***eWOM and sentiment analysis to support decision processes within maritime heritage museum networks. The case of Arca Adriatica.***

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**Abstract**

Museum networks are proliferating in the Mediterranean area showing new forms of collaboration between public and private institutions. Museums and heritage conservation play a fundamental role in tourism development. The purpose of the present working paper is to provide an analysis of the museum network experience in order to define a set of useful and viable marketing strategies to be adopted by the museum management with respect to the relative tourist context. The case of the Arca Adriatica maritime museum network - a network of eight maritime museums representing the core asset of an elaborated tourist product - has been analyzed and considered particularly relevant and of peculiar interest. After the analysis of the museum network and its most important related points of interest, managerial recommendations within strategic and tactical perspectives are hence presented.

**Keywords**: eWOM, sentiment analysis, museum network, maritime museums, cultural marketing

**Issue and argument**

Research on networks management has a long tradition. However, museum networks have rarely been studied directly. In particular, a number of questions regarding how to improve the marketing decision process for museum networks remain to be addressed. Considering previous studies on museum visitors' satisfaction, it seems not deepened the relationship between a museum network and visitor experience.

The main contribution provided by the present study tries to improve the museum managerial process by answering the question: "How data analysis from eWOM concerning the visitors' experience can effectively support the marketing of maritime museum networks while defining their value proposition"? In order to answer the research question, we focused on the international museum network named Arca Adriatica, an Interreg project between nine partners from Italy and Croatia which has involved eight ecomuseums on the maritime heritage of the Adriatic Sea in the Mediterranean. We hence analyzed the relative electronic word of mouth (eWOM) through a sentiment analysis and a text analysis performed with Atlas TI. Results highlighted the characteristics of the museum offering within the network that most influence the electronic word of mouth (eWOM) of its visitors.

From a methodological point of view, big data freely available on the web, with particular reference to the museum eWOM published on platforms such as Tripadvisor and Google reviews, represent a precious source of data to orient the managerial decision process. Our findings recommend paying particular attention when using sentiment analysis tools to understand consumer behaviour in the field of arts and culture. A thorough text analysis of the eWOM conducted in parallel by two researchers is resulted to be more reliable and insightful than the sentiment analysis.

The medium-small size, the peculiar nature of the museums' collection, and the geographical area throughout which the network is scattered are relevant variables to better understand the context of the present research, especially when compared with the findings of other museum studies. It is possible to consider the Arca Adriatica museum network in comparison with other museum networks in the cultural field, by means of a table representing four different types of museum networks (see table 1).

**Table 1 - Types of museum networks**

| | | Nature of the museum network offering | |
|---|---|---|---|
| | | Heterogeneous | Homogenous |
| Geographic localization | Scattered | Balkan Museum Network | ARCA ADRIATICA |
| | Concentrated | Portuguese Museum Network,Lodi, Mantova | Contemporary art |

The Arca Adriatica museum network falls into the category showing homogeneous offering with a scattered geographic localization.
Beside the different museums, the Arca Adriatica tourist product offers several important cultural products represented within the different Centres of Excellence and Interpretation Centres. Each partner is also located within a tourist and cultural context characterized by the presence of other tourist stakeholders with which a relationship has been established (see the Synoptic Table of Partner Actions at the end of the present document) and several other cultural points of interest (or attractors) that contribute to enrich the overall tourist package and make it more appealing for prospects and customers.

**Literature review**

Museum networks are proliferating in the world and in the Mediterranean area showing new forms of collaboration between public and private institutions (Scrofani & Ruggiero, 2013). The spreading of the museum networks is a phenomenon that is considered deserving of being studied (Alberti et al., 2005) as they represent museum systems able to generate value for visitors and prospects (Pencarelli & Splendiani, 2011). Furthermore, museum networks can improve the image of a geographic region not only at a national level but also internationally (Sizova & Ulianova, 2015; Kaulen, Chuvilova & Cherkaeva, 2015), attracting tourists and enhancing the educational programs (Takenouchi et al., 2014).
The literature on the matter has shown different tendencies that range from the adoption of new technologies and virtual reality within more traditional museums to the coordination and integration policies among homogeneous and heterogeneous institutions. The nowadays pervasiveness of digital technologies (Wellman & Rainie, 2012; Bonazzi, 2015) and the impact of the digital transformation over museums (Bertacchini & Morando, 2013; Bautista 2013) have increased the visitor active participation to the fruition process of the museum and its collections. At the same time it has allowed the use of virtual reality (Bertacchini et al., 2006) and the creation of digital archives able to longitudinally narrate the evolution of museums and the digitalization of their collections (Bonnefoit & Rérat, 2017).
The accumulation of documents and data allows the feeding of such archives representing rich and useful sources of data creating value for those interested in the field (Coones, & Rühse, 2017). Real time feeding of the museum network Wikipedia page as well as the application of a verification protocols to the glossary of the content creation management of online museum presentation or a joined portal for libraries, archives and museums represent just an example of how the MusIS (the South-Western German Museum Network) has employed new technologies for museums networks (Schweibenz & Sieglerschmidt, 2008). Following the examples of Jongno museum district in Seoul it appears that through clever museum app it would be possible to allow a museum network to be perceived by its visitors as a single big smart museum (Bae, Im, Lee, 2013).
In general, museums play an important role in tourism development (Cerquetti & Montella, 2015) and they also produce an important action in preserving and promoting the material and immaterial heritage (Khakzad & Griffith, 2016). Specifically, over the last few years, there is an emerging interest in the ethnographic maritime museums (Fromm, 2016) located in the Adriatic coast and islands (Bender, 2015). As specified in the previous section, our interest is focused on the emerging museum network linked to the Arca Adriatica project.
A museum network must satisfy four conditions (Guintcheva & Passebois-Ducros, 2012):

- keeping a long-term orientation,
- promoting culture being involved in a protective political environment,
- developing the complementarities between the museums without depriving individual museums from their identity,
- being committed to a continuous innovation attitude leading to new cultural initiatives and long-term sustainability of the network itself.

The Arca Adriatica museums network represents a bureaucratic (Gray & McCall, 2018) network that respects the four above-mentioned conditions in order to succeed in its populated and progressively more dynamic competitive arena.

The evaluation of the museum network performance, though, is particularly complicated. The need to deal with different institutions characterized by an heterogeneous set of goals such as not for profit, economic long term sustainability, profit, stakeholders satisfaction, etc. makes it necessary to use qualitative variables and not only quantitative ones in order to evaluate the managerial performance. Some research have shown how the fuzzy logic expert system can be extremely effective in measuring such performance as it employs both types of variables: qualitative and quantitative (Venturelli, et al., 2015). In order to evaluate the social effectiveness as measure of museum networks effectiveness, a series of factors have been identified by the model: accessibility, social cohesion, absorptive capacity (absolute and relative), social capital and knowledge gatekeeper. These factors have been grouped in second order factors concerning: museum visitors, absorptive capacity, networking and economic impact.

In other cases, such as the one of the Balkan Museum Network, the relative performance has been qualitatively measured observing the quality of ties both, between any two nodes and at its overall network level. The quality of ties, in this case, depended on the nature of the knowledge exchanged and on the type of collaboration among the individuals involved in (Lozano, 2016). Of course the nature of the Balkan Museum Network shows clear specificities that make it hard to compare it with other museum networks. In the case of Arca Adriatica museum network the first model of performance evaluation (Venturelli, et al., 2015) appear to be the most suitable one. In general, the museum network governance finds one of its best practice pillar in the elaboration of a thorough, complete and well conceived communication plan (Coluccio, 2013) or, in a even more complete and effective marketing plan. In this research we focus on the analysis of Arca Adriatica customers and their drivers of satisfaction and dissatisfaction as it is a crucial phase for the proper definition of a marketing plan (Biglino & Amantini, 2016).

**Methodology**

The aim of the present study is to answer the following research question: how data analysis from eWOM concerning the visitors' experience can effectively support the marketing of maritime museum networks while defining their value proposition?

The study adopts a single case study research design (Yin, 2017) with an exploratory approach that uses desk analysis and text analysis as main methods of data collection and analysis. The case study chosen is represented by the Arca Adriatica museum network. The eight museums are shown in Table 2. As for the data collection process all the museums' reviews published on Tripadvisor and Google Business have been counted. The count report is shown in table 2.

Table 2 - The Arca Adriatica museum network and reviews

| Partner | Museum | Google Review | Tripadvisor Review | Stars |
|---|---|---|---|---|
| Rovigno (Croatia) | Casa della Batana | 204 | 22 | 4.33 |
| Primorje – Gorski Kotar County e Kvarner Region (Croatia) | Maritime and History Museum | 674 | 48 | 4.39 |
| Cesenatico (Italy) | Museo Marineria Cesenatico | 1662 | 686 | 4.69 |
| S. Benedetto del Tronto (Italy) | Museo d'Arte sul Mare (MAM) | 453 | 359 | 4.57 |
| Cervia (Italy) | Museo MUSA (Magazzini del Sale) | 792 | 37 | 4.31 |
| Venezia (Italy) | Museo Storico Navale | 676 | 567 | 3.99 |
| Tkon (Croatia) | Zavicajni Muzej Biograd Na Moru | 15 | 9 | |

| | | | | |
|---|---|---|---|---|
| Tricase (Italy) | Museo delle Imbarcazioni Tradizionali e dell'Arte Marinaresca | 12 | 0 | |
| Malinska-Dubašnica (Croatia) | No maritime museum | - | - | |

The study is divided in two phases:
- phase 1 sentiment analysis of the eWOM
- phase 2 manual text analysis of the eWOM

As illustrated in table 1, two of the network museums (*Zavicajni Muzej Biograd Na Moru* of Tkon in Croatia and the *Museo delle Imbarcazioni Tradizionali e dell'Arte Marinaresca* of Tricase in Italy) show very few reviews. As the number of reviews is not sufficient to grant the reliability of the results produced through the statistical analysis, these two museums have not been considered in the present study.

In the first phase, the data analysis considered at first 6216 comments of which 4488 from Tripadvisor and 1728 from Google.
Besides each museum in itself, also the context within which the museum is located has been studied through the analysis of the eWOM concerning the respective most important tourist attractors, i.e. points of interest (PoI). A total amount of 31.621 reviews have been then analyzed through the following tools:

- Orange 3.26.0
- PASSW 18.0.0

In this way it has been made possible to measure the correlation between the elements characterizing the reviews of the network museums and the elements characterizing their context, and carry out the relative sentiment analysis.
The analytical tool employed for the sentiment analysis is Vader: lexicon- and rule-based sentiment analysis (Hutto & Gilbert, 2014). The tool has been developed considering the features and performances of the main alternatives software available, such as: ANEW, LIWC, SentiWordNet, the General Inquirer, together with machine learning oriented techniques that rely on Maximum Entropy, Support Vector Machine (SVM) algorithms, and Naive Bayes. It employs a combination of quantitative and qualitative methods to construct and empirically validate a gold-standard list of lexical features that suit perfectly micro-blog and reviews text analysis (Hutto & Gilbert, 2014).

During the second phase of the data analysis process a sample of 591 reviews has been analyzed in parallel and independently by two researchers through Atlas TI in order to achieve a deep understanding of the most relevant variables influencing the eWOM valence.
The aim of this second phase was to test the validity of the coding process that emerged in the previous phase. A verification process that we considered essential to verify the interpretative reliability and replicability of the automatic sentiment analysis: "Any use of automated content analysis tools should be accompanied by human review of the output or conclusions of the tool" (Duarte et. Al., 2017:6).
To confirm the validity and the replicability of the analysis performed by the software, we opted for a manual text analysis entrusted to two coders. As stated by Krippendorff:"[...] the reading of textual data as well as of the research results is replicable elsewhere, that researchers demonstrably agree on what they are talking about. Here, then, reliability is the degree in which members of a designated community agree on the readings, interpretations, responses to, or uses of given texts or data. [...] Researchers need to demonstrate the trustworthiness of their data by measuring their reliability" (Krippendorff, 2018, p. 277).
The research team proceeded to follow the methodological indications aimed at carrying out the Intercoder Agreement (Krippendorff, 2018; MacPhail, Khoza, Abler and Ranganathan, 2015).
The process for the ICA analysis in fact provides for the creation of a Master Project, containing the documents to be encoded, the 591 reviews. The Principal Investigator (PI) develops the coding system by adding clear definitions for each code in the project. Based on the Master Project, the PI creates a sub-project for the ICA analysis.
At this point there are two options:
        a) PI can remove all citations, so that the snapshot project for coders contains only documents that need to be encoded and codes with definitions;
        b) leave the citations in the project, but remove all the encodings.
Our research team chose the first hypothesis.

The PI therefore saved the sub-project, created a bundle file and sent it to the encoders, other than those who operated / generated the encoding system. Once the two encoders completed the process, they prepared a bundle file and sent it back to the PI, who then computed the Intercoder Agreement, to assess the reliability of the analysis. Once a satisfactory ICA coefficient is achieved, the principal investigator has the assurance that his or her codes can be understood and applied by others and can continue to work with the code system.

In the following table the 3 are illustrated the list of Items list used for the text manual analysis.

**Table 3 - Items list for text manual analysis**

|  | Label |  |
|---|---|---|
| Core Offering | Art, artists, artifacts, historic value, collection | The collection is beautiful, interesting, large, vast, allows you to understand the history, a good experience, etc. |
| Peripheral services |  |  |
|  | Gift Shop | Bookshop and products offered (books, souvenirs etc.) |
|  | Food services | Food, bars, drinks |
|  | Guide | Personal human guide: competence, kindness, experience |
|  | Audio guide | Price, completeness, ease of use |
|  | Guidebook | Also brochures and portable information documents |
|  | Staff | All staff (including cleaning staff) |
|  | Ticket price | Amount and value compared to the offer |
|  | Seats | Benches and seating |
|  | Special events | Concerts, parties, tours, dinners and temporary exhibitions |
|  | WC | Presence, cleanliness and accessibility of bathrooms |
|  | Reservation | Process of booking the ticket, the visit, the guide. |
|  |  |  |
| Ambience | Building | Historical nature of the building (architecture, decorations,) |
|  | Photos | Considerations regarding the possibility of taking photos to commemorate the visit. |
|  | Location (Context) | Places surrounding the museum |
| Management and curatorship |  |  |
|  | Layout | Signage, spaces within which the exhibition is set up, lifts, size of the exhibition area, mobility and pathways |
|  | Display | Setting up, the curator's ability to inform and transfer a positive experience to the visitor |
|  | Lighting | Lights and lighting |
|  | Labels | Information labels |
|  | Opening time | Opening hours or days of the museum |
| Experience |  |  |
|  | Duration of the visit | Time spent in the museum |
|  | Too many photos | Too many photos taken by other visitors affecting the overall museum experience |
|  | Crowding | Crowd, too many people, chaos |
|  | Queue | Outside the museum or inside (ticket, entrance, cloakroom, audio guide, toilet, etc.) |
|  |  |  |
|  | Behavioral Intention | Visitor recommendations addressing other potential visitors |

**Takeaway and results**

After a first descriptive analysis of the reviews reported on TripAdvisor and Google it turns out that most of the words used in the comments are neutral and that only very few reviews use negative or very negative words.

The compound index for the different points of interest is satisfactorily with an overall mean value of .344, a minimum value of .057 for the Gangaro point of interest in Tkon - Croatia, and a maximum value of .630 for the point of interest of Porto Canale Leonardesco in Cesenatico - Italy (see table 4).

**Table 4 - Point of Interests: Descriptive Statistics for positive/negative/neutral and compound scores**

| Points of Interest | Positive | | | negative | | | neutral | | | compound | | | Evaluation in Numbers | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Count | Mean | STD Deviation | Count | Mean | STD Deviation | Count | Mean | STD Deviation | Count | Mean | STD Deviation | Count | Mean | STD Deviation |
| Arsenale di Venezia | 1916 | ,255 | ,242 | 1916 | ,025 | ,064 | 1916 | ,720 | ,237 | 1916 | ,483 | ,377 | 1916 | 4,470 | ,747 |
| Beach Dražice, Soline | 1502 | ,117 | ,258 | 1502 | ,008 | ,052 | 1502 | ,160 | ,309 | 1502 | ,114 | ,258 | 1502 | 4,403 | ,893 |
| Casa Della Batana | 222 | ,120 | ,251 | 222 | ,004 | ,019 | 222 | ,264 | ,387 | 222 | ,152 | ,287 | 222 | 4,477 | ,955 |
| Casa delle Farfalle | 1727 | ,245 | ,221 | 1727 | ,019 | ,048 | 1727 | ,631 | ,293 | 1727 | ,507 | ,381 | 1727 | 4,159 | ,950 |
| Cathedral of Our Lady of the Assumption | 68 | ,180 | ,160 | 68 | ,014 | ,029 | 68 | ,717 | ,270 | 68 | ,541 | ,366 | 68 | 4,029 | ,772 |
| Centro Visite Salina di Cervia | 1297 | ,150 | ,224 | 1297 | ,014 | ,052 | 1297 | ,408 | ,394 | 1297 | ,279 | ,392 | 1297 | 4,230 | 1,026 |
| Chiesa di Sant'eufemia | 2421 | ,267 | ,194 | 2421 | ,021 | ,048 | 2421 | ,712 | ,189 | 2421 | ,613 | ,351 | 2421 | 4,461 | ,728 |
| Cokovac Monastery | 211 | ,178 | ,265 | 211 | ,006 | ,029 | 211 | ,300 | ,362 | 211 | ,246 | ,333 | 211 | 4,697 | ,699 |
| Croatian Littoral | 719 | ,143 | ,260 | 719 | ,009 | ,044 | 719 | ,258 | ,363 | 719 | ,190 | ,327 | 719 | 4,531 | ,834 |
| Faro del Porto | 134 | ,156 | ,110 | 134 | ,020 | ,040 | 134 | ,824 | ,108 | 134 | ,506 | ,367 | 134 | 4,157 | ,734 |
| Franciscan monastery | 12 | ,176 | ,130 | 12 | ,009 | ,030 | 12 | ,816 | ,120 | 12 | ,575 | ,441 | 12 | 4,333 | 1,155 |
| Frankopan Castle | 1293 | ,254 | ,307 | 1293 | ,014 | ,054 | 1293 | ,384 | ,367 | 1293 | ,303 | ,357 | 1293 | 4,415 | ,827 |
| Fulfinum Mirine | 264 | ,135 | ,228 | 264 | ,021 | ,072 | 264 | ,298 | ,368 | 264 | ,193 | ,324 | 264 | 4,311 | ,932 |
| Galesnjak Island | 179 | ,178 | ,301 | 179 | ,021 | ,113 | 179 | ,298 | ,382 | 179 | ,156 | ,312 | 179 | 4,60 | ,979 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | 9 | |
| Gangaro island | 19 | ,112 | ,288 | 19 | ,044 | ,190 | 19 | ,160 | ,334 | 19 | ,057 | ,273 | 19 | 4,737 | ,562 |
| Imbarcazioni Tradizionali | 12 | ,228 | ,323 | 12 | ,021 | ,073 | 12 | ,251 | ,317 | 12 | ,219 | ,404 | 12 | 4,667 | ,492 |
| Island of Krk | 1290 | ,475 | ,300 | 1290 | ,015 | ,067 | 1290 | ,510 | ,290 | 1290 | ,561 | ,313 | 1290 | 4,736 | ,671 |
| Island of Lošinja | 855 | ,188 | ,268 | 855 | ,007 | ,028 | 855 | ,328 | ,369 | 855 | ,318 | ,388 | 855 | 4,661 | ,742 |
| Katarina Island | 182 | ,200 | ,184 | 182 | ,016 | ,037 | 182 | ,630 | ,312 | 182 | ,518 | ,410 | 182 | 4,280 | ,965 |
| Magazzini Sale | 843 | ,198 | ,276 | 843 | ,005 | ,034 | 843 | ,340 | ,373 | 843 | ,274 | ,341 | 843 | 4,319 | ,886 |
| Museo Civico della Laguna Sud | 296 | ,161 | ,287 | 296 | ,006 | ,040 | 296 | ,249 | ,364 | 296 | ,198 | ,317 | 296 | 4,355 | ,879 |
| Museo Civico della NavigazioneFluviale | 223 | ,176 | ,238 | 223 | ,009 | ,031 | 223 | ,411 | ,386 | 223 | ,331 | ,398 | 223 | 4,475 | ,837 |
| Museo d'Arte sul Mare | 812 | ,170 | ,219 | 812 | ,013 | ,040 | 812 | ,468 | ,387 | 812 | ,378 | ,394 | 812 | 4,574 | ,652 |
| Museo della Marineria | 1654 | ,235 | ,251 | 1654 | ,009 | ,036 | 1654 | ,590 | ,347 | 1654 | ,453 | ,370 | 1654 | 4,580 | ,683 |
| Museo Storico Navale | 1243 | ,149 | ,192 | 1243 | ,028 | ,065 | 1243 | ,554 | ,375 | 1243 | ,317 | ,430 | 1243 | 4,200 | 1,055 |
| Palazzina Azzurra | 279 | ,116 | ,182 | 279 | ,013 | ,053 | 279 | ,391 | ,404 | 279 | ,219 | ,355 | 279 | 4,215 | ,943 |
| Piazza delle Conserve | 1186 | ,130 | ,220 | 1186 | ,007 | ,038 | 1186 | ,412 | ,417 | 1186 | ,238 | ,334 | 1186 | 4,418 | ,806 |
| Piazza Spose dei Marinai | 857 | ,131 | ,254 | 857 | ,011 | ,064 | 857 | ,261 | ,373 | 857 | ,167 | ,309 | 857 | 4,448 | ,823 |
| Porto Canale Leonardesco | 4508 | ,254 | ,184 | 4508 | ,010 | ,033 | 4508 | ,736 | ,182 | 4508 | ,630 | ,309 | 4508 | 4,668 | ,558 |
| Porto Turistico | 66 | ,214 | ,214 | 66 | ,016 | ,062 | 66 | ,559 | ,344 | 66 | ,495 | ,440 | 66 | 4,500 | ,809 |
| San Benedetto del Tronto | 3466 | ,236 | ,182 | 3466 | ,014 | ,041 | 3466 | ,621 | ,285 | 3466 | ,605 | ,377 | 3466 | 4,585 | ,685 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Santuario della Madonna Assunta | 22 | ,163 | ,121 | 22 | ,030 | ,054 | 22 | ,715 | ,253 | 22 | ,429 | ,491 | 22 | 4,773 | ,429 |
| Squero di San Trovaso | 319 | ,133 | ,167 | 319 | ,014 | ,032 | 319 | ,696 | ,339 | 319 | ,359 | ,368 | 319 | 4,524 | ,672 |
| St. Apolinar parish church | 27 | ,180 | ,275 | 27 | ,020 | ,050 | 27 | ,244 | ,314 | 27 | ,195 | ,454 | 27 | 4,407 | 1,010 |
| Torre Palane | 36 | ,224 | ,266 | 36 | ,019 | ,058 | 36 | ,535 | ,370 | 36 | ,430 | ,374 | 36 | 4,722 | ,513 |
| Torre San Michele | 1028 | ,129 | ,261 | 1028 | ,007 | ,066 | 1028 | ,243 | ,371 | 1028 | ,156 | ,288 | 1028 | 4,441 | ,816 |
| Torrei Gualtieri | 409 | ,151 | ,238 | 409 | ,008 | ,026 | 409 | ,413 | ,407 | 409 | ,270 | ,360 | 409 | 4,433 | ,722 |
| Zavicajni Muzej Biograd Na Moru | 24 | ,161 | ,168 | 24 | ,014 | ,041 | 24 | ,450 | ,371 | 24 | ,385 | ,413 | 24 | 4,333 | ,761 |

In the column "positive", "negative" e "neutral" it is reported, respectively, the distribution in percentage of the positive, negative and neutral components according to the sentiment indicator[11]. provided by Vader. The value of the compound index named "compound" represents the valence score defined as follow[2]: "It is a score assigned to the word under consideration by means of observation and experiences rather than pure logic.

- Consider the words 'terrible' , 'hopeless', 'miserable'. Any self-aware Human would easily gauge the sentiment of these words as Negative.
- While on the other side, words like 'marvelous', 'worthy', 'adequate' are signifying positive sentiment.

According to the academic paper on VADER, the Valence score is measured on a scale from -4 to +4, where -4 stands for the most 'Negative' sentiment and +4 for the most 'Positive' sentiment. Intuitively one can guess that midpoint 0 represents 'Neutral' Sentiment, and this is how it is defined actually too. […] Valence score of some context-free text are:

- Positive Valence: "okay" is 0.9 "good" is 1.9, and "great" is 3.1,
- Negative Valence: "horrible" is –2.5, emoticon ' :( ' is –2.2, and "sucks" and it's slang derivative"sux" are both –1.5.

The compound score is computed by summing the valence scores of each word in the lexicon, adjusted according to the rules, and then normalized to be between -1 (most extreme negative) and +1 (most extreme positive). This is the most useful metric if you want a single one-dimensional measure of sentiment for a given sentence.

As explained in the paper, in order to obtain a normalized value ranging from 0 to 1 the following normalization formula has been applied:

$$x = \frac{x}{\sqrt{x^2 + a}}$$

Where $x$ is equal to the sum of valence scores of constituents words and alpha is equal to the normalization constant (with default value of 15).

As it can be seen in table 5, the mean evaluation of the different Arca Adriatica groups of interest, given by the most relevant point of interests within the territory of each Arca Adriatica partner is around 4,5 on a scale ranging from 1 to 5.

**Table 5 - Groups of Interest: Descriptive Statistics for Evaluation in numbers**

| Group Of Interest | Evaluation in Numbers | | | |
|---|---|---|---|---|
| | Count | Mean | STD Deviation | Median |
| Batana | 2825 | 4,451 | ,767 | 5,000 |
| Cesenatico | 8205 | 4,591 | ,663 | 5,000 |
| San Benedetto del Tronto | 4557 | 4,560 | ,704 | 5,000 |
| Cervia | 4895 | 4,264 | ,940 | 5,000 |
| Porto Museo di Tricase - Ecomuseo di Venere | 136 | 4,618 | ,667 | 5,000 |
| Malinska-Dubašnica | 303 | 4,320 | ,945 | 5,000 |
| Tkon Municipality | 1911 | 4,458 | ,886 | 5,000 |
| Venezia | 3997 | 4,382 | ,873 | 5,000 |

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[1] 1 https://medium.com/ro-data-team-blog/nlp-how-does-nltk-vader-calculate-sentiment-6c32d0f5046b
[2] https://blog.quantinsti.com/vader-sentiment/#:~:text=Compound%20VADER%20scores%20for%20analyzing,1%20(most%20extreme%20positive).

| | | | | |
|---|---|---|---|---|
| LP – Primorje – Gorski Kotar County e Kvarner Region | 4792 | 4,551 | ,777 | 5,000 |

The analysis of the compound index distribution has signaled that parametric indicators (mean as measure of centrality and standard deviation as measure of variability) cannot be applied. Thus the median is used as a centrality measure and the interquartile percentile is used as a measure of variability. The analysis of the points of interest has been performed and in order to establish whether there are any median values non-significantly different the parametric test Mann-Whitney has been run in order to compare two independent samples.

**Table 6 - Points of Interests: Descriptive Statistics for compound index (order by median value)**

| Points of Interest | Compound | | | | | |
|---|---|---|---|---|---|---|
| | Count | Mean | STD deviation | Percentile 25 | Median | Percentile 75 |
| Zavicajni Muzej Biograd NaMoru | 15 | ,616 | ,357 | ,550 | ,7501 | ,840 |
| Museo d'Arte sul Mare | 528 | ,599 | ,318 | ,457 | ,6705 | ,842 |
| Museo della Marineria | 1381 | ,547 | ,327 | ,372 | ,6249 | ,818 |
| Museo Storico Navale | 909 | ,425 | ,448 | ,061 | ,5719 | ,785 |
| Maritime and History Museum | 295 | ,462 | ,357 | ,226 | ,5719 | ,748 |
| Imbarcazioni Tradizionali | 6 | ,570 | ,211 | ,459 | ,5709 | ,637 |
| Magazzini Sale | 458 | ,471 | ,341 | ,351 | ,4588 | ,754 |
| Casa Della Batana | 87 | ,388 | ,346 | ,000 | ,4215 | ,710 |

At this point the analysis of the group of interest has been performed (see table 7) and the different G.o.I. have been ordered by rank. Data concerning the eight museums (points of interest) have been excluded from the analysis. For the same reasons of the previously test, the parametric test Mann-Whitney has been run in order to compare two independent samples. the analysis comparing all the possible couples of group of interest has shown significant results. This means that there are no median values within the list ordered by rank that can be considered "not-significantly different". The analysis of all couples of values has always shown significant results. As it can be easily observed in table 7, the San Benedetto del Tronto group of interest shows the highest median value (.7955) and the Tkon Municipality group of interest exhibits the lowest median value (.4754).

**Table 7 - Groups of Interests: Descriptive Statistics for compound index (order by median value)**

| Group Of Interest | Compound | | | | | |
|---|---|---|---|---|---|---|
| | Count | Mean | STD deviation | Percentile 25 | Median | Percentile 75 |
| San Benedetto del Tronto | 3164 | ,677 | ,322 | ,598 | ,7955 | ,898 |
| Batana | 2575 | ,610 | ,339 | ,475 | ,7184 | ,863 |
| Porto Museo di Tricase -Ecomuseo di Venere | 100 | ,586 | ,356 | ,411 | ,7168 | ,872 |
| Cesenatico | 5504 | ,601 | ,311 | ,458 | ,6881 | ,844 |
| Cervia | 2682 | ,502 | ,382 | ,280 | ,5994 | ,807 |
| LP – Primorje – Gorski KotarCounty e Kvarner Region | 3014 | ,528 | ,339 | ,402 | ,5994 | ,785 |
| Venezia | 2441 | ,495 | ,347 | ,275 | ,5916 | ,772 |
| Tkon Municipality | 630 | ,398 | ,351 | ,000 | ,4754 | ,637 |

The analysis comparing points of interest (P.o.I.) and groups of interest (G.o.I.) has been conducted. Once again the Mann-Whitney non-parametric test for independent groups has been run. The column labeled with "p-level" shows whether the test is significant with respect to a significance level of 95% (p < 0.05). In the "comparison" column it can be identified the type of relationship between P.o.I. and G.o.I. when the p- test is significant. It can be noticed that in the case of Porto Tricase there isn't a significant difference between the median value of the respective P.o.I. and G.o.I. The median value of Tkon P.o.I. is significantly higher than its G.o.I. In all the other cases the G.o.I. exhibit higher median values than their respective P.o.I.

**Table 8 - Comparison between points of interest and groups of interest**

| | | Compound | | |
|---|---|---|---|---|
| | | Median | p-level | Comparison |
| Batana | GoI: Batana | ,7184 | <0,001 | GoI>PoI |
| | PoI: Casa della Batana | ,4215 | | |
| Cesenatico | GoI: Cesenatico | ,6881 | <0,001 | GoI>PoI |
| | PoI: Museo della Marineria | ,6249 | | |
| San Benedetto | GoI: San Benedetto del Tronto | ,7955 | <0,001 | GoI>PoI |
| | PoI: Museo d'Arte sul Mare | ,6705 | | |
| Cervia | GoI: Cervia | ,5994 | ,001 | GoI>PoI |
| | PoI: Magazzini Sale | ,4588 | | |
| Porto Tricase | GoI: Porto Museo diTricase | ,7168 | | GoI PoI not significantly |
| | | | n.s. | |

| | | | | | |
|---|---|---|---|---|---|
| | PoI: Imbarcazioni Tradizionali | ,5709 | | different |
| Tkon | GoI: Tkon Municipality | ,4754 | | |
| | PoI: Zavicajni MuzejBiograd Na Moru | ,7501 | ,006 | PoI>GoI |
| Venezia | GoI: Venezia | ,5916 | 0,04 | GoI>PoI |
| | PoI: Museo Storico Navale | ,5719 | | |
| Lpprimorje | GoI: Lpprimorje | ,5994 | | |
| | PoI: Maritime and HistoryMuseum | ,5719 | ,002 | GoI>PoI |

It has then been performed a correlation analysis between the compound index of each point of interest and the respective data on the tourists arrivals. Given that the compound index follows a not-normal distribution a Rho of Spearman correlation test has been performed (Gauthier, 2001; Wissler, 1905).

**Table 9 - Spearman correlation between the 8 P.o.I. and the arrivals**

| | | | Arrivals | Compound |
|---|---|---|---|---|
| Spearman Rho | Arrivals | Coefficient of correlation | 1,000 | -,429 |
| | | Sig. (2- | . | ,289 |
| | | code)N | 8 | 8 |
| | Compound | Coefficient of correlation | -,429 | 1,000 |
| | | Sig. (2- | ,289 | . |
| | | code)N | 8 | 8 |

As it can be noticed in graphic 1, the dot in the upper part of the graphic represents the "Museo Storico Navale" of Venice. Because of the very high number of visitors and the relative higher number of reviews with respect to the other P.o.I., it is considered an outlier. The correlation index in this first run of the analysis is not significant (.289).
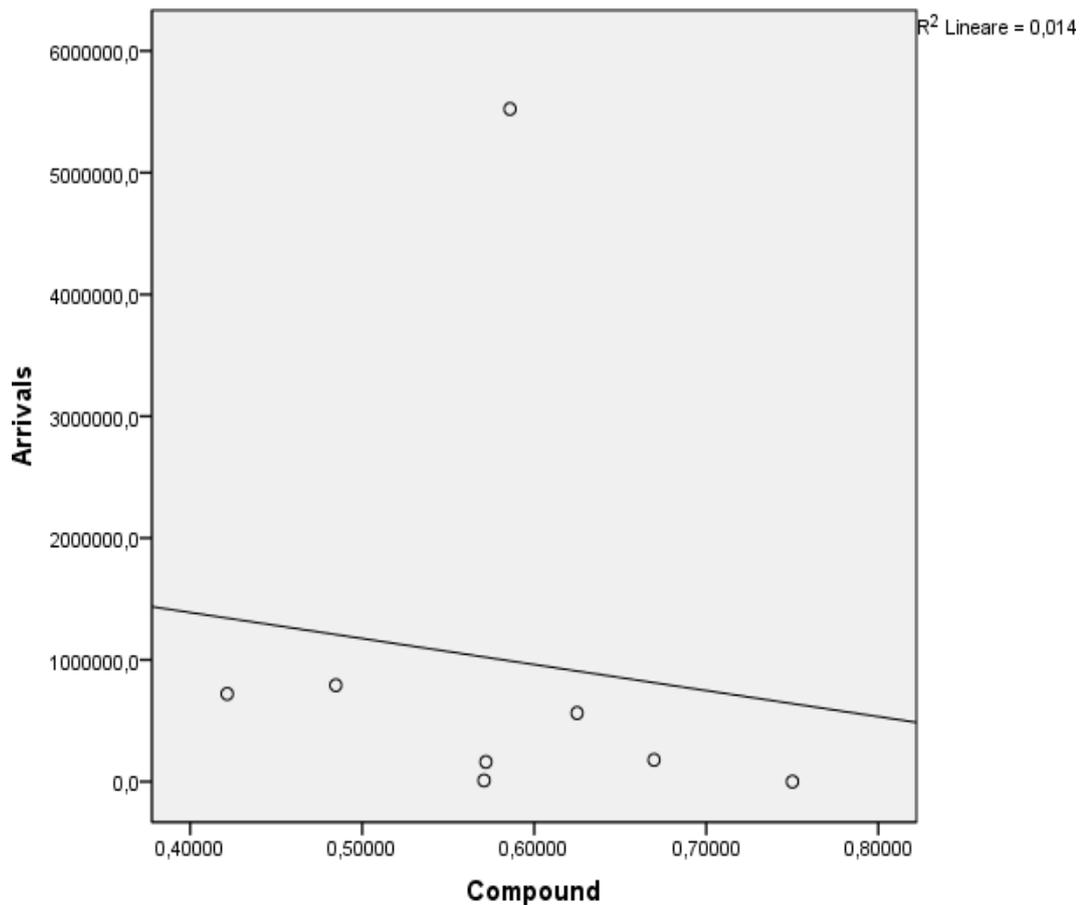
**Graphic 1- Correlation chart between the 8 P.o.I. and arrivals**

The Point of Interest of "Museo Storico Navale" shows many more reviews than the other point of interest and may represent a problem in order to reach a significant correlation index. Even eliminating it from the analysis the results show that the correlation test Rho of Spearman (Croux & Dehon, 2010) is not significant but very close to be significant (p = 0.119) showing a clear tendency toward an inverse proportionality ratio(Rho = 0.643).

**Table 10 - Correlation test Rho of Spearman between arrivals and compound index (= sentiment)**

|  |  |  | Arrivals | Compound |
|---|---|---|---|---|
| Spearman Rho | Arrivals | Coefficient of correlation | 1,000 | -,643 |
|  |  | Sig. (2- | . | ,119 |
|  |  | code)N | 7 | 7 |
|  | Compound | Coefficient of correlation | -,643 | 1,000 |
|  |  | Sig. (2- | ,119 | . |
|  |  | code)N | 7 | 7 |

Preliminary results highlight the negative correlation between the visitors' eWOM valence relative to each maritime heritage museum and the attractiveness of the city in which the museum is located. By analyzing the eWOM valence of the most important tourist attractions in each of the cities hosting the Arca Adriatica museums, we show a clear trend demonstrating that the more the visitors of the city (arrivals), the less the eWOM valence attributed to the relative maritime museums (see graphic 2).
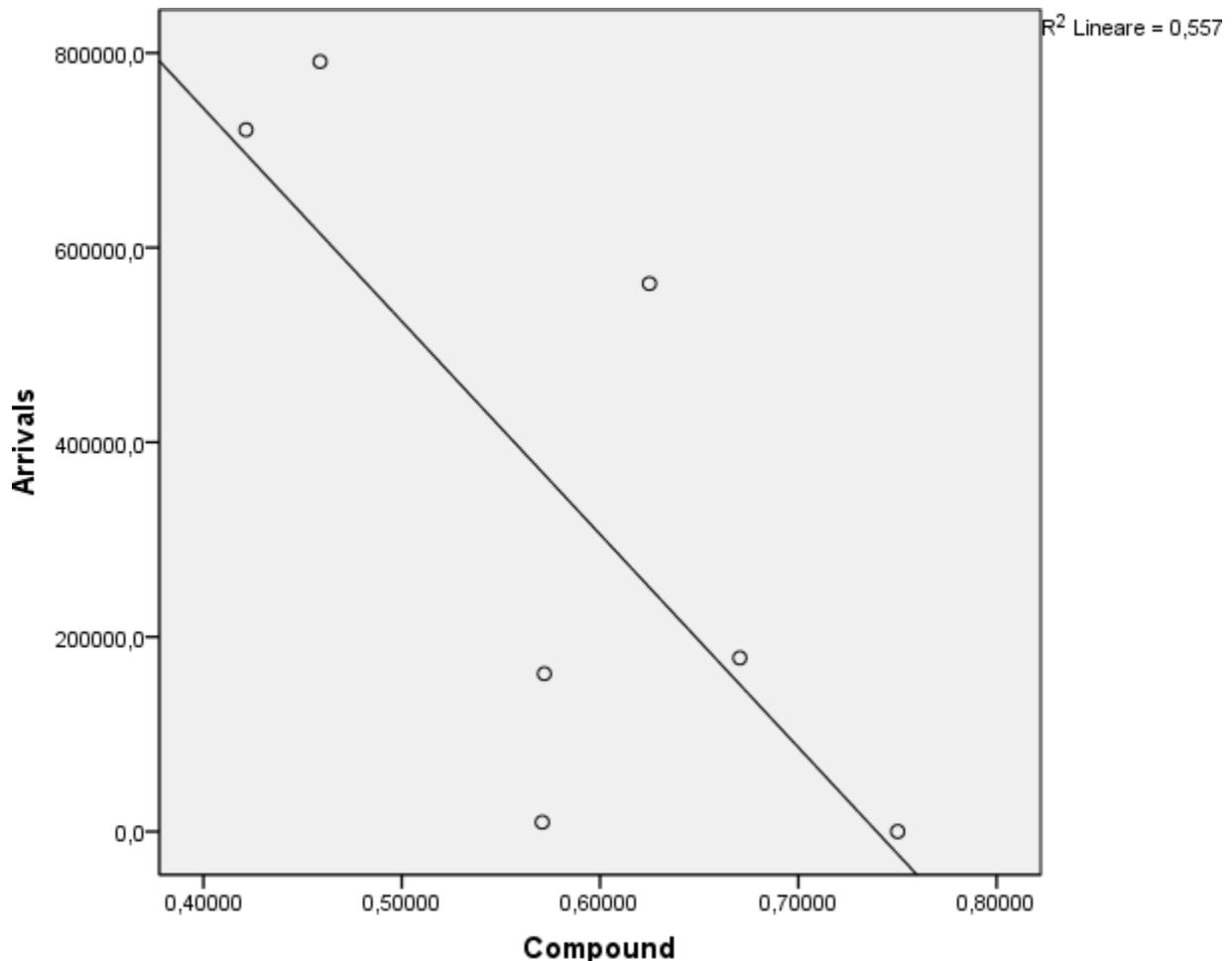


**Graphic 2 - Negative correlation between arrivals and sentiment**

In the attempt to interpret the negative correlation between the attractiveness of the tourist destination context (represented by the yearly arrivals of the city) and the museum visitors satisfaction (represented by the eWOM valence, i.e the number of stars attributed to the museum) shown in Figure 1 many hypothesis were formulated. The first element to consider is that the most important tourist destinations have a wide variety of museum options for their visitors, while less important tourist destinations have a less to offer in terms of museum choices. In other words highly touristic cities are characterized by a higher competition between museums, while smaller and less attractive city centers are characterized by a low level of competition between museums. It is our opinion that in a highly competitive environment (wider choice) most of the visitors will be very well informed and interested in the maritime history, while in a lowly competitive environment (less choice) occasional visitors and casual tourist will choose to visit the maritime museum with a greater proportion. For example, in a city like Venice if a visitor chooses to visit the "Museo Storico Navale" they renounce to visit more than a hundred between museums (47), monumental sites and temporary exhibitions. In a small town (i.e Cesenatico or Tricase) the local maritime museum has a good chance to be the most important cultural attraction in the neighborhood. It is reasonable to expect from highly interested and motivated

visitors passionate for maritime history a higher level of expected performance as they have previous knowledge of the matter. Occasional visitors have lower expectations and thus it will be more likely for them to end up satisfied about their maritime museum visit. Theoretically speaking we refer to the theory concerning the moderating role of competitiveness on the relationship between satisfaction and results (Jones and Sasser, 1995) where results can be represented by customer loyalty but also by the quality of the museum. The theory states that in high competitive environments the level of satisfaction has to be higher in order to produce positive results in comparison with low competitive environments.

Another promising finding concerns the attributes of the maritime heritage museum experience that influence the eWOM valence. These attributes turn out to be different with respect to those of fine arts museums (Zanibellato, Rosin, & Casarin, 2018). On the basis of these results, strategic and operative recommendations will be provided to support the marketing process in order to better design the offering within museum networks in the maritime heritage field.

Furthermore, the second phase of the research, aimed at certifying the reliability of the of the most relevant variables influencing the eWOM valence, gave a positive result. The two researchers, who independently analyzed the 951 reviews, achieved a Krippendorff's Cu /cu-alpha coefficient of 0.808. A valid coefficient to certify the reliability of the analysis. In Fact, social scientists commonly rely on data with reliabilities $\alpha \geq 0.800$, consider data with $0.800 > \alpha \geq 0.667$ only to draw tentative conclusions, and discard data whose agreement measures $\alpha < 0.667$.

This result is important as it confirms the reliability of the coding model and its replicability to deepen the research field.

Important strategic and operative recommendation emerged from the qualitative data analysis of the reviews content. By referring to each museum of the Arca Adriatica network, beside the overall appreciation expressed through 1-5 stars, specific elements contribute to provide an overall analysis of the museum network. For example, one of the most highly rated museums in the network - Museo d'Arte sul Mare in San Benedetto del Tronto Italy - has received critics from two different groups of customers. One group pointed out that after twilight there is not enough lightning to read the labels of the work of arts positioned along the pier walk. For example:

"*I recommend walking during the day, because at night the lighting is poor.*"

The attention of this group of visitors is mainly addressed to the works of arts collection. Another group maintains that the lightning is just perfect and that in this way it preserves the right atmosphere of the romantic walk along the sea pier. For example:

"*The idea is to create a "yard art" outdoor exploiting the masses of the walk to the red light is excellent.*"

This group is more focused on the environment and its romantic and dreaming atmosphere. The two groups of visitors show different attitudes and advance antithetic requests.

In this case, the management has to face a marketing decision: to please one group or the other. A specific audience study is then required to support this decision but the eWOM analysis clearly highlights this problematic and helps the shaping process of the museum's value proposition.

On the other hand, most criticisms converge pointing out the poor maintenance of the work of arts exposed to the atmospheric factors, implicitly denouncing a lack of investment for the preservation of this open air museum collection.

"[...] *and you enjoy it or not  the state of preservation of these works lets you down*"

Through the qualitative in depth analysis of the eWOM it is possible to distinguish among two segments of museum visitors: one referring to the mature part of the market with customers that are informed and well acknowledged about the nature of the tourist product proposed, and the tourist segment, referring to an audience who is not informed about the product offered and who, very likely, has not yet consumed similar product before. In cases like this a multiple marketing approach is recommended by the contemporary marketing practices (Coviello et al, 2002; Vassileva, 2017). The first segments, should be addressed primarily through a relationship marketing approach

(Gummesson, 2017; Gummesson, 2011), with the goal to develop a long term loyalty relationship with the relative target customers. Such type of potential museum visitors usually attend maritime festivals, such as Brest International Maritime Festival, Oostend Maritime Festival, La Semaine du Golfe de Morbihan de Vannes, Irish Maritime Festival at Drogheda Port, Great Yarmouth Maritime Festival, Baltic Sail Festival, etc. Then, the recommendation for museum networks like Arca Adriatica is to take advantage of their overall size to legitimate their presence and gain visibility among European maritime events in order to attract and redirect maritime passionate customers to visit the museums of the network.

From a methodological perspective, the findings of the present study are aligned to confirm that automatic sentiment analysis is useful only if combined with manual text analysis in the field of museums and maritime heritage exhibitions. Discrepancies identified through the assessment of the automatic sentiment analysis results led the research team to conduct further inquiries. Our conclusions point out that automatic sentiment analysis can actually provide valuable preliminary results useful to identify a path to be verified by means of subsequent manual text analysis. Low levels of accuracy in the automatic analysis of the Arca Adriatica museum network negatively impact on finding reliability.

**Conclusion**

The aim of the paper was to analyse the emerging museum network Arca Adriatica through the relative electronic word of mouth (eWOM). Starting from the results obtained, interesting lines of future research are opened.

Relevant strategic and operative managerial options emerged together with some methodological warnings relative to the use of sentiment analysis. If the sentiment analysis can be considered a very efficient method to automatically interpret huge volumes of textual data, its effectiveness has to be followed up by human intervention to prevent significant misinterpretations.

The present study should proceed with a further qualitative data collection and analysis. Personal semi-structured interviews addressing the most relevant decision makers within the museums of the Arca Adriatica network represent the next step to triangulate our findings in the four following areas. Without informing the interviewees about the results of the present study - in order to not to cause any bias - we would like to inquire the following aspects:

- perception gap: what museum visitors perceive with respect to what the management does
- the added value, weaknesses and strengths of being in a museum network rather than playing as an "isolated" museum
- strategies and courses of action planned to improve the single museum's current situation
- managers' reactions to the main criticisms reported in the museums' reviews by customers.

Another possible development of the research concerns the measurement of the level of motivation and expertise of the maritime museum visitors with respect to the competitiveness of the touristic contexts in which the museums are located. The results of such analysis could predict the average level of museum visitors satisfaction allowing a deeper knowledge of this particular audience.

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