The application of web-tracking method for research of local government units' websites utility

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Abstract **-** One of the basic qualities of the region's development Is an information technology, where is the information technology playing essential and vital role in the development of the region. Especially at this time the information technology, it is making progress be developed in the field of Internet and information society, which is makes governments trying hard to improve the interface of electronic Web Pages and makes it suitable for future requirements. As yet, however, there is no constant standard in local government interfaces of the sort used by investment companies to attract investors, customers and other companies. On the other side, the interfaces of local governments do not meet the following requirements. We have analyzed the information of Polish local government web sites because we did not find the ideal qualities required, and that satisfy the requirements of successful websites in the world. The essential goal of this study, is developing Polish local government websites to be more adequate, efficient and Usability for the foreign investor in Poland. The study also aims is extracting a good quality and characteristics from websites to be circulated to the other websites.
Keywords: local government website, web-tracking, information architecture, Usability website, knowledge-base

1   Introduction

The goal of the following protocol is to provide methodological recommendations of optimize Polish local government websites dedicated to foreigner investors in the Polish cities. The study focuses on analyzing and improving the usability usually carried out in relation to commercial online systems such as electronic trading systems, social websites, e-banking or tourist systems. This Study is testing a service facility of Polish local government websites in terms of economic usability for foreigners visiting Poland for tourism, investment and business. The model of structured content focused on improving the information architecture and usability testing. The proposed method allows the selection of the optimal procedure in the local governments in order to achieve an adequate range of information and content provide adequately to the users' needs. The range of design includes the organizational process, navigation project and outlining search systems that would assist the user with obtaining information. The role of study is to help decision-makers to identification of specific website quality lacks. One of the problems of Polish local government websites involved with localization and language selection, which can bear upon the usability of a website. For example, we observed that some city websites have much more information in the Polish language than in English, and increase frustration for foreigner users. In addition, some websites use textual translation engines, which gives results in limited and weak translations.

Previous research has also shown that a user may become frustrated when page-load times exceed 8 to 10 seconds without feedback.

Another problem involves user behavior in different cultures. Some foreigners users have extensive internet experience and some have less, and their interests seriously. French people have different interests from people from the U.S., for example, and both have different interests from Middle Eastern people.

- In the use of multivariate methods analysis, Comparative studies Internet service facility in researching gives us ready to perform the scheduling of the local government websites in terms of usefulness of information for foreigners visiting the Polish local government web site.

- The use of web tracking method in the knowledge base integrated with a web browser can Opportunities and to identify and assess the quality of service information website.

Link methods of analysis multivariate and measurement data allows the development of information structures, which can be more efficient and enhance the interface of Polish local government websites.

Designing complex internet systems requires consideration of a set of functional aspects. Utility, which identified as an attribute specifying the ease of using interactive devices and applications, is becoming increasingly influential. Local government websites usually have different specification and objectives. A study conducted in this area is not as widely implemented as in commercial systems. Recently available publications have exhibited new dedicated research which focuses on systems of certain cities or regions. They can be a decisive factor for foreigners choosing a holiday destination, businessmen looking for investment locations

or potential students choosing the place of their future education. Building information infrastructure based on well developed networks and shared database are the contemporary need and prerogative of public institutions. Consequently, The optimization and evaluate procedures in the Polish local Government website and quality of interfaces of cities in order to achieve an adequate range of available information and content relevant to the user's needs. As methods by which citizens can influence the extent of government failure at the local government level, both exit and voice have various limitations [6]. In the last few years, There still does not exist a consensus about how to evaluate the results of the investments in e-government projects. Because the fact that isn't all the results of the e-government innovation processes. On the other hand, the complexity itself of the concept of e-government makes it difficult to define an evaluation system that can be applied to all the areas covered by that concept (e-Democracy, e-Administration, e-Services) [4]. Joint development of the Internet is the process of interaction by a group of local governments cooperating. This process enables citizens to track and trace the status of the interface and access to the site and evaluate the application the modification on the site. [5]. The difference between a website with no visitors from the search engines and a website that is full of visitors from the search engines is optimal. Search Engine Optimization is the difference between loss and profit on the Internet in the local government website. [2]

2. Evaluating website local government:

Web site optimization focuses on how "computer programs" at Google and the other search engines will perceive your website with the goal of getting them to recommend (rankings) your website to as many people as possible who are searching for keywords relating to your products and services.

2.2 Website Design:

For most businesses, the best choice is a combination of both worlds. The website should be well optimized to get search engines and recommend websites. At the same time, the website needs to be well designed to convert "visitors" to buyers.

How to tell a Good Website Optimizer from a Bad Website Optimizer?

There is a few uncomplicated questions make it easy to differentiate between a good and poor website optimizer.

We have seen far too many people lose time, money and sometimes their dreams, because they hired a website company that failed to market their products and services successfully [3]. For years, many people assumed that websites were like magic because they saw the commercials and heard stories of people building websites and getting rich. Many people assumed when create a good website would be soon have lots of new clients wanting to buy your products and services.

The truth is that websites are not magic. A good website that attracts new clients from Google and the other search engines can make your company a substantial profit. On the other hand, a poor website was like putting your advertisement in last year's phone book after everyone has already thrown it in the trash.

3. Methodology:

3.1 1 Data Collect:

This Study is testing a service facility of Polish local government websites in terms of economic usability for foreigners visiting Poland for tourism, investment and business. The modeling and optimization of the structural content focused on improving the information architecture and usability testing. We Determined the main and sub-main factor in Polish local government websites for collecting data information. Given the limited analysis-oriented research which would also determine some standards for local governmental websites, the methodology proposed for this study is a comparative analysis. This method enables identification of model sites and specifying indicators of multidimensional-input evaluation from the point of usability and information access. In order to evaluate city websites, each of them should be assigned to certain variables that are necessary to determine their suitability. The variables should be selected in a way that would reflect the strengths and weaknesses of the chosen approach. The usefulness of the website to the visitors not residing in a given city has been considered into account. This could be tourists, potential investors, students, etc. The aims of the research is to comparative analysis of websites in selected Polish cities and performing their ranking by means of aggregative vector measurement.

The study involved the analysis of 20 cities, where the information published on the websites available in two languages: Polish, and English. Nine categories have defined, each of them classified into subgroups:

1. Education (kindergartens, elementary schools, middle schools, high schools, colleges, exchanging text books)
2. Tourism and tourist attractions (mountains, rivers, marine areas, forests, monuments, recreational areas, museums)
3. Hotels (4-5 star, 1-3 star hotels, guest houses, motels, youth hostels)
4. Restaurants (pubs and clubs, bars, cafés, casinos, restaurants)
5. Transportation (airports, parking lots, buses, taxi, airport, parking, trams, trains, railway, ticket Price)
6. Accommodation

7. Investments (investment offer, investment services, locations, information about investments, Investment incentives, IT, news and publications)

8. Health (medical hotline, pharmacies, first aid, dentists, English-speaking doctors, emergency Service)

9. Business (commerce Chamber, Business Center Club, economic zones, the city offers, conferences, business and marketing, information and publications)

Within each category, points on a scale of 0 .. 9 awarded, depending on the accessibility of information (By using arithmetic mean value). In this way, we have nine indicators has obtained. The comparative analysis of Polish city websites of aggregative vector measurement has been used.

We began by collecting data from Polish local government websites using 9 factors (education, tourism, investment, health, hotels, restaurants, accommodations, transportation, business). All factors subdivided into different properties ; for example, we have 7 categories related to investment that mean sub-factor (investment offers, investor service, location of investment, information about investment, investment incentives, IT, news and publications). We used a range from 0 to 9 to grade these categories, depending on how much information is available and how long it takes to access. Note that we extracted all information for two languages, Polish and English. All information collected in 2012.

The role of methodology is to help decision-makers to identify the determinants shortfalls in website quality. We created an electronic questionnaire system that finds and stores all user navigation (links Used), and recognizes the web page type using web tracking and a custom-built knowledge base. The system also records all answers with times for each question and stores all of them into a database for analysis.

Table (1): Shows collected data information for the main category in an English language website

Cites	Education	Tourism	Hotel	Restaurant	Transports	Accommodations	Investment	Healthy	Business
Poznan	0	9	9	9	9	5	7	0	0
Szczecin	2	5	9	9	0	0	4	0	0
Warsaw	0	3	2	9	3	2	0	2	5
Krakow	0	2	9	9	9	6	0	9	5
Wroclaw	0	0	0	0	0	0	0	0	0
Gdansk	0	9	9	9	9	9	5	0	5
Lodz	0	2	9	0	9	9	6	9	6
Bydgoszcz	0	5	0	0	1	1	5	5	5
Lublin	0	6	9	0	0	9	5	0	5
Katowice	0	7	0	0	6	0	9	0	9
Bialystok	6	5	0	0	0	0	3	0	3
Gdynia	0	3	0	0	0	0	3	0	0
Czestochowa	0	2	9	0	0	9	0	0	0
Sosnowiec	0	0	0	0	0	0	0	0	0
Radom	0	2	7	9	0	9	7	0	0
Kielce	0	3	6	0	0	6	4	0	4
Gliwice	2	2	4	9	0	4	5	0	0
Torun	2	0	9	9	0	9	2	0	0
Bytom	0	0	0	0	0	0	7	0	0
Zabrze	0	0	0	0	0	0	0	0	0

Table (2): Shows collected data information for the main category in a Polish language website.

Cites	Education	Tourism	Hotel	Restaurant	Transports	Accommodation	Investment	Healthy	Business
Poznan	9	7	9	9	9	9	9	7	5
Szczecin	4	7	8	5	0	0	9	0	0
Warsaw	9	7	4	9	0	4	0	4	2
Krakow	9	6	0	5	9	3	4	0	3
Wroclaw	8	3	9	5	9	9	0	7	8
Gdansk	8	6	9	0	8	9	9	3	5
Lodz	7	3	9	8	6	9	9	5	4
Bydgoszcz	9	3	9	0	7	9	4	5	6
Lublin	0	5	9	0	0	9	8	0	9
Katowice	9	3	4	0	0	4	9	0	3
Bialystok	9	6	4	7	8	4	3	5	2
Gdynia	6	3	0	0	8	0	7	0	0
Czestochowa	8	2	9	0	9	9	6	7	1
Sosnowiec	9	1	3	3	4	3	9	1	1
Radom	9	1	8	8	8	8	7	5	1

Kielce	8	3	5	0	5	5	4	3	6
Gliwice	9	9	4	9	4	4	4	3	5
Torun	1	5	9	9	1	9	8	0	5
Bytom	9	0	0	0	0	0	6	3	0
Zabrze	0	0	3	3	5	3	1	7	4

When we distinguish between (table 1) and (table 2) is clear to find that information in Polish language have much more information than English language. This is mean that local governments do not have an interest in an English language website .

2.3 Primary Questionnaire Form:

After creating 11 questions for three factors of interest (investment, business, tourism), The primary questionnaire form has been tested on people of various cultures in several countries (China, Malaysia, USA, UAE, Iraq, etc.). We selected 5 questions for each factor using a Laggard scale of 1 to 5 and input them into an electronic questionnaire system. The system had built by VB.net.

2.4 Web-tracking and Knowledge base system:

A typical test procedure for the construction of such a measuring method consists of five stages: (1) selection, (2) elimination and (3) normalization of variables, (4) determining the pattern and anti-pattern and (5) synthetic vector measurement. Elaborate model of user test by using electronic questionnaire system. We selected 8 cities for foreign and Polish users using the K-mean method and the Matlab code program. This method will give's Four groups of a city's website.

The system involved in working on knowledge base to recognize the web page type begin the process before the user do answer for each question. We selected three factors (investment, business and tourism) and built a database of keywords and root words for each factor. The system compares the words on a given webpage with the database to classify the web page as one of the three types.
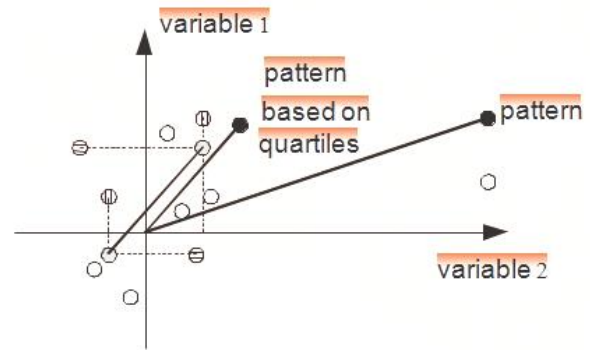
During the user exam, the system stores all navigation browsing for the user (user imprint) into a database, answers the questions (yes/no), time taken to answer, quality of answers (0–9), usability, friendliness, design, name of cities, the number of characters in the last web page accessed, number of links followed, webpage type, and date of registration entry.

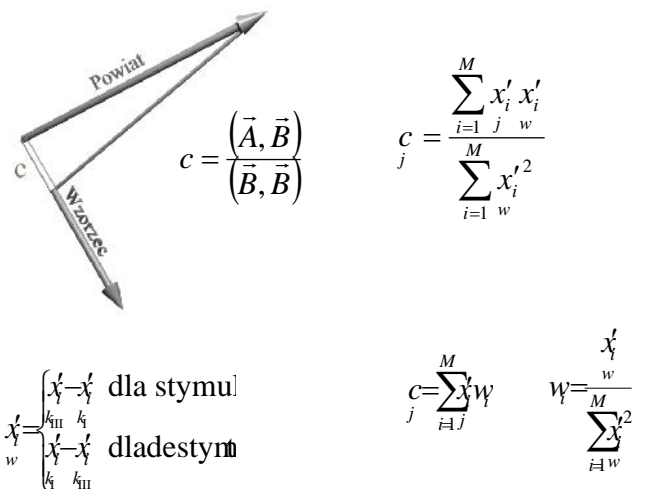PROPOSED SOLUTION STRUCTURE SYNTHETIC VECTOR MEASURE (1)
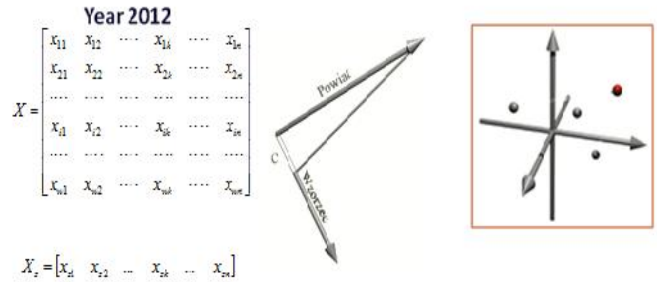
Fig(1): SHOWS PROPOSED SOLUTIONS DESIGN VECTOR MEASURE SYNTHETIC (1)

PROPOSED SOLUTIONS DESIGN VECTOR MEASURE SYNTHETIC (2)

Fig(2): SHOWS PROPOSED SOLUTIONS DESIGN VECTOR MEASURE SYNTHETIC (2).

$$c = \frac{(\vec{A}, \vec{B})}{(\vec{B}, \vec{B})} \qquad c_j = \frac{\sum_{i=1}^{M} x'_{ij} x'_{iw}}{\sum_{i=1}^{M} x'^2_{iw}}$$

$$x'_{iw} = \begin{cases} x'_i - x'_{k_{III}} & \text{dla stymul} \\ x'_{k_i} - x'_{k_{III}} & \text{dladestym} \end{cases} \qquad c_j = \sum_{i=1}^{M} x'_i w_i \qquad w_i = \frac{x'_{iw}}{\sum_{i=1}^{M} x'^2_{iw}}$$

fig(3): shows the implicit explorer worked and allows us to browse inside the electronic questionnaire system. More than 100 users of different cultures participated in the trial of the system.

The system involved in working on the knowledge base to recognize the web page type begin the process before the user do answer for each question. We selected three factors (investment, business and tourism) and built a database of keywords and root words for each factor. The system compares the words on a given webpage with the database to classify the web page as one of the three types.

During the user exam, the system stores all navigation browsing for the user (user imprint) into a database, answers the questions (yes/no), time taken to answer, quality of answers (0–9), usability, friendliness, design, name of cities, the number of characters in the last web page accessed, number of links followed, webpage type, and date of registration entry.

The following data is output by the system for analysis:

1. Username, age, nationality and date of initial registration
2. The name of a city represented by the website in question
3. Answers to questions (yes/no)
4. Breadth of information and ease of access, rated from 0 to 9 (0 = bad, 9 = excellent)
5. Number and name of links visited during the experiment time while the electronic questionnaire was active (user imprint)
6. Time has taken to answer each question
7. Number of characters on the last page viewed before answering
8. Web page types (investment, business, tourism)
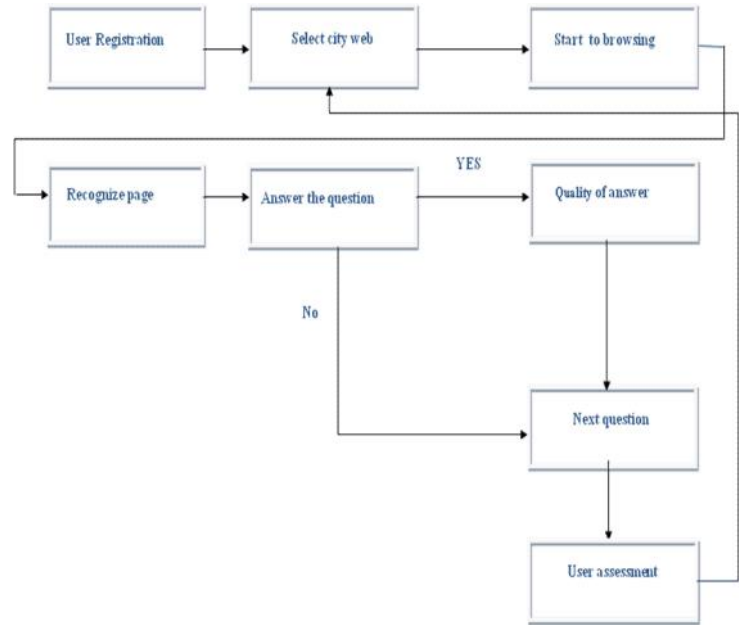9. Web site usability, friendliness and design, as evaluated by the user, also on a 0– 9 scale

Fig (4) : Shows Diagram of the electronic questionnaire system .

8 cities have been selected during test by foreign and Polish Users for analyzing, four Cities selected by using K-mean method and used Matlab code program to find city rank selection. This method divided into four Groups depending on the neighbors rank of this city's website.

K-mean provided 4 city from 4 groups, and we added additional 4 city because k-mean is not giving Szczecin and Warsaw in it. The suggestion is to added two cities to make more accurate in optimal result table (3,4) shows the rankings of cities with selection.

Table (3,4): Shows cities rank selection in two different language English and Polish.

Polish Language		English Language	
cities	City rank	cities	City Rank
Pozna	0.627918795	Gdansk	0.300890218
Łód	0.356818455	Łód	0.254301204
Wrocław	0.327098077	Kraków	0.246476613
Gda sk	0.256504776	Poznan	0.151361403
Radom	0.228583174	Radom	-0.158444048
Bydgoszcz	0.157219013	Lublin	-0.170852858
Cz stochowa	0.154811287	Katowice	-0.190982279
Gliwice	0.137088899	Toru	-0.248599483
Toru	0.11001893	Warszawa	-0.28296486
Białystok	0.087457734	Szczecin	-0.294884339
Lublin	-0.033613078	Gliwice	-0.342692366
Kielce	-0.112845762	Bydgoszcz	-0.361186167

Warszawa	-0.121313587		Kielce	-0.394656442
Kraków	-0.127732333		Cz stochowa	-0.474687161
Szczecin	-0.24010667		Białystok	-0.580116427
Sosnowiec	-0.246101711		Bytom	-0.723229225
Zabrze	-0.25567629		Gdynia	-0.747166266
Katowice	-0.307492287		Sosnowiec	-0.871013565
Gdynia	-0.423679691		Wrocław	-0.871013565
Bytom	-0.574957731		Zabrze	-0.871013565

Toru	0.11001893	-0.248599483
Warszawa	-0.121313587	-0.28296486
Wrocław	0.327098077	-0.871013565
Zabrze	-0.25567629	-0.871013565

Fig(5):Shows the K-mean result

🟥 Polish
🟨 English
🟦 Composite

3. Empirical study

Table (7): Shows the values of variables assigned to websites of Polish city in the Polish language.

Group No.	K-mean		Group No.	K-mean method
1	0.437278442		1	-0.204454645
2	0.161669116		2	-0.806687237
3	-0.399318711		3	-0.400667713
4	-0.180610215		4	0.20575736

1	Łód		1	Katowice
2	Bydgoszcz		2	Gdynia
3	Gdynia		3	Kielce
4	Kraków		4	Krakow

Table (6):Shows cities selected in the web-tracking system

Cities	Web Polish Language	Web English Language
Białystok	0.087457734	-0.580116427
Bydgoszcz	0.157219013	-0.361186167
Bytom	-0.574957731	-0.723229225
Cz stochowa	0.154811287	-0.474687161
Gda sk	0.256504776	0.300890218
Gdynia	-0.423679691	-0.747166266
Gliwice	0.137088899	-0.342692366
Katowice	-0.307492287	-0.190982279
Kielce	-0.112845762	-0.394656442
Kraków	-0.127732333	0.246476613
Łód	0.356818455	0.254301204
Lublin	-0.033613078	-0.170852858
Pozna	0.627918795	0.151361403
Radom	0.228583174	-0.158444048
Sosnowiec	-0.246101711	-0.871013565
Szczecin	-0.24010667	-0.294884339

Towns	Education	Tour ism	Hotels	Restaurants	Transport	Accommodations	Investments	Health	Business
Białystok	9	6	4	7	8	4	3	5	2
Bydgoszcz	9	3	9	0	7	9	4	5	6
Bytom	9	0	0	0	0	0	6	3	0
Cz stochowa	8	2	9	0	9	9	6	7	1
Gda sk	8	6	9	0	8	9	9	3	5
Gdynia	6	3	0	0	8	0	7	0	0
Gliwice	9	9	4	9	4	4	4	3	5
Katowice	9	3	4	0	0	4	9	0	3
Kielce	8	3	5	0	5	5	4	3	6
Kraków	9	6	0	5	9	3	4	0	3
Łód	7	3	9	8	6	9	9	5	4
Lublin	0	5	9	0	0	9	8	0	9
Pozna	9	7	9	9	9	9	9	7	5
Radom	9	1	8	8	8	8	7	5	1
Sosnowiec	9	1	3	3	4	3	9	1	1
Szczecin	4	7	8	5	0	0	9	0	0
Toru	1	5	9	9	1	9	8	0	5
Warszawa	9	7	4	9	0	4	0	4	2
Wrocław	8	3	9	5	9	9	0	7	8
Zabrze	0	0	3	3	5	3	1	7	4

When creating a pattern and anti-pattern all the variables were taken as stimulants. Table (7) shows the value of measurement for individual cities. The city of Poznan has the best website. It is clear that the value of measurement for this website significantly varies from all the others. The pieces of information in the examined categories were available on this site. Therefore, this website can be considered exemplary. The two subsequent cities characterized by a much smaller value of measurement, but their sites are similar to each other. The worst websites are those of Bytom and Gdynia. This is mainly due to lack of information in most of the categories. Similar calculations were made for WebPages in English. Table number (8) shows the values of indicators for individual cities. Table (8). The Values of variables for websites in English.

Towns	Education	Tourism	Hotels	Restaurants	Transport	Accommodation	Investments	Health	Business
Białystok	6	5	0	0	0	0	3	0	3
Bydgoszcz	0	5	0	0	1	1	5	5	5
Bytom	0	0	0	0	0	0	7	0	0
Cz stochowa	0	2	9	0	0	9	0	0	0
Gda sk	0	9	9	9	9	9	5	0	5
Gdynia	0	3	0	0	0	0	3	0	0
Gliwice	2	2	4	9	0	4	5	0	0
Katowice	0	7	0	0	6	0	9	0	9
Kielce	0	3	6	0	0	6	4	0	4
Kraków	0	2	9	9	9	6	0	9	5
Łód	0	2	9	0	9	9	6	9	6
Lublin	0	6	9	0	0	9	5	0	5
Pozna	0	9	9	9	9	5	7	0	0
Radom	0	2	7	9	0	9	7	0	0
Sosnowiec	0	0	0	0	0	0	0	0	0
Szczecin	2	5	9	9	0	0	4	0	0
Toru	2	0	9	9	0	9	2	0	0
Warszawa	0	3	2	9	3	2	0	2	5
Wrocław	0	0	0	0	0	0	0	0	0
Zabrze	0	0	0	0	0	0	0	0	0

While standardizing, the average value and standard deviation calculated for the websites in the Polish language consider to represent the average value and standard deviation. Similarly, the adopted pattern was the same pattern as the pattern for the websites in Polish language. Thus, the measure in both studies can be related to each other. The results of calculations presented in Table 3,4. It is clear that most cities do not pay close attention to the English versions of their websites. The value of measurement for the website of Poznan, the best in the previous list almost reached zero. In the previous table, the website of Poznan would be placed among average websites. Wroclaw, along with Zabrze fell from third to the last place on the ranking list. This results from the lack of information from the analyzed categories in English. Unique page is that of the city of Gdansk since the value of measurement for the English version of this website is higher than that of its Polish counterpart. This reveals a huge effort of the rulers of this city to attract foreign tourists.

4. Conclusion

The article presented a comparative analysis of selected websites of Polish cities in three languages: Polish, English and German. The analysis was based on a synthetic vector measure. In some cases, the analyzed websites of the cities turned out to be insufficient, especially when it comes to foreign languages. A lot of cities did not publish any useful piece of information for foreigners (in the analyzed categories). Along with which one would expect a large number of foreign tourists. Such research could enable developing a standardized website for the local government unit. Positively influence the position and perception of Polish cities in relation to other cities around the world.

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