
Application of Text Mining in the Analysis of Relations between Military Units and Local Government Units

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Abstract:

Purpose: The aim of this article is to determine how the local governments of medium-sized cities see a military unit located on their territory in the context of its participation in social and economic processes.

Design/Methodology/Approach: The article presents the results of a research carried out using the diagnostic survey method, utilising the interview technique. For the analysis of the collected material and presentation of the results, the methods of Text mining as well as R v.3.6.1 program and RStudio editor were used.

Findings: The use of text mining for the analysis of links between military units and local government units allowed to deepen the knowledge on the significance given by local government representatives to the presence of the army and its impact on socio-economic processes in specific territorial units.

Practical Implications: The results of the research can be used in designing local development strategies and creating conditions for local agents to work together for development. In addition, they can be used to better understand the links between local governments and military units, by decision makers at the central level.

Originality/Value: The results of the research indicate the possibility of using text mining for the analysis of complex links identified between entities on the territory of communes. Text mining allows to combine a qualitative and quantitative approach, in the context of identifying the impact of individual entities on the development of the commune and creating meanings in the process of interaction between entities located on its territory.

Keywords: Military units, local government, development challenges, Text mining.

JEL classification: J18, J53, R11, R58.

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1. Introduction

The Local development is defined as a process of diversification and enrichment of economic and social activity in a given territory, which consists in amassing and coordination of resources and energy (Bessiere, 1998; Coffey and Polese, 1985; Jewtuchowicz, 2005; Johannisson and Nilsson, 1989; Trigilia, 2001) and as a process of changes "taking place in a given local arrangement, taking into account the needs, preferences and hierarchy of values inherent in that arrangement" (Kogi and Di Martino, 1995; Parysek, 1996; White *et al.*, 2001). The factors of local development include the economic, social, technical, technological and environmental-spatial ones. Their role has changed over the years, which is also reflected in the transformations occurring in particular places, in local space. From the subjective point of view, military units are also considered as a factor that may affect the development of particular places in the local space (Coffey and Polèse, 1984; Bellandi, 2001; Lackey *et al.*, 2002; Wong, 1998).

The above considerations and the awareness that the relations between the military unit and the local environment (Kearney, 1995), on the one hand, are complex and, on the other hand, are often overlooked inspired the authors of the article, who have been conducting research aimed at identifying the relations between the military units and entities located (Paasi, 2008; Vardoulakis *et al.*, 2003) on the territory of communes since 2010 (local authorities, businesses, educational institutions, NGOs, etc.). The findings so far show that the influence of a military unit on the pace and intensity of processes in the local economy and community activity depends on the size of the military unit and its character, the size of the commune, its structure and nature of economic activity, population potential and its location in the country (Piotrowska-Trybull, 2013; Sirko *et al.*, 2019). In the source literature, the presence of military units on the territory of communes is considered as a sign of state interventionism (Andersson and Lundberg, 2007; Paloyo *et al.*, 2010). In those places where the military is located, a mechanism of cumulative causality may be activated (Myrdal, 1958) manifesting itself in certain changes in the territory (Malmberg *et al.*, 1996). Thus, although the activities of military units, which are a component of the armed forces, are aimed at effectively ensuring external security for the general public, their presence on the territory of the communes contributes to the potential of these places (Gondusky and Reiter, 2005).

Analysing the development factors in particular territories, one should take into account the population and economic potential of a given locality, in particular the economic structure of entities located there, as well as social bonds which are the basis for building social capital. It needs to be stressed that the potential, size and attractiveness of a locality is an important parameter affecting the development potential of a particular place in space and the ability to respond to contemporary technological, climatic, social and economic and other similar challenges (Leigh and Blakely, 2016). In this context, the results of the forecast of the Polish Academy of Sciences are interesting, indicating that almost half of medium-sized cities in Poland

are at risk of marginalisation and crisis phenomena (Muschett, 1996). The negative phenomena in these centres include depopulation of cities, disintegration of social ties, intensified migration for work, weakening of the economic (including industrial) structure, lack of capital for investments (EUROSTAT, 2019; Kuźmiński *et al.*, 2020; Olkiewicz *et al.*, 2020).

In view of the above, while continuing the research, at this stage the focus shifted towards determining how the local authorities of medium-sized cities perceive the military (Lackey *et al.*, 2002) unit located on their territory, and in particular, to what extent the stationing of a military unit in a medium-sized city supports development processes and allows to counteract the aforementioned negative phenomena. The results were compared with those obtained at earlier stages of analyses.

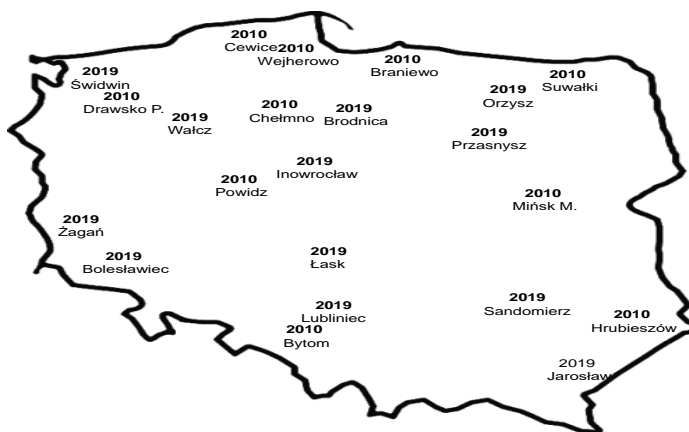
2. Materials and Methods

The survey, which sought to learn the opinions of local government representatives on the impact of military units stationed on their territory on the socio-economic situation in their communes, was carried out in 2010 and 2019 (Berman, 2019). The communes where the military units were located were selected based on the Regulation of the Minister of National Defence of 24 November 2009 *on the creation of garrisons and the definition of tasks, seats and territorial range of jurisdiction and their commanders* (Journal of Laws No. 206, item 1592).

Interviews (structured, in-depth) with representatives of local governments, in 2010, were conducted in ten communes, and in 2019, in twelve communes (Figure 1). During the interviews, the respondents expressed their opinion on the relationship between the military unit and the local government unit, in social, economic and environmental terms. Each of the respondents was asked questions in a fixed order and the interviewer, if necessary, asked more detailed questions. The interviews were varied in terms of their duration, which resulted, among other things, from the fact that in some of them, the respondents outlined the municipal profile in great detail and described its current social and economic situation. The information about the social and economic situation in their communes was supplemented by information obtained from the websites of the Central Statistical Office – Local Data Bank.

The interviews were recorded, which allowed for their later transcription. Consequently, a separate text file was created based on each interview (Xia and Shao, 2005). The content of each file was translated into English and placed in separate files with txt extension, also called the documents. A document is a specific piece of text, a single sentence, the said file, or a larger study. A set of documents forms a corpus (Provost *et al.*, 2015). The interviews that were conducted in 2010 formed the first corpus and the interviews conducted in 2019 constituted the second one.

Figure 1. Location of communes where interviews were conducted in 2010 and 2019



Source: Own study.

Prior to the relevant analyses, the texts were cleaned up and prepared for further transformations. All characters except for letters were removed, and upper case letters were changed to lower case. Useless/stopwords were also removed. The remaining words have been reduced to the basic version. In the next step the texts were converted to a data matrix (documents-terms). Elements of the matrix represented the meaning of words in individual documents. In the next steps the frequency of occurrence of words in particular interviews (documents) was calculated, correlation between terms was determined, sentiment analysis and thematic modelling was performed. These issues are presented in more detail in the works of (Freeman and Ross, 2018; Gągolewski, 2016; Grolemond and Wickham, 2018; Kwartler, 2017; O’Neil and Schutt, 2013; Provost *et al.*, 2015; Silge and Robinson, 2017).

The analysis of the interviews was conducted using the R v.3.6.1 program and the RStudio editor. Word Clouds and bar and line diagrams were used to illustrate the analysis results. In Word Clouds drawings, the frequency of word occurrence affects its size – the more often it appears, the bigger it is. Word clouds were generated with the same settings as for the minimum number of word occurrence in the corpus. The article does not include all graphs, e.g. dendrograms, which were obtained during cluster analysis.

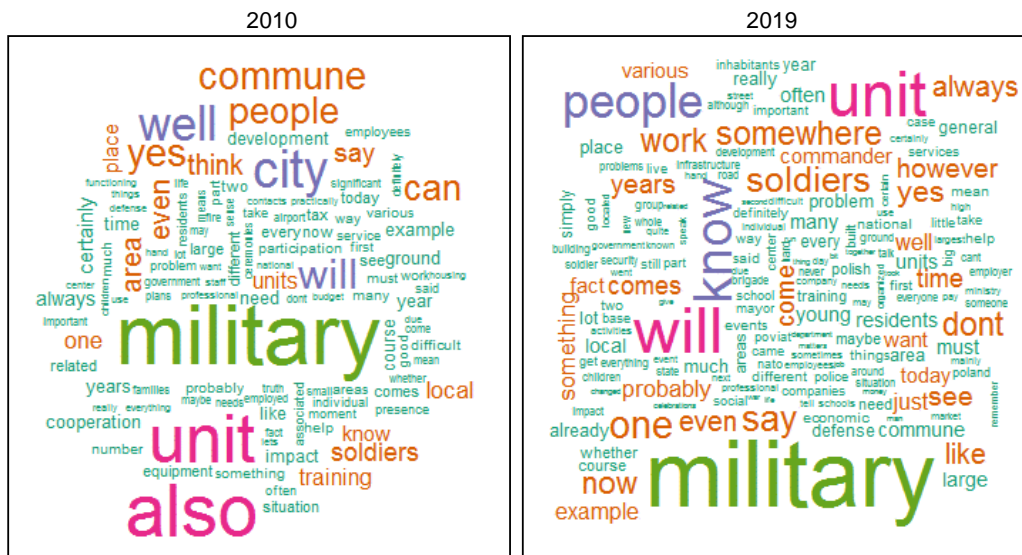
Taking into account the fact that the duration of interviews, and thus the number of words in particular documents were not the same, the results were placed on a single scale (Figure 7 and Figure 9) to better illustrate the distribution of emotions during the interview. The analysis of texts (Figures 2-10) was based on the solutions presented in the cited studies, especially in the works of (Silge and Robinson, 2017; Grolemond and Wickham, 2018) and presented on the Internet, e.g. (Murphy, 2017).

3. Results

3.1 Meaning Given to the Military Unit by Local Government Representatives

In the statements of the persons interviewed, words describing the military unit in the commune, including its interaction with the local community, often appeared. Figure 2, in the form of a cloud of words, shows the words that most often appeared in the first corpus (2010) and second corpus (2019). The names of cities were deliberately removed from the corpus.

Figure 2. Words in the corpus that occurred at least 20 times



Source: Own study.

Words used by respondents to describe a military unit, which is one of the local agents in the commune, reflect their understanding of the essence of the army and its role in the local government community. The importance ascribed to a military unit is connected with its basic function, namely guaranteeing citizens' safety and building trust in the institutions of the state determined by the effectiveness of training, education of soldiers fostering the features necessary in service and equipment of units (Shamir and Ben-Ari, 2002). This is indicated by the use of the following words: *training, course, defence, equipment, professional, truth, ceremonies, security*. Another importance attributed to the entity is related to its role in the commune as: an employer, a tax payer, a service provider and a principal of works. In this case, in turn, the following words appear: *employees, infrastructure, airport, road, impact, influence, work, companies, tax*. In expressing their opinion, the respondents made use of their own experience gained through coexistence and cooperation of the army with other entities in the commune, as well as their own observations and knowledge and values instilled in them in the process of

upbringing and education at home and at school (Delazar, 2004). The subjective meaning ascribed by the respondents to the experience of the military is objectified in the process of inter-institutional cooperation, during the evaluation of its effects by the community, as well as through the prism of the roles that the respondents perform in the structures of local government (Ben-Ari, 1998). Moreover, the nature and intensity of interactions between individuals and institutions, as well as the accompanying rituals and diverse conditions in the environment of these entities also influence the assignment of specific meanings to a military unit (Levy and Merry, 1986).

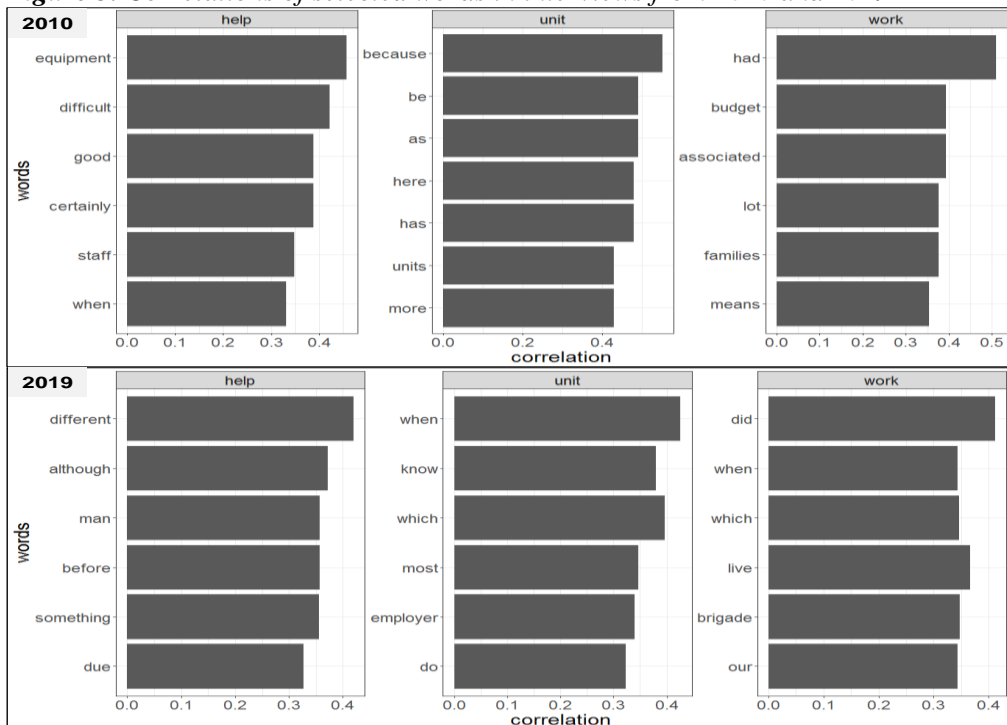
In the next step, in the analysed corpora, the interdependence of words related to the interaction between the military unit and the commune was checked. Figure 3 shows the correlation between the words *unit*, *work*, *help* and other words (Pion-Berlin, 2003). In 2010, there was also a correlation (at the level from 0.6 to 0.4) between the word *budget* and the words: *tax*, *significant*, *airport*, *work*, *means*. Such a correlation between the indicated word *budget* and other words did not occur in the corpus from 2019. The data in Figure 3 shows that the word *help* offered by the military is related to personnel, equipment, difficult situations and the certainty of support by the military. The word *unit* in turn is connected with certainty and the role of employer. The word *work*, on the other hand, is associated with budget, resources, family, life.

Taking into account the meaning of the words in the content of the interviews and using the method of hierarchical clustering (Euclidean distance, Ward method), it was found that both in 2010 and 2019, the statements of the representatives of the communes were combined into groups, indicating some common features of these localities: such as geographical location, the strength of military influence on the local economy, the experience of the communes located in the western part of the country related to the liquidation of units after 1990 and the presence of allied troops on their territory (Helm, 2007; Lingras, 1995; McDermott, 1998; Ward and Hook, 1963). This is particularly visible in the situation of those communes that are located near the north-eastern and eastern border (2010 - Suwałki, Braniewo, Hrubieszów), (2019 - Orzysz, Przasnysz, Jarosław) or western (2019 - Żagań, Bolesławiec).

The share of particular words, including *help*, *unit* and *work*, in the statements of local government representatives in 2010 and 2019 was not the same. In 2010, the word *help* most often appeared in interviews in the following communes: Drawsko-Pomorskie, Suwałki, Bytom, Hrubieszów, among others, in the context of support provided by the military unit in a situation of natural disaster and the involvement of the army in educational activities with children and young people. In 2019, the word *help* and *unit* were used less frequently, while the word *work* appeared more often. This was emphasised in connection with the respondents' perception of an important role of the unit in the local labour market and fears of losing their jobs in the situation of its dislocation. In 2019, the word *help* was used more often in the following communes: Świdwin, Wałcz, Orzysz, Przasnysz and Lubliniec. It

occurred in the context of the readiness of services to help residents, help for veterans, support for blood donation and the need to increase social assistance in the situation of dislocation of the army from the commune. The above mentioned activities pointed to the activity of both sides, the army and the local government, in providing various types of help and exhibiting the values connected with it.

Figure 3. Correlations of selected words in interviews from 2010 and 2019



Source: Own study.

In turn, with regard to the word *work* in 2010, its use is noticeable in almost all interviews with regard to the following situations: changes in the place of work/service (arrival/departure), stability of work in the army, jobs for civilian employees, restructuring of companies in the period of transformation and liquidation of jobs in particular industries, as well as the outflow of young people from the army to other professions (Waite and Berryman, 1986). In 2019, its use was associated with attractive working conditions in the army, stability of work, prestige associated with work in the army, but also the concerns about negative consequences for the city as a result of the dislocation of the unit (Clemens and Milsom, 2008; Kocher and Thomas, 1994; Mayer, 2009; Patrician *et al.*, 2010).

To compare the occurrence of words in interviews conducted in 2019, the interviews were divided into three zones. The first commune_West zone included interviews conducted in the communes located in the western part of the country (Bolesławiec,

Świdwin, Wałcz, Żagań). The second commune_Center zone included interviews with the communes: Brodnica, Inowrocław, Lubliniec, Łask. In the last commune_East, there were interviews conducted in the communes: Jarosław, Orzysz, Przasnysz, Sandomierz. The result of the comparison is presented in Figure 4.

Figure 4. Comparison of the frequency of words, in interviews, in the communes of the western, central and eastern part of the country



Source: Own study.

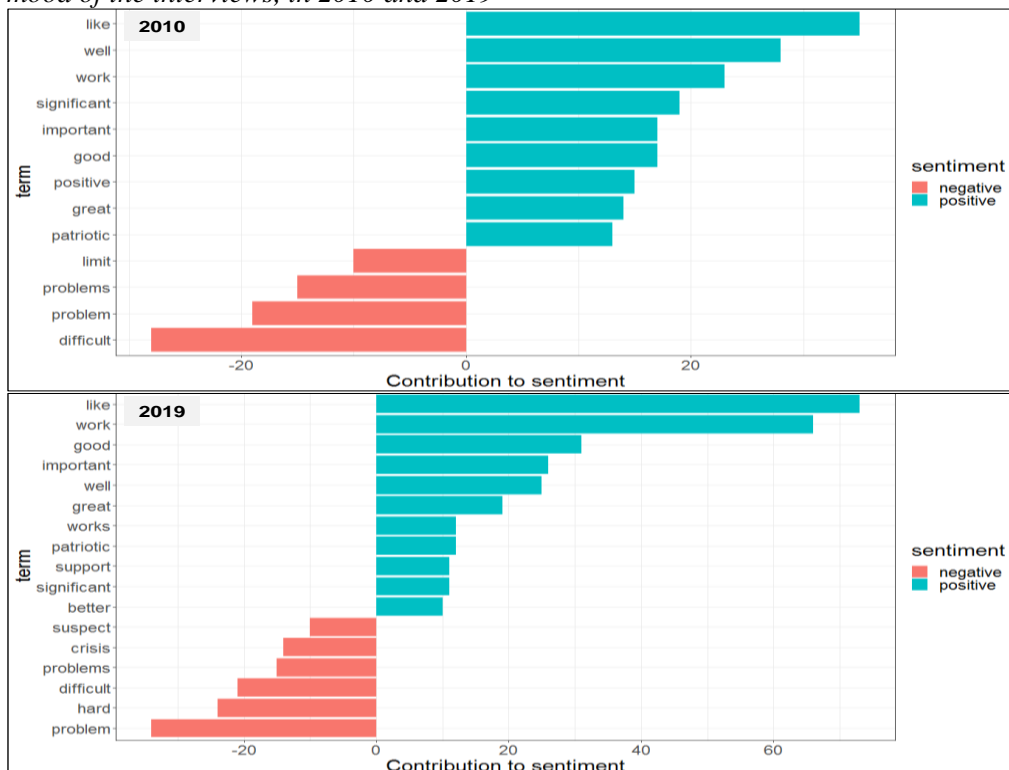
Words that are close to the dashed line (Silge and Robinson, 2017) had a similar frequency in interviews in every part of Poland (e.g. *city, army, people, soldiers*). Those that are further away from this line were more frequent in interviews in a specific part of the country (to the left of the line for *commune_West*, to the right of the line for *commune_Center* and *commune_East*). In communes located in the west of the country, words such as: *entrepreneurs, employer, training, influence, develop* appeared more often than in central communes. In the latter, in turn, the following words were more frequent: *earn, budget, employees*. This may indicate the adoption of two perspectives: employer and employee to describe the situation in the local economy (Bartik and Upjohn, 1991; Palmer *et al.*, 1993).

At the same time, in communes in the west of the country, the following words were used: *American troops, planes, forests, training, planning, industry, construction, accidents, difficulties* were used more often than in the east, exhibiting the specificity and conditions of the functioning of units. Whereas in the east of the country, the following words were used more often: *ceremonies, associations,*

commander, taxes, access, so the symbolic dimension of the functioning of the army in society was also emphasised. It is also characteristic that for commune_East words extend to lower frequencies (Silge and Robinson, 2017), in commune_Center there is an empty space. This observation is confirmed by a higher correlation of words from commune_West with words from commune_East (0.84), than with words from commune_Center (0.76).

Analysing the content of the interviews, different observations can be made. A sentimental analysis was used to assess the overtones of local government representatives' statements (Silge and Robinson, 2017; Kwartler, 2017). Its application allows us to understand how the mood changed during the interview and which words spoken by the interviewers contributed to it. In all interviews, both in 2010 and 2019, good moods prevailed. Figure 5 shows the words that generally contributed to a positive or negative mood.

Figure 5. The most important words positively and negatively influencing the mood of the interviews, in 2010 and 2019



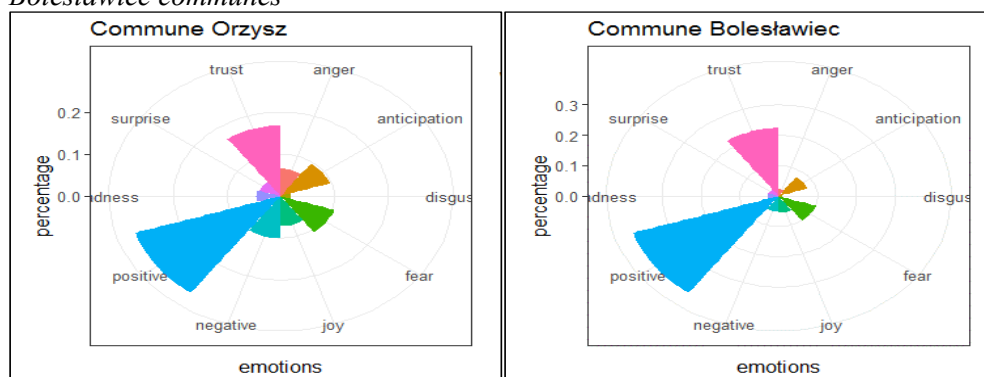
Source: Own study.

The following words had a positive impact on the statements of local self-government representatives concerning the assessment of the presence of military units and relations between them, among others: *work*, *support*, *patriotic*. The

positive mood was also connected with the use of words describing the contribution of a military unit to the development and functioning of local economy and community activity, namely: *significant, important, great, good*. At the same time, the representatives of local governments, characterising the situation in communes, pointed out the problems connected with the condition of the economy and those resulting from threats on the territory of communes. Words such as: *problem, difficult, hard, limit, crisis*, created a negative mood in this case.

Using the *nrc* lexicon (Silge and Robinson, 2017; Kwartler, 2017), it was also checked how often words with positive or negative overtones appeared during interviews. In some communes, the distribution of emotions and mood changes were different (Bolesławiec, Orzysz), in others, a certain similarity can be seen (Łask, Świdwin). This was illustrated for the communes which are located near the border and in the centre of Poland. The selection of these communes was caused by differences in population and economic potential and in their location on the national territory. The comparison of emotions accompanying the respondents during the interview in Orzysz and Bolesławiec shows the domination of positive emotions and trust. In both communes the importance of the military unit for the local economy and quality of life of the community was stressed. At the same time, the analysis allowed to notice differences in emotions reflecting fear, anger, expectation (Figure 6).

Figure 6. *Distribution of emotions during the interview in Orzysz and Bolesławiec communes*



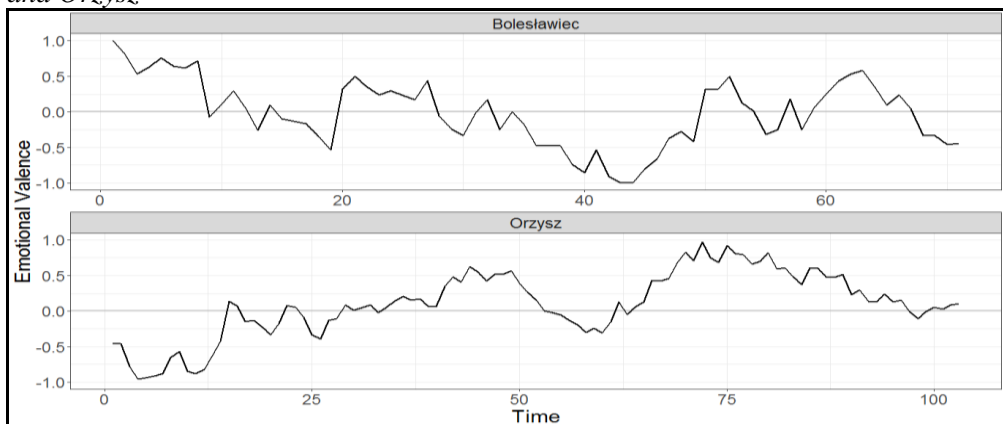
Source: Own study.

The interview with the representative of the Orzysz commune began with an in-depth description of the situation in the commune at the beginning of the 1990s, when the army limited the number and part of its activities in areas not directly related to the training of soldiers. As a result, it resulted in the cessation of some activities and the closure of some entities in the city which had previously provided services to the inhabitants, including soldiers. Thus, the initial part of the interview was dominated by negative emotions describing fear and uncertainty accompanying the residents. In the further part of the interview the mood changes, the activities

undertaken by the city together with the military unit are described, which in turn resulted in the improvement of the socio-economic situation and finding a development path which is a distinguishing feature among other communes of Warmian-Masurian voivodeship, which base their development strategies mainly on tourism (Figure 7). The dynamics of the interview in Bolesławiec and the emotions connected with it were a little different than in Orzysz. The conversation began by emphasising the positive effects associated with the presence of a military unit in the city. Whereas the negative emotions in the interview appeared in connection with the discussion of the potential negative impact of the unit on the environment in connection with the development of military infrastructure on the training ground and in the context of noise generated by military transports.

The comparison of subsequent interviews in the communes of Łask and Świdwin also indicated the accompanying, mostly positive emotions and expressed trust. Slightly less frequent were the emotions of expectations. They were signalled in the context of expectation of positive changes in the city, also related to the presence of the army in its area. Both interviews also noted fear, the source of which are concerns about the liquidation or reduction of the scope of activity of a military unit in a specific location (Figure 8).

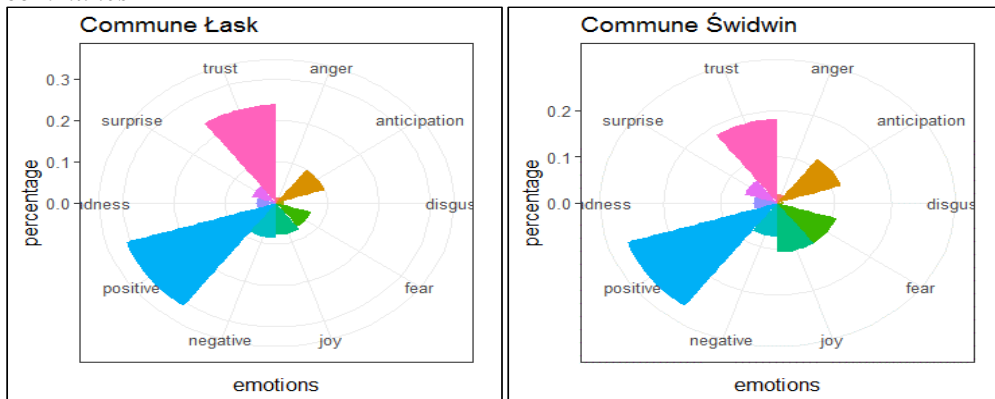
Figure 7. Mood change during the interview in the municipalities of Bolesławiec and Orzysz



Source: Own study.

The comparison of subsequent interviews, in the communes of Łask and Świdwin, also showed that they were accompanied by predominantly positive emotions and expressed trust. Slightly less frequent were the emotions of expectations. They were signalled in the context of expectation of positive changes in their cities, related also to the presence of the army in their area. However, both interviews also noted fears, the source of which are concerns about the liquidation or reduction of the scope of activity of the military unit in a particular location.

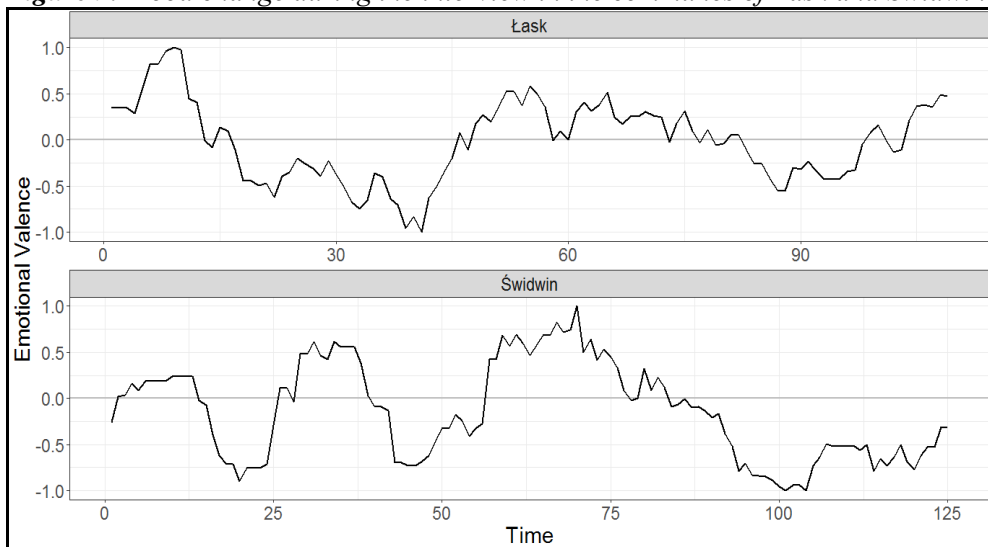
Figure 8. Distribution of emotions during the interview in Łask and Świdwin communes



Source: Own study.

The source of positive emotions at the initial stage of the interview in Łask are described social and economic benefits connected with the presence of the army in this place and emphasising the modernity of the unit and the fact that it is a showcase of the city. In the further part of the interview, there appear threads connected with potential adverse effects of liquidation of the unit and noise generated by planes, which is reflected by negative emotions. The subsequent threads of the interview relate to cooperation, including the organisation of joint ventures, and again they are characterised by positive emotions. They change in the final part of the interview due to the emphasis on the inability to meet certain needs due to insufficient social infrastructure (Figure 9).

Figure 9. Mood change during the interview in the communes of Łask and Świdwin

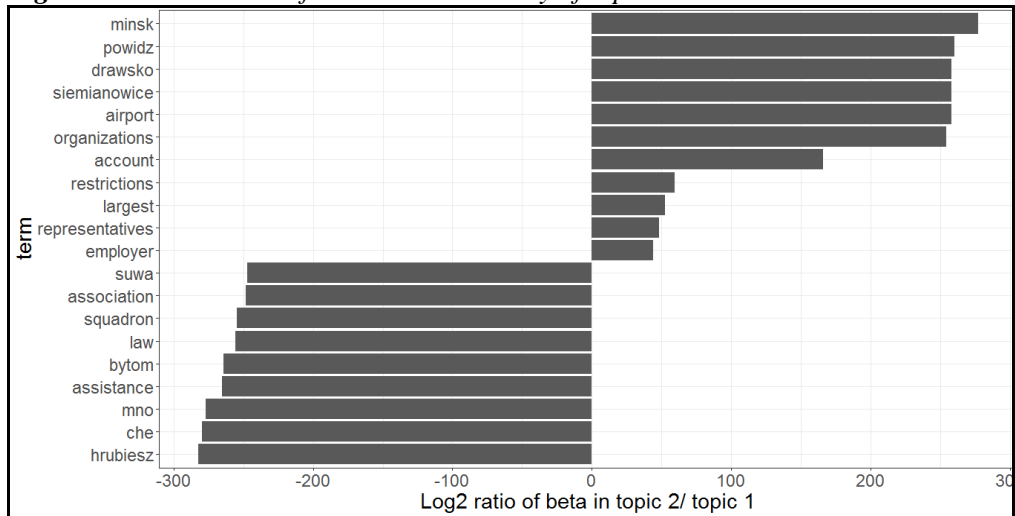


Source: Own study.

The interview conducted in Świdwin is characterised by a relatively high mood changeability. In the initial phase of the interview, positive emotions resulting from the signalled benefits that the city benefits from the presence of the army prevail. The next phase is characterised by negative emotions connected with the indication that the presence of the army may pose a threat to the city in case of a conflict. In the further part, positive emotions return, as the advantages of the army – a stable employer attracting young people to the city – are emphasised. The cooperation based on equality and respect of partners and its importance in smaller communities is emphasised. Further negative emotions in the conversation are an effect of anticipating dramatic consequences for the city related to the liquidation of the unit, as well as stressing that the spectre of unit closure has already loomed over the city on several occasions. Negative emotions also concern the noise generated by the equipment used by the soldiers.

Bearing in mind that each of the documents under analysis is a mixture of topics, and each topic is a mixture of words (Provost *et al.*, 2015; Silge and Robinson, 2017), based on the latent Dirichlet allocation, two topics were separated in the 2010 and 2019 corpora, described by the probability of the occurrence of particular words (it may happen that particular words will occur in several topics). Figure 10 shows the words that had the greatest impact on the diversity of topics in the interviews that were conducted in 2010.

Figure 10. Words that influenced the diversity of topics in 2010 interviews



Source: Own study.

In 2010, in addition to the names of communes to which the respondents often referred, these were the words *airport*, *squadron*, *restrictions*, referring to the specificity of military units (the type of armed forces they represented). In 2019, as in 2010, these were also the names of communes and the words: *lake*, *tourist*,

museum, referring to the specificity of solutions and alternative development directions in selected communes.

4. Discussion

The results of the research indicate the possibility of using Text mining for the analysis of complex links identified between entities on the territory of communes. Text mining allows to combine a qualitative and quantitative approach, in the context of identifying the impact of individual entities on the development of the commune and creating meanings in the process of interaction between entities located on its territory.

The research was financed from the task "Military units in local communities – social, economic, environmental context", within the framework of statutory activities specified in the Task and Financial Plan of scientific activity of the War Studies University, no. II.3.23.

5. Conclusions

The article focuses on the analysis of links between military units and local government units, in the context of contemporary challenges to development. Local governments, being responsible for the effects of local development management, face a number of social, climate, economic and technological challenges. Their ability to respond to these challenges varies, depending on their resources and ability to use them effectively. Counteracting the depopulation of cities and communes, the disintegration of social ties, increased migration for work, capital barriers, they look for opportunities to strengthen endogenous potential, inter alia, by building relations with local agents present in a given territory, including the military units.

The presence of military units is of significant importance, especially in those cities that are losing their social and economic functions. Their presence, as it was stressed, is a manifestation of state interventionism, and at the same time stimulates the mechanism of cumulative causality.

When military units are stationed on the territory of individual cities over a long period of time, they leave their "mark" on them. They are a feature that makes the cities stand out from the other ones. They are perceived as a showcase of the city, build its prestige, and sometimes affect the trajectory of its development. Military units are described, by representatives of local authorities, in the context of their basic function of guaranteeing the security of citizens (as they are a component of the armed forces) and a complementary function, consisting in participating in socio-economic processes in a given territory, as well as a symbolic function (the long-term duration of the state, being an element of statehood).

The application of Text mining to the analysis of links between military units and local government units allowed to combine a qualitative and quantitative approach. The words most frequently used by the respondents were identified, it was indicated which words often occurred together, interviews were grouped, and the subjects were separated in corpora. The sentiment analysis used to assess the mood of local government representatives' statements made it possible to see how it changed during the interview, as well as which words were decisive for the mood change. The comparison of emotions accompanying the respondents during the interviews indicated the domination of positive feelings over the negative ones. The former were connected with reference to events that brought about beneficial effects for boosting the economy and activating the community in connection with the presence of a military unit in the city. The importance of cooperation and the values which are the basis for its development – respect, selfless help, willingness to help and trust – were emphasised. The latter ones, expressed less frequently, referred to the feelings created as a result of unit's adverse impact on the natural environment, noise generated by military transports. Relatively strong were concerns about the future of a city deprived of a military unit or a situation where the scope of its activity would be limited (reduction in the number of people). Moreover, as a result of the analyses carried out, it was possible to identify the meanings assigned to the military in the interaction processes by local government representatives. This also served to deepen the understanding of the existing links, which may constitute a source of counteracting unfavourable trends.

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