build simple tools to track change. A few simple, reproducible measures are enough to track progress over time. At the same time, the visibility of actual municipal spending under PNRR Measure 1.4.1 for website rebuilds is uneven; references linking awards to procurement identifiers (CUP/CIG) are not systematically published and are often not machine-readable, constraining verification over time.

This study is descriptive and cross-sectional, based on alignment of ISTAT and IPA registries and linkage to PNRR 1.4.1 beneficiary lists. Results reflect the landing page at crawl time, so redirects, protection layers, cookie banners and late-loaded styles may affect computed colours. Detection of Bootstrap Italia relies on heuristic signals and should not be read as proof of formal compliance. The study does not assess usability, accessibility or normative conformity. Mitigations for data quality and measurement are reported in §2.7.

Future work should replace the single snapshot with periodic measurement so that trends are visible and simple to compare. A light extension to the method can add WCAG text–background contrast checks on header text and primary actions as a quick signal of alignment, by running a preliminarily scoped contrast screen limited to the two header bands (computed text colour vs. background) and reporting the share of sites meeting AA thresholds; this offers an initial compliance signal to trend over time without claiming a full accessibility assessment.

The goal is a simple, repeatable view of progress that anyone can read.

5. Conclusion

This paper establishes a national baseline for colour usage in Italian municipal website headers by linking official registries to PNRR 1.4.1 beneficiaries and capturing browser-rendered colours for both header bands. Municipalities align by family towards blue rather than on the exact institutional colour (Blu Italia). Within-site coherence between centre and slim bands is generally acceptable. Funding aligns with measurability, reflecting more stable and parsable structures without implying formal compliance.

The unusual degree of cross-municipal standardisation turns a diffuse web estate into a measurable public infrastructure. This unlocks transparency and continuous monitoring because simple colour-based indicators can be computed reliably, compared across regions and understood by non-specialists. Used alongside structural and accessibility checks, these indicators support longitudinal tracking and targeted support, and they enable researchers and civil society to build practical tools for oversight.

6. Conflict of interest declaration

The authors declare no conflict of interest.

7. Funding source declaration

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8. Short biography of the authors

Enea Ahmedhodzic - PhD candidate in Computer Science specialising in IT systems for transparency in public administration. She holds an MSc in Conservation Science from the University of Milan and has worked with cultural institutions to use emerging technologies in film-heritage preservation. Her research covers data curation, open knowledge and expanding public access to cultural collections.

Beatrice Sarti - Postdoctoral Research Fellow at the Computer Science Department of the University of Milan. Her research interests include Color Science, Colorimetry, and Image Enhancement, with a particular interest in Cultural Heritage applications. She is a member of the Italian Color Group (Gruppo del Colore) and the editor for the Research Culture and Science Books (RCASB) series.

Andrea Mario Trentini - Assistant professor at the Università degli Studi di Milano, teaching Programming 101, Embedded Systems, and Digital Citizenship. He co-founded I&T Mentor (2002-2006), specializing in object-oriented software consultancy. He has taught professional courses on Unix/Linux, Java, and UML. A Computer Science graduate (1996), he also attended the CEFRIEL Master in IT. He supports Free Software, serves on the Maison de l'Italie board, and is passionate about reading, traveling, and various activities.

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