

## Article

# Military Leader Behavior Formation for Sustainable Country Security

Svajone Bekesiene <sup>1,\*</sup> , Ieva Meidute-Kavaliauskiene <sup>1</sup>  and Šárka Hošková-Mayerová <sup>2</sup> <sup>1</sup> General Jonas Zemaitis Military Academy of Lithuania, Silo 5a, 10322 Vilnius, Lithuania; ieva.meidute@lka.lt<sup>2</sup> Department of Mathematics and Physics, University of Defence in Brno, Kounicova 65, 662 10 Brno, Czech Republic; sarka.mayerova@unob.cz

\* Correspondence: svajone.bekesiene@lka.lt; Tel.: +370-68-648-000

**Abstract:** The continuous improvement of military leadership identity to maintain excellent performance with respect to the promotion of mission success is a highly desired by the Lithuanian Armed Forces. This study seeks to identify the criteria for effective leadership behavior that is appreciated by Lithuanian servicemen. The validated Leader Behavior Description Questionnaire (LBDQ XII) was used to collect data representing followers' preferences with respect to commander–leader behavior by assessing twelve leadership behavior criteria. Additionally, commander–leaders were chosen as experts to judge the importance of the criteria by pair-wise assessment. Consequently, the Fuzzy Decision Making (FDM) with Fuzzy Decision Making Trial and Evaluation Laboratory (DEMATEL) method based on the new concept of the relationship between the influenced and influencing criteria were employed to analyze the ranking using leadership behavior and to establish the causal relationships among the criteria when the collected data were expressed in trapezoidal fuzzy numbers. This study contributes to military leadership by using a novel approach for identifying and prioritizing the behavior criteria for leaders. The results indicate six “cause” constructs: ability to persuade, taking the lead, result orientation, accurate forecasting, building interpersonal relationships, and cooperation with managers. These findings could assist militaries in designing effective improvement strategies for continuous leadership training.

**Keywords:** military leadership; LBDQ XII; behavior formation; Fuzzy DEMATEL; trapezoidal fuzzy numbers



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## 1. Introduction

Along with changing threats posed to international security, the armed forces have transformed themselves, adopting new postmodern forms of organization in which the leadership and leaders play the main role. In general, the leadership phenomenon has aroused great interest in the world of global academic science. Management and leadership, as critical factors for organizational success or failure, have been attracting increasing research and discussion worldwide. Reviews of scholarly studies suggest that there are many different theoretical approaches to explain the complexity of the leadership process [1–16]. Some researchers conceptualize leadership through the prism of traits or behaviors, whereas others view it from an information processing perspective or a relationship perspective.

Over the past 60 years, there have been even 65 different classification systems developed to define the dimensions of leadership [2]. The scientific literature offers a plethora of concepts and definitions for leadership. Having reviewed leadership theories and research, Higgs and Rowland [3] pointed out that there are almost as many different definitions of leadership as there are people who have tried to define it. The same was confirmed by McCauley [4], who referred to leadership as a totality of art, mastery and talent that is difficult to compress into one definition. Other researchers [5] approach leadership as an organizational process in which an individual seeks to achieve the goals of the organization

by influencing group members, or leadership is defined [6] as the relationship between the group members and the leader inducing other members to accomplish tasks. In addition, some authors define leadership in terms of power relationships existing between leaders and followers. From this viewpoint, leaders have power that they employ to influence others. Another leadership description identifies it as a transformational process that influences followers to achieve more than is usually expected of them. Finally, some scholars define leadership from a skills perspective. This approach stresses the capabilities (knowledge and skills) enabling effective leadership. Despite the multitude of ways in which leadership has been conceptualized, the following components can be identified as key criteria defining leadership: first, leadership can be defined as abilities growth process; second, leadership involves impact on others; third, leadership happens in groups; fourth, leadership encompasses common goals [7–11]. Based on the above definitions, leadership can be described as a process in which one person is able to make an impact on a group of persons to accomplish a common goal. Analyzing the understanding of leadership inevitably poses the question as to how these concepts relate and differ. There are different possible answers to this question. Most people think that these are identical concepts referring to a person who inspires and encourages others to move forward, generates ideas, and whom others want to look up to. In reality, however, it is often the case that a manager is only a formal leader and does not engage in development or promotion of innovation and fostering of the organization's values and culture. There are two forms of leadership: one form appears when people who are managers can be the leaders according to their formal position in an organization, while the second form suggests that there are other people who are leaders because of the way they are treated by other group members. These two common forms of leadership are called assigned leadership and emergent leadership [12]. The person assigned to a leadership position does not always become the real leader in a particular setting (assigned leadership). When a person is not in a formal leadership position, but is perceived by that person's colleagues as the most influential member of a group or organization, the person is exhibiting emergent leadership. This type of leadership is not assigned by position; rather, it emerges over a period of time as a result of effective communication in the organization. A unique perspective on leadership emergence is provided by social identity theory [13]. Drawing on this perspective, emergent leadership occurs when an individual fits with the personality of the group as a complete. As groups progress over time, a group original also changes. Persons develop as leaders in the group when they become most like the group original. When people become very close to the group original, they become attractive leaders of the group and can influence the group.

Sustainable leadership demands a fundamentally different approach to selecting and developing leaders vs. the methods being used by most business organizations today. It requires a change in mindset on the part of boards of militaries to start operating according to this logic. Current human resources practices in the army typically adopt a more short-term outlook, which does not support sustainability. We believe the concept of sustainable leadership is here to stay, although the field still is emerging, and the terminology will evolve. We hope the ideas in this study will inspire further research and spur useful debate.

These investigations used the fuzzy method with DEMATEL for numerous explanations. First, due to the multi-dimensional and interactive character of leader behavior, methods of assessment that mix quantitative viewing platforms and qualitative investigation can include the attention of subjective and imprecise traditional analyses. Second multi-criteria management decision analysis and the fuzzy theory has been widely used. In the fuzzy concept, experts can directly use natural semantics to assess, and then the semantic explanation is transformed into the evaluator's assessment rating of the score of association or possibility of the number of dissimilar measures through dissimilar relationship function associations. Therefore, the evaluator can easily and fully express the evaluation value of his subjective judgment. Third, DEMATEL is appropriate for the investigation and assessment of undefined and ambiguous context such as the competitive military leadership. Moreover, the DEMATEL mostly evaluates the tangled and multipart

relationships of multi-criteria in social science problems and explores the importance and interconnection between numerous criteria. It made up the weakness of traditional statistical analysis methods by obtaining the directionality and rank of impact among indicators. To our knowledge, the DEMATEL technique has not yet been used in the background of the military leadership surveys. In this investigation, we attempt to establish a comprehensive framework of military leadership behavior (MLB) using 12 criteria following the well-known Leader Behavior Description Questionnaire form XII (LBDQ XII) [14–17].

Information of fundamental military leadership competencies can help to focus on the continuous and consistent process of training commander–leaders. Employing an empirical approach, this research implements Structural Equation Modeling and fuzzy DEMATEL to achieve the following aims:

- Find the main military leadership competencies for Commander–leaders through a continuous and consistent process of training at all career levels;
- Notice the relationships between the military leadership competencies;
- Rank the key military leadership capabilities;
- Evaluate the leadership competencies focusing on the qualities, abilities and targeted leadership pattern necessary for a commander–leader that must be developed from the very first stage of soldier’s professional career.

To realize the aforementioned purposes, this study will be used to help to find the answers to the following research questions:

1. What are the main leadership competencies for commander–leader-specific characteristics and other qualities which are developed in educational institutions and throughout the soldier career—from junior to senior commanders?
2. What are the cause-and-effect relationships among leadership competencies for effective application of a leadership model for military professionals using fuzzy DEMATEL?
3. What is the significance of these competencies that can facilitate the formation of a model commander–leader?
4. Which leadership competencies are more relevant for continuous improvement of leadership skills by learning from own mistakes and mistakes of others, without being afraid to acknowledge them and take responsibility for oneself and subordinates?

The subsequent structure of this paper is organized as follows. First, the work done by other researchers related to leadership behavior criteria investigations is presented. Then, the research methodology for continuous military leadership behavior investigations and an identification method based on fuzzy DEMATEL is described. Furthermore, we present in detail the surveys conducted in the military to identify main constructs of commander–leader’s behavior on the basis of the leaders’ followers’ assessment by Structural Equation Modeling (SEM) and the fuzzy DEMATEL model when the different level commander–leaders (experts) of the Lithuanian army weigh the same twelve criteria using the pair-wise comparison method. Finally, the outcomes of fuzzy DEMATEL analysis and interpretation of get result in line with previous studies are presented.

## 2. Leadership Success Criteria

Leadership is not limited to the ability to plan, organize, conduct, and supervise daily operations of a military organization. Leadership is a mixture of coercion, persuasion, and personal example. This mixture forces people to do what the commander wants, even when they do not like the mission [18,19].

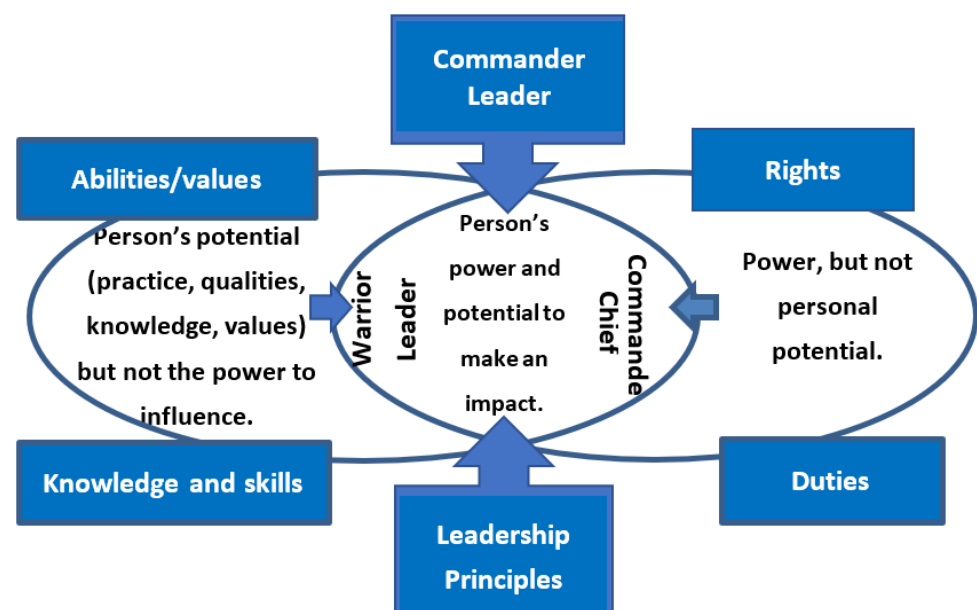
The military leadership guide for cadets says that military leadership is the process involving commander’s influencing soldiers to accomplish the mission successfully. It is the commander’s ability to inspire subordinates to perform the mission so that to achieve a timely and quality result. Military leadership is based on a strict hierarchy and execution of orders, and requires the commander to be prepared not only to persuade and inspire, but sometimes to force soldiers to carry out orders by motivating using his/her personal example. This usually happens during combat missions, under conditions of physical and

psychological stress that can make the mission unattractive [20]. It is this combination of military leadership that encourages soldiers to do what the commander orders them.

Many scholars exploring the phenomenon of leadership agree that greater effects can be achieved through persuasion, encouragement, and personal example than through robust forms of leadership [21–23]; however, a commanding voice is useful in some cases, especially when operating outside the comfort zone. Soldiers usually obey instinctively, but they willingly and enthusiastically follow orders of a commander with a strong character, impeccable reputation, and necessary knowledge and experience.

The Lithuanian Military Academy (LMA) defines an officer as a citizen, who faithfully serves the Republic of Lithuania, has a university degree and special education in military service, is a reputable teacher, has a rational mindset, and demonstrates high behavioral and communication culture, strong morals and integrity. The LMA, as a provider of commanding officer courses, uses a leadership model based on three main areas of leadership: knowledge, leadership behavior and values, and skills. These milestones serve as a basis for building the Lithuanian military organizational structure and establishing functions of its structural units. Leadership is important from the selection phase up to the award of the first officer rank. The leadership development program is based not only on theoretical lectures and practical reinforcement of leadership skills during the exercise, but also on adherence to daily behavior, appropriate lifestyle, discipline and daily routine, as well as transfer of leadership experience to junior cadets.

The armed forces training doctrine [24] defines commander training as a well-considered, continuous, coherent and gradual process taking place in all three areas of military education and training (institutional, operational and self-improvement) [25], through a lifelong synthesis of knowledge, skills and experience (see Figure 1).



**Figure 1.** Military leadership schema drawn by roles presented in the Lithuanian Military Doctrine.

All areas of the Lithuanian military education and training model are intended to educate commanders by providing relevant knowledge and different experience. The leadership training process requires not only necessary character traits, appropriate behavioral standards from commanders, but also their intellectual abilities. The armed forces training doctrine [24] states that commanders include the commander of the army (armed forces), the commander of operational forces, commanders of different military kinds, elements, and other military (operational) units (and/or warfare commanders). Commanders include all persons working for the national defense system whose duties authorize the command of subordinate soldiers and civilian personnel in the national defense system. The concept

of a commander includes commanders (superiors), non-commissioned officers and other persons in leading positions authorized to command, manage (control), inspect and make decisions. Commanders should be an example of a commander–fighter–leader, capable of making timely and correct decisions, not afraid of responsibility, open to innovation, and performing assigned duties in a professional manner and with certainty. Commanders play an important role in all areas of military education and training. Professionally trained commanders, capable of performing assigned tasks, make a significant contribution to the training of military (operational) units, as their preparedness and command of operations determine the results of task accomplishment. Commanders should improve their leadership skills until they feel able to take on command responsibilities. According to the armed forces training doctrine [16], commanders are required to demonstrate the following characteristics:

- be competent, self-confident and vibrant-thinking;
- be able to successfully lead subordinates in performing the assigned missions and tasks;
- be proficient and circumspect;
- be able to give orders towards implementation of the plan and intentions of a senior commander;
- be courageous and able to manage risk;
- take constant care of subordinates.

In the army, commanders are usually identified with the concept of a leader, which means that a commander–leader must display appropriate treatment with respect to subordinate soldiers, be able to understand, inspire and motivate in order to achieve common goals through teamwork (sometimes in very difficult conditions and in unknown environments). Appropriate behaviors of commanders (superiors) are not limited to the exercise of their powers (given authority or powers) and giving orders, but also involve being an example for others [26,27].

Leaders not only teach, but also learn from successes and failures, experience and knowledge, books and people, and life itself. Effective leaders inspire loyalty to the organization and confidence in themselves and others, because they themselves act confidently, honestly, and trust the team. Leadership is a continuous process of improvement [18]. If a leader does not build confidence in himself/herself and in others, that leader cannot expect loyalty to the organization's values and respect, without which it is difficult to operate in a teamwork environment and which, in turn, changes the internal atmosphere and affects the organization's performance.

Based on the arguments above, this study produces a structural background of the constructs of validated questionnaire [14] to represent the behavior that characterizes a military leader. To enhance the validity of the chosen behavior criteria, this study adopted in-depth interviews with soldiers of various ranks to assess the list of indicators. The military leadership is usually combined as a structure of multi-dimensional concepts and factors. The associations between factors are complex and can be interdependent. According to a study by Littrell [28], who contributed to Leader behavior theory, the leader's success depends on many variables and leadership style. Hogg et al. [29] further pointed out that a great leader is formed and not born, and it is important to simultaneously consider the causal relationship of different significant aspects when choosing the leadership design strategy. In order to achieve better relationships between leaders and their followers to determine leadership success, great leader formation strategic goals have to be set [29]. Moreover, it should be taken into account that the external situation is dynamic and the leadership is not static at all. Earlier researchers have put forward numerous dissimilar views, but in fact, it is problematic to point out an agreement set. It is more problematic to recommend the effective application of a leadership model that can only be ensured through a continuous and consistent process of training commander–leaders at all career levels [30]. Therefore, for any army, the question is, how to identify and understand the relationships among commander–leader-specific characteristics in order to help militaries to develop the appropriate competency and other qualities in educational institutions



and throughout the career—from junior to senior commanders (superiors)? The present study aims to fill this gap in the context of the right continuous improvement of leadership behavior skills.

### 3. Survey Methodology

The purpose of this research was to establish the cause-and-effect relationships among the leadership behavior criteria for different levels of commander–leaders in the Lithuanian army. The research design scheme is presented in Figure 2. Leadership studies have always been a challenge and a sphere of interest for researchers, and the wide range of leadership theories in the scientific literature shows the complexity of this phenomenon as well as scientists’ desire to analyze it.

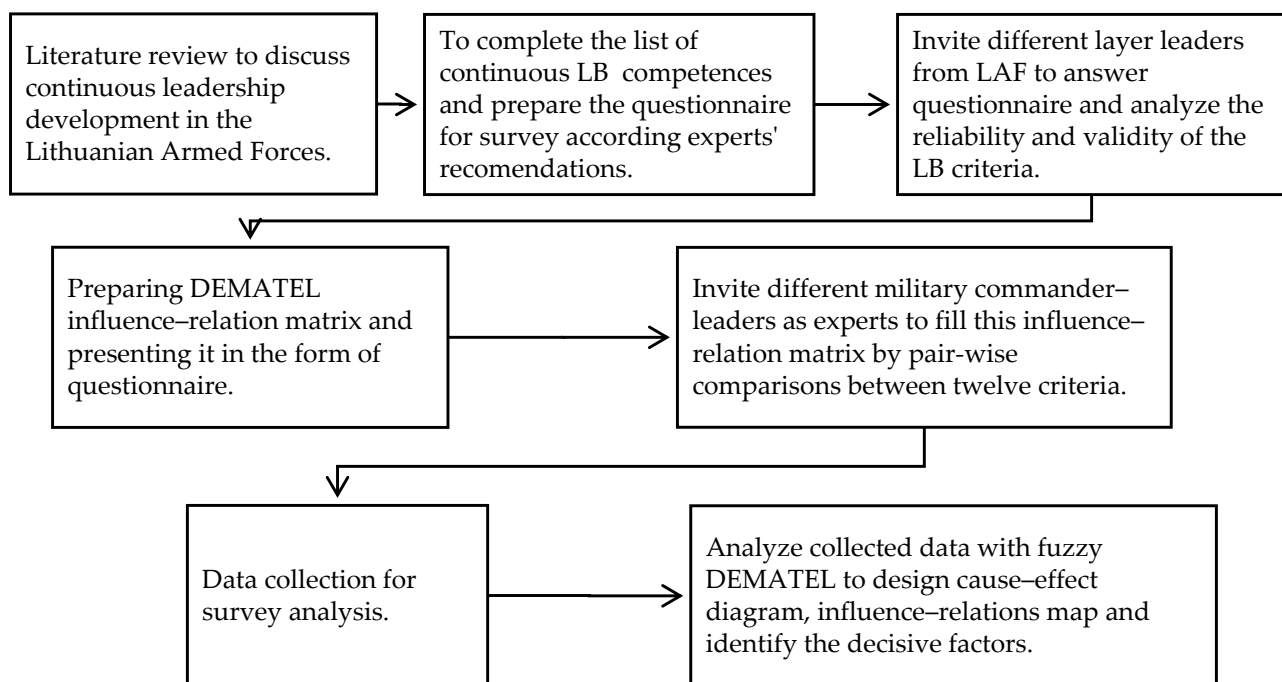


Figure 2. The research design scheme.

Therefore, the first step of the survey was to choose the leadership criteria to be identified as the primary ones for continuous leadership development on the basis of a literature review. The second step was to choose the validated questionnaire [13,14]. Later, respondents from the Lithuanian Armed Forces were invited to express their opinions as leader followers and as commander–leaders (experts). Accordingly, the Structural Equation Modeling (SEM) technique was used.

SEM was used in order to construct and assess the leadership behavior model designed on the basis of the twelve criteria using the LBDQ XII questionnaire [13,14]. The designed theoretical military leadership behavior causal model was based on path analysis, factor analysis, and linear regression. Additionally, the constructs of latent variables were analyzed and measured [31–35]. The SEM tested causal relationships between twelve constructs that were designed from 100 independent variables and one dependent variable.

Following the SEM analysis rules, firstly, the measurement for convergent validity was established and the designed structural model verified. The confirmatory factor analysis (CFA) of twelve scales (leadership behavior criteria) and estimation of model fit was conducted by IBM SPSS AMOS 26v. Following the rule [33], the factor loadings of twelve constructs were estimated by CFA. This data analysis made it possible to identify the path coefficient measurements. Next, the construct’s convergent validity was assessed. Following the CFA methodology [36–45], construct convergent validity was evaluated by

factor loading values, Cronbach's Alpha, composite reliability (CR), and average variance extracted (AVE) [37]. In this way, the stability of the designed leadership behavior model was measured by evaluating the construct's convergent validity. Consequently, the specific indication of construct validity of the all-model measurement as the goodness-of-fit were selected, as follows: a  $\chi^2$  test, the ratio of  $\chi^2$  to degree of freedom, the adjusted goodness of fit index (AGFI), the root mean square error of approximation (RMSEA) [36–45], the normed-fit index (NFI), the competitive fit index (CFI), and the Tucker-Lewis Index (TLI) [38].

Starting from the fourth step to the seventh, the fuzzy technique was used with DEMATEL for the analysis and evaluation of uncertain and ambiguous context of military leadership. The multi-dimensional and interactive nature of military leadership behavior was analyzed using a comprehensive methodology whereby the study assessment was combined the quantitative viewpoints and the qualitative analysis carried out by commander-leaders as experts. Moreover, the fuzzy theory was used to convert the semantic leader behavior evaluations of experts into the evaluator's assessment degree value through the membership function by using trapezoidal fuzzy numbers. Finally, to help in structuring the methodology followed, a research flowchart was used as shown in Figure 2. The research flow diagram mainly depicts the process structure for analyzing military leadership behavior and then identifying the significant leadership skills.

#### The Fuzzy DEMATEL Approach

To our knowledge, the Decision-Making Trial and Evaluation Laboratory analysis has not yet been applied to military leadership behavior investigations, and this technique was chosen for this study as it is a comprehensive method for building and analyzing a structural model of causal relationships among various aspects as shown in Table 1.

**Table 1.** The experts' averaged leadership behavior assessment data.

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12
L1	0	L	H	VL	H	VL	VH	H	VL	VL	H	VH
L2	VH	0	VH	H	M	VH	H	H	M	VL	M	H
L3	H	M	0	VL	VL	H	L	VL	M	M	H	H
L4	H	VH	H	0	M	H	VH	M	VH	H	VH	VH
L5	M	H	VL	H	0	M	VL	M	M	M	M	VL
L6	H	M	M	VL	VL	0	VL	VL	H	VL	M	M
L7	H	VH	VH	H	VH	VH	0	M	VH	VL	M	H
L8	VH	M	M	H	VL	H	H	0	VL	M	VL	VL
L9	VH	H	H	H	H	VH	H	VH	0	VH	M	M
L10	H	H	H	VH	VL	H	H	H	H	0	VL	L
L11	VH	VH	VH	H	H	VH	M	H	H	H	0	M
L12	H	H	VH	H	H	VH	VH	H	H	H	VH	0

Notes: Data assessment in linguistic terms: VL = Very Low; L = Low; M = Medium influence; H = High influence; VH = Very high influence.

Additionally, it has to be pointed out that the DEMATEL principally investigates the complicated and multifaceted correlation of multi-criteria in social science problems and explores the significance and interconnection between numerous criteria [39–45]. Furthermore, this method makes up for the weaknesses of traditional statistical analysis methods by obtaining the directionality and degree of effect between analyzed criteria. Taking into account all of the above, the steps of the fuzzy DEMATEL approach process can be presented as eight steps, which are described in detail below.

Step 1. The DEMATEL analysis starts with the set-up of the direct relationship matrix  $Y$ , which represents the assessment between criteria provided by experts after pair-wise comparisons between twelve leadership behavior criteria. In the case of this survey, the multiple experts' judgement was used, and all experts individually completed the same criteria assessment matrix. Later, the arithmetic mean of all of the experts' judgements was used to generate the direct relation matrix  $Y$ , which is shown in Table 1.

Step 2. The fuzzy linguistic scale table has to be generated. Due to the fact that experts usually use linguistic terms to express the relationships between criteria, fuzzy numbers were used for calculation. A fuzzy judgement is a valuable instrument for taking the uncertainty and variety of linguistic decision senses essential to expressing fundamental associations. For this survey data analysis, the uncertainties of experts' assessments were taken into account, and the linguistic variable influence scores were used with five linguistic terms [44]: Very low, Low, Medium, High, Very high. Five linguistic terms were associated with positive trapezoidal fuzzy numbers  $(l_{ij}, m_{ij}, r_{ij}, u_{ij})$  (see Table 2).

**Table 2.** Linguistic terms and corresponding fuzzy numbers.

Linguistic Terms		Influence Scores	<sup>1</sup> Fuzzy Numbers $(l, m, r, u)$
VL=	Very low	0.125	$(0, 0, 0.25, 0.25)$
L=	Low	0.1875	$(0, 0, 0.25, 0.50)$
M=	Medium	0.375	$(0, 0.25, 0.5, 0.75)$
H=	High	0.625	$(0.25, 0.5, 0.75, 1)$
VH=	Very high	0.8125	$(0.5, 0.75, 1, 1)$

<sup>1</sup> Notes: Fuzzy number = trapezoidal fuzzy numbers.

Step 3. Create a fuzzy direct relation matrix. After the judges complete their association and evaluation of the impacts and orders among the criteria, the corresponding values of which are presented in Table 2, the linguistic variable "effect" can be converted into positive trapezoidal fuzzy records. Later, the initial fuzzy direct relationship matrix  $Y$  can be constructed as shown by Equation (1):

$$Y = \begin{matrix} C_1 \\ C_2 \\ \vdots \\ C_n \end{matrix} \begin{bmatrix} 0 & y_{12} & \cdots & y_{1n} \\ y_{21} & 0 & \cdots & y_{2n} \\ & & \ddots & \\ y_{n1} & y_{n2} & \cdots & 0 \end{bmatrix}, \quad (1)$$

where  $y_{ij} = (y_{ij}^1, y_{ij}^2, y_{ij}^3, y_{ij}^4)$  is the trapezoidal fuzzy number and represents the judgement on the intensity of the correlation between criteria  $C_i$  and  $C_j$  provided by expert  $E_k$ ,  $k = 1, 2, \dots, m$ ,  $i, j = 1, 2, \dots, n$ .

Step 4. Now fuzzy direct relation matrix  $Y$  has to be normalized. The initial fuzzy direct correlation matrix  $Y$  can be transformed to normalized fuzzy direct relation matrix  $\tilde{Y}$  following Equations (2) and (3), presented below. The entry  $\tilde{a}_{ij}$  of matrix  $\tilde{Y}$  is defined as follows:

$$\tilde{a}_{ij} = \sum_{j=1}^n \tilde{y}_{ij} = \left( \sum_{j=1}^n l_{ij}, \sum_{j=1}^n m_{ij}, \sum_{j=1}^n r_{ij}, \sum_{j=1}^n u_{ij} \right), \quad (2)$$

where

$$u = \max_{1 \leq i \leq n} \left( \sum_{j=1}^n u_{ij} \right), \max_{1 \leq j \leq n} \left( \sum_{i=1}^n u_{ij} \right). \quad (3)$$

Earlier, the normalized fuzzy direct relation matrix  $\tilde{Y}$  can be constructed by the following equations:

$$\tilde{Y} = u^{-1} \otimes Y, \quad (4)$$

$$\tilde{Y} = \begin{bmatrix} \check{y}_{11} & \check{y}_{12} & \cdots & \check{y}_{1j} \\ \check{y}_{21} & \check{y}_{22} & \cdots & \check{y}_{2j} \\ & & \ddots & \\ \check{y}_{i1} & \check{y}_{i2} & \cdots & \check{y}_{ij} \end{bmatrix},$$



where  $\tilde{y}_{ij}$  can be calculated by the equation:

$$\tilde{y}_{ij} = \frac{\tilde{y}_{ij}}{u} = \left( \frac{l_{ij}}{u}, \frac{m_{ij}}{u}, \frac{r_{ij}}{u}, \frac{u_{ij}}{u} \right). \quad (5)$$

Step 5: Now the total fuzzy relation matrix  $\tilde{G}$  has to be designed. Once the normalized fuzzy direct relation matrix is obtained, the identity matrix  $I$  has to be used to design the total fuzzy relation matrix  $\tilde{G}$ , which can be calculated using the following equation:

$$\begin{aligned} \tilde{G} &= \tilde{Y} + \tilde{Y}^2 + \dots + \tilde{Y}^p \\ &= \tilde{Y} (I + \tilde{Y} + \tilde{Y}^2 + \dots + \tilde{Y}^{p-1}) \\ &= \tilde{Y} (I + \tilde{Y} + \tilde{Y}^2 + \dots + \tilde{Y}^{p-1}) (I - \tilde{Y}) (I - \tilde{Y})^{-1} \quad . \\ &= \tilde{Y} (I - \tilde{Y})^{-1}, \text{ when } \lim_{p \rightarrow \infty} \tilde{Y}^p = [0]_{n \times n} \end{aligned} \quad (6)$$

$$\tilde{G} = \begin{bmatrix} \check{g}_{11} & \check{g}_{12} & \dots & \check{g}_{1n} \\ \check{g}_{21} & \check{g}_{22} & \dots & \check{g}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \check{g}_{m1} & \check{g}_{i2} & \dots & \check{g}_{mn} \end{bmatrix}, \quad (7)$$

when each element  $\check{g}_{ij}$  can be presented as:

$$\check{g}_{ij} = (l''_{ij}, m''_{ij}, r''_{ij}, u''_{ij}), \quad (8)$$

where  $l''_{ij}$ ,  $m''_{ij}$ ,  $r''_{ij}$  and  $u''_{ij}$  can be expressed by the formulas below:

$$\begin{aligned} [l''_{ij}] &= \tilde{Y}_l \times (I - \tilde{X}_l)^{-1} \\ [m''_{ij}] &= \tilde{Y}_m \times (I - \tilde{X}_m)^{-1}; \\ [r''_{ij}] &= \tilde{Y}_r \times (I - \tilde{X}_r)^{-1}; \\ [u''_{ij}] &= \tilde{Y}_u \times (I - \tilde{X}_u)^{-1}. \end{aligned} \quad (9)$$

Step 6: The total fuzzy relation matrix  $\tilde{G}$  (presented by Equation (7)) defuzzification. These calculations can be conducted through Formula (6). To achieve the transformation of the total fuzzy relation matrix  $\tilde{G}$  and to defuzzify it into a crisp total-relation matrix  $G$ , the recalculation values of matrix  $\tilde{G}$  elements have to be performed using Formula (10):

$$G = [g_{ij}], \quad i, j \in \{1, 2, \dots, n\}, \quad (10)$$

$$\text{where } g_{ij} = \frac{[(u_{ij} - l_{ij}) + (m_{ij} - l_{ij}) + (r_{ij} - l_{ij})]}{4} + l_{ij}. \quad (11)$$

Step 7: Now the rows and columns of matrix  $G$  have to be summed up. The total-relation matrixes of  $G$  elements' sum of rows and sum of columns are represented separately as  $D$  and  $R$  in Equation (12):

$$D = (d_i)_{n \times 1} = \left[ \sum_{j=1}^n g_{ij} \right]_{n \times 1}; \quad R = (r_j)'_{1 \times n} = \left[ \sum_{i=1}^n g_{ij} \right]'_{1 \times n}. \quad (12)$$

Then, the values of  $D + R$  and  $D - R$  can be calculated to represent the degree of importance of criteria  $i$  in the entire system and the net effects that criteria  $i$  contributes to the system, respectively.

Step 8. Now a structural model has to be established. After evaluation of the cause–effect relationships between pair-wise assessed criteria, the fuzzy DEMATEL investigation finishes with the establishment of a structural model. The causal diagram in DEMATEL analysis presents the causality between assessed criteria can be established by mapping the dataset of the calculated rate ( $D + R$ ) and ( $D - R$ ). The data set of ( $D + R$ ) values representing the horizontal axis was calculated by summation of the  $D$  with  $R$ , and the data set of ( $D - R$ ) illustrates the vertical axis; these values were completed by subtracting  $D$  from  $R$ . The value ( $D + R$ ) represents the power of influence between the criteria and depicts the significance or importance degree of each criteria, with high values representing the high powers of influence. The values of the ( $D - R$ ) data set show the relation of the criteria by causality, and represents the reciprocal effect by which the criteria are divided into a cause or an effect group. The positive ( $D - R$ ) values specify that the criteria belong to the cause group, and according to the value weight, the power of influence can be identified; the higher the value, the greater the influence. Additionally, negative values ( $D - R$ ) can define the effect group criteria [44]. Finally, taking into account all of the explanations mentioned above, the causal diagram can be constructed to illustrate the criteria's sense in relationships.

Additionally, it has to be mentioned that the total-relation matrix  $G$  can also provide an explanation as to how criteria affect each other. In this case, the threshold value should be set up, and by this value, insignificant relationships indicated in the total-relation matrix  $G$  have to be filtered out, and the internal relations matrix calculated. In this way, it is possible to identify and to map the cause–effect relationship accordingly, when partial relations are neglected and the network relationship map (NRM) is plotted. The values in total-relation matrix  $G$  that are greater than the threshold value is depicted in the NRM. The threshold value for relations can be calculated on the basis of the average values of the matrix  $G$ . Then, all values in matrix  $G$  that are smaller than the threshold value are changed to zero, because the causal relation mentioned above is not considered [45]. Subsequently, the causal diagrams illustrate the complex causal relationships of the criteria as a structural model, providing valuable understandings for strategy development. Subsequently, with the help of a causal diagram, militaries can make accurate decisions by recognizing the difference between the causes and effects in leadership behavior criteria.

#### 4. Research Sample

The data were collected using a survey carried out in the Lithuanian Armed Forces (LAF) in spring 2020. To represent the general population of professional military service soldiers who were serving in LAF units during the research there was questioned the 220 knowledgeable military service soldiers with dissimilar military positions and those from all units of the Lithuanian Armed Forces (LAF). They had to complete the Leader Behavior Description Questionnaire (LBDQ—Form XII) [13,14]. Additionally, 37 commander–leaders were chosen as experts to assess the twelve leadership criteria via pair-wise assessment. The experts were selected on the basis of their experience. Research was completed using traditional paper questionnaires presented in the Lithuanian language. This study followed the principles of ethical considerations by Bryman and Bell [46]. The data were handled with care, avoiding deception or exaggeration regarding the aims and objectives of the research. Any misleading information was avoided.

##### 4.1. Study Questionnaire Description

Leader Behavior Description Questionnaire Form XII (LBDQ Form XII) and individual data pages (IDP) were the survey tools chosen for data gathering in these investigations. LBDQ Form XII was established by Stogdill [15] after expansion of the primary LBDQ questionnaire presented by Halpin and issued by the Fisher College of Business in 1963.

The expanded questionnaire was established in order to obtain clarifications of leader behavior as observed by followers within the background of 12 criteria as subscales. The twelve criteria were coded and their descriptions, as specified by Stogdill [15,16], are presented in Table A2, Appendix A.

#### 4.2. Variables and Data Composition

To find out the success of the consistent process of LAF commander–leader training at all career levels, the behavior of LAF commander–leaders was measured using the LBDQ Form XII [13–16]. This questionnaire comprises 100 hypothetical statements describing leader behavior, which are divided into 12 measurement scales consisting of 5 or 10 statements. A description of the LBDQ-XII questionnaire scales is provided in Table A2, Appendix A. Study participants were asked to describe how often their line manager behaves (does not behave) in a team. The expressed opinions were measured on the basis of five categories of responses, which were provided in LBDQ Form XII [13–16] and are explained in Table A1, Appendix A.

The combined scale score is calculated by summing the scores obtained in the evaluation of each statement. A higher statement score reflects a leader who always or often behaves in this way and, conversely, the lower the score, the less often such a leader’s behavior is observed while working in a group. The 100 statements reflecting various work situations are classified into twelve constructs: Representation (L1), Conflict resolution (L2), Tolerance of uncertainty (L3), Ability to persuade (L4), Clear structure (L5), Tolerance and freedom (L6), Taking the lead (L7), Attentiveness/attention to others (L8), Result orientation (L9), Accurate forecasting (L10), Builds interpersonal relationships (L11), and Cooperation with managers (L12) are presented in Table A2, Appendix A.

### 5. Study Results

#### 5.1. Structural Equation Analysis Procedures

The factor analysis was used to determine whether the constructs of leader behavior were sufficiently valid and reliable. The Cronbach’s alpha coefficient variation interval was from 0.706 to 0.952 for constructed measurable factors scale and was in line with other studies’ recommendations [36–41]. The confirmatory factor analysis results are presented in Table 3.

**Table 3.** Description of Leader Behavior Questionnaire.

Main Construct Description	<sup>1</sup> Subconstruct Description	<sup>2</sup> Cronbach’s Alpha	<sup>3</sup> CR	<sup>4</sup> AVE
Representation (L1)	q1, q11, q21, q31, q41	0.828	0.89	0.63
Conflict resolution (L2)	q51, q61R, q71R, q81, q91R	0.833	0.90	0.80
Tolerance of uncertainty (L3)	q2, q12R, q22, q32, q42R, q52, q62R, q72, q82, q92R	0.763	0.93	0.74
Ability to persuade (L4)	q3, q13, q23, q33, q43, q53R, q63, q73, q83, q93	0.952	0.99	0.95
Clear structure (L5)	q4, q14, q24, q34, q44, q54, q64, q74, q84, q94	0.887	0.97	0.88
Tolerance and freedom (L6)	q5, q15, q25, q35, q45, q55, q65R, q75, q85, q95	0.932	0.98	0.92
Taking the lead (L7)	q6R, q16R, q26R, q36R, q46R, q56R, q66R, q76, q86, q96	0.813	0.95	0.80
Attentiveness/attention to others (L8)	q7, q17, q27, q37, q47, q57R, q67, q77, q87R, q97R	0.904	0.98	0.89
Result orientation (L9)	q8, q18, q28, q38, q48, q58, q68R, q78, q88, q98	0.786	0.93	0.77
Accurate forecasting (L10)	q9, q29, q49, q59, q89	0.835	0.90	0.80
Builds interpersonal relationships (L11)	q19, q39, q69, q79, q99	0.904	0.95	0.88
Cooperation with managers (L12)	q10, q20, q30, q40, q50, q60, q70, q80, q90, q100	0.706	0.89	0.68

Notes: <sup>1</sup> Subconstruct consists of 100 statements evaluated in the scale from 5—behavior is always demonstrated to 1—behavior is never demonstrated, and the scores of the twenty selected statements (q6R; q12R; q16R; q26R; q36R; q42R; q46R; q53R; q56R; q57R; q61R; q62R; q65R; q66R; q68R; q71R; q87R; q91R; q92R; q97R) are calculated in reverse order (scale from 1—behavior is always demonstrated to 5—behavior is never demonstrated); <sup>2</sup> Reliability statistics for main constructs measured by Cronbach’s Alpha; <sup>3</sup> CR = composite reliability; <sup>4</sup> AVE = average variance extracted.

Moreover, the composite reliability (CR) of the twelve constructs varied between 0.89 and 0.99 and was above the recommended 0.60 [29–34]. While the average variance extracted (AVE) from the twelve constructs ranged from 0.63 to 0.95, it was above the recommended value of 0.5 [24,36–45]. The data validity analysis results led us to continue with SEM analysis, which was performed using IBM AMOS 26v.

The confirmatory factor analysis procedures were used to test the twelve predictive main constructs as indicators of theorized leadership behavior model. The twelve predictive indicators in the Leader Behavior Description Questionnaire were tested and the minimum was achieved. The computed SEM analysis on the hypothesized model allowed us to identify the goodness-of-fit of its construct. The detailed results on nine assessment values are presented in Table 4.

**Table 4.** Theorized Model description by goodness-of-fit statistics.

Index Fit	<sup>1</sup> Recommended Value	Theorized Model
CMIN/DF	≤3	1.626
Probability level	>0.05	0.093
RMSEA	≤0.08	0.041
GFI	≥0.9	0.992
AGFI	≥0.8	0.892
RMR	<0.5	0.306
NFI	≥0.9	0.934
CFI	≥0.9	0.945
TLI	≥0.9	0.886

Notes: <sup>1</sup> Hair et al. (2010) recommended value.

The goodness-of-fit of constructed theoretical model (see Table 4) was  $\chi^2/df = 1.626$ , which was less than the standard score of the three suggested by [45]. The goodness-of-fit index (GFI) had a score of 0.992, exceeding the 0.9 recommended by Hair et al. [39]. The adjusted goodness-of-fit index (AGFI) had a score of 0.892, exceeding the 0.8 recommended by [40]. The root mean square error of approximation (RMSEA) had a score of 0.041 and was slightly lower than the requirement suggested by Hair et al. [39]. All the scores of the normed-fit index (NFI) (0.934) and competitive fit index (CFI) (0.945) exceeded the value of 0.9 recommended by [40], but the Tucker-Lewis Index (TLI) had a score of 0.886, which did not exceed the recommended value of 0.9 [41–45]. The results in Table 3 confirms that the values of goodness-of-fit indicate that the leader's behavior measurement model exceeded the minimum barrier value.

## 5.2. Cause and Effect Relations between the Leadership Behavior Constructs

To correctly evaluate the relationships between leadership behavior constructs and indicators, there a group of experts was assembled, comprising senior officers and junior officers. Of these, 30.6% of experts were senior officers and 69.4% were junior officers. The experts had the possibility to express the worries and requirements in their conclusion, which had to be reconciled by essential agreement; meanwhile, all parties contributed to the achievement or failure of the verdict.

Moreover, in order to simplify the professionals' holistic consideration of the purposes of the development scheme, their understanding of the Fuzzy DEMATEL technique [46–52], and how to use direct relationship Matrix Y for pair-wise comparison and measurement, a training session was held for clarification and preparation. Later, following the suggestion procedure and the Fuzzy DEMATEL technique, the causativeness and strong point of the effect associations between the 12 leadership criteria was measured. The comprehensive evaluation procedure is illustrated as follows, on the basis of the fuzzy DEMATEL investigation steps.

Step 1. The investigation starts with the construction of the direct relationship matrix Y. The evaluation of the 12 criteria in the form of direct relationship matrix Y was designed on the basis of 37 professionals' judgement and is shown in Table 1.

Step 2. The evaluation criteria are defined and a fuzzy semantic scale is designed. In this study, twelve leadership criteria were chosen for evaluation: Representation (L1), Conflict resolution (L2), Tolerance of uncertainty (L3), Ability to persuade (L4), Clear structure (L5), Tolerance and freedom (L6), Taking the lead (L7), and Attentiveness/attention to others (L8), Result orientation (L9), Accurate forecasting (L10), Builds interpersonal rela-

tionships (L11) and Cooperation with managers (L12). To evaluate these criteria the fuzzy semantic measure and its equivalent fuzzy value, the attribution function, was constructed on the basis of agreement [46].

Step 3. Conception of the fuzzy direct relation matrix. Taking into account the values in Table 2, the effects between the 12 criteria were obtained. The influence identified by the linguistic variable was transformed into a positive trapezoidal fuzzy value, then the initial fuzzy direct relation matrix  $Y$  was obtained. To design the initial fuzzy direct relation matrix  $Y$  as shown in Table 5 there were used the arithmetic average of the assessment.

**Table 5.** The initial direct relation matrix.

	L1	L2	L3	L4	L5	L6
L1	(0, 0, 0, 0)	(0, 0.25, 0.5, 0.75)	(0.25, 0.5, 0.75, 1)	(0, 0, 0.25, 0.25)	(0.25, 0.5, 0.75, 1)	(0, 0, 0.25, 0.25)
L2	(0.5, 0.75, 1, 1)	(0, 0, 0, 0)	(0.5, 0.75, 1, 1)	(0.25, 0.5, 0.75, 1)	(0, 0.25, 0.5, 0.75)	(0.5, 0.75, 1, 1)
L3	(0.25, 0.5, 0.75, 1)	(0, 0.25, 0.5, 0.75)	(0, 0, 0, 0)	(0, 0, 0.25, 0.25)	(0, 0, 0.25, 0.25)	(0.25, 0.5, 0.75, 1)
L4	(0.25, 0.5, 0.75, 1)	(0.5, 0.75, 1, 1)	(0.25, 0.5, 0.75, 1)	(0, 0, 0, 0)	(0, 0.25, 0.5, 0.75)	(0.25, 0.5, 0.75, 1)
L5	(0, 0.25, 0.5, 0.75)	(0.25, 0.5, 0.75, 1)	(0, 0, 0.25, 0.25)	(0.25, 0.5, 0.75, 1)	(0, 0, 0, 0)	(0, 0.25, 0.5, 0.75)
L6	(0.25, 0.5, 0.75, 1)	(0, 0.25, 0.5, 0.75)	(0, 0.25, 0.5, 0.75)	(0, 0, 0.25, 0.25)	0, 0, 0.25, 0.25)	(0, 0, 0, 0)
L7	(0.25, 0.5, 0.75, 1)	(0.5, 0.75, 1, 1)	(0.5, 0.75, 1, 1)	(0.25, 0.5, 0.75, 1)	(0.5, 0.75, 1, 1)	(0.5, 0.75, 1, 1)
L8	(0.5, 0.75, 1, 1)	(0, 0.25, 0.5, 0.75)	(0, 0.25, 0.5, 0.75)	(0.25, 0.5, 0.75, 1)	(0, 0, 0.25, 0.25)	(0.25, 0.5, 0.75, 1)
L9	(0.5, 0.75, 1, 1)	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0.5, 0.75, 1, 1)
L10	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0.5, 0.75, 1, 1)	(0, 0, 0.25, 0.25)	(0.25, 0.5, 0.75, 1)
L11	(0.5, 0.75, 1, 1)	(0.5, 0.75, 1, 1)	(0.5, 0.75, 1, 1)	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0.5, 0.75, 1, 1)
L12	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0.5, 0.75, 1, 1)	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0.5, 0.75, 1, 1)
	L7	L8	L9	L10	L11	L12
	(0.5, 0.75, 1, 1)	(0.25, 0.5, 0.75, 1)	(0, 0, 0.25, 0.25)	(0, 0, 0.25, 0.25)	(0.25, 0.5, 0.75, 1)	(0.5, 0.75, 1, 1)
	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0, 0.25, 0.5, 0.75)	(0, 0, 0.25, 0.25)	(0, 0.25, 0.5, 0.75)	(0.25, 0.5, 0.75, 1)
	(0, 0, 0.25, 0.50)	(0, 0, 0.25, 0.25)	(0, 0.25, 0.5, 0.75)	(0, 0.25, 0.5, 0.75)	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)
	(0.5, 0.75, 1, 1)	(0, 0.25, 0.5, 0.75)	(0.5, 0.75, 1, 1)	(0.25, 0.5, 0.75, 1)	(0.5, 0.75, 1, 1)	(0.5, 0.75, 1, 1)
	(0, 0, 0.25, 0.25)	(0, 0.25, 0.5, 0.75)	(0, 0.25, 0.5, 0.75)	(0, 0.25, 0.5, 0.75)	(0, 0.25, 0.5, 0.75)	(0, 0, 0.25, 0.25)
	(0, 0, 0.25, 0.25)	(0, 0, 0.25, 0.25)	(0.25, 0.5, 0.75, 1)	(0, 0, 0.25, 0.25)	(0, 0.25, 0.5, 0.75)	(0, 0.25, 0.5, 0.75)
	(0, 0, 0, 0)	(0, 0.25, 0.5, 0.75)	(0.5, 0.75, 1, 1)	(0, 0, 0.25, 0.25)	(0, 0.25, 0.5, 0.75)	(0.25, 0.5, 0.75, 1)
	(0.25, 0.5, 0.75, 1)	(0, 0, 0, 0)	(0, 0, 0.25, 0.25)	(0, 0.25, 0.5, 0.75)	(0, 0, 0.25, 0.25)	(0, 0, 0.25, 0.25)
	(0.25, 0.5, 0.75, 1)	(0.5, 0.75, 1, 1)	(0, 0, 0, 0)	(0.5, 0.75, 1, 1)	(0, 0.25, 0.5, 0.75)	(0, 0.25, 0.5, 0.75)
	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0, 0, 0, 0)	(0, 0, 0.25, 0.25)	(0, 0, 0.25, 0.50)
	(0, 0.25, 0.5, 0.75)	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0, 0, 0, 0)	(0, 0.25, 0.5, 0.75)
	(0.5, 0.75, 1, 1)	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0.25, 0.5, 0.75, 1)	(0.5, 0.75, 1, 1)	(0, 0, 0, 0)

Step 4. Now the normalized fuzzy direct relation matrix has to be constructed. This work can be done by ensuring the earlier presented Equation (3) for calculation maximum  $u$ -value ( $u= 30.5$ ). Then, Equation (4) is used to convert all the measures in the fuzzy direct relation matrix to find the normalized fuzzy direct relation matrix  $\tilde{Y}$ .

Step 5. Establish a total fuzzy direct relation matrix  $\tilde{G}$ . After obtaining the normalized fuzzy direct relation matrix, the next task is to construct the total fuzzy direct relation matrix in the way shown by Equation (10), as shown in Table 6.

Step 6. The total fuzzy direct relation matrix  $\tilde{G}$  using Equation (11) is now defuzzified, and all fuzzy values are changed to crisp values, as shown in Table 7.

On the basis of the measures in the total relation matrix, we can see the common connections between the twelve leadership behavior constructs. Additionally, to predict the appropriate relation and to eliminate confusion in the description of the influence–relations map, the threshold number was calculated as the mean average [44]. In this study, the threshold value was equal to 0.237.

**Table 6.** The normalized fuzzy direct relation matrix.

	L1	L2	L3	L4
L1	(0, 0, 0, 0)	(0.000, 0.000, 0.008, 0.016)	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)
L2	(0.016, 0.025, 0.033, 0.033)	(0, 0, 0, 0)	(0.016, 0.025, 0.033, 0.033)	(0.008, 0.016, 0.025, 0.033)
L3	(0.008, 0.016, 0.025, 0.033)	(0.000, 0.008, 0.016, 0.025)	(0, 0, 0, 0)	(0.016, 0.025, 0.033, 0.033)
L4	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0, 0, 0, 0)
L5	(0.000, 0.008, 0.016, 0.025)	(0.008, 0.016, 0.025, 0.033)	(0.000, 0.000, 0.008, 0.008)	(0.008, 0.016, 0.025, 0.033)
L6	(0.008, 0.016, 0.025, 0.033)	(0.000, 0.008, 0.016, 0.025)	(0.000, 0.008, 0.016, 0.025)	(0.000, 0.000, 0.008, 0.008)
L7	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0.008, 0.016, 0.025, 0.033)
L8	(0.016, 0.025, 0.033, 0.033)	(0.000, 0.008, 0.016, 0.025)	(0.000, 0.008, 0.016, 0.025)	(0.008, 0.016, 0.025, 0.033)
L9	(0.016, 0.025, 0.033, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0.008, 0.016, 0.025, 0.033)
L10	(0.008, 0.016, 0.025, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)
L11	(0.016, 0.025, 0.033, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0.008, 0.016, 0.025, 0.033)
L12	(0.008, 0.016, 0.025, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0.008, 0.016, 0.025, 0.033)
	L5	L6	L7	L8
	(0.008, 0.016, 0.025, 0.033)	(0.000, 0.000, 0.008, 0.008)	(0.016, 0.025, 0.033, 0.033)	(0.008, 0.016, 0.025, 0.033)
	(0.000, 0.008, 0.016, 0.025)	(0.016, 0.025, 0.033, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0.008, 0.016, 0.025, 0.033)
	(0.000, 0.000, 0.008, 0.008)	(0.008, 0.016, 0.025, 0.033)	(0.000, 0.000, 0.008, 0.016)	(0.000, 0.000, 0.008, 0.008)
	(0.000, 0.008, 0.016, 0.025)	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0.000, 0.008, 0.016, 0.025)
	(0, 0, 0, 0)	(0.000, 0.008, 0.016, 0.025)	(0.000, 0.000, 0.008, 0.008)	(0.000, 0.008, 0.016, 0.025)
	(0.000, 0.000, 0.008, 0.008)	(0, 0, 0, 0)	(0.000, 0.000, 0.008, 0.008)	(0.000, 0.000, 0.008, 0.008)
	(0.016, 0.025, 0.033, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0, 0, 0, 0)	(0.000, 0.008, 0.016, 0.025)
	(0.000, 0.000, 0.008, 0.008)	(0.008, 0.016, 0.025, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0, 0, 0, 0)
	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)
	(0.000, 0.000, 0.008, 0.008)	(0.008, 0.016, 0.025, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0.008, 0.016, 0.025, 0.033)
	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0.000, 0.008, 0.016, 0.025)	(0.008, 0.016, 0.025, 0.033)
	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0.008, 0.016, 0.025, 0.033)
	L9	L10	L11	L12
	(0.000, 0.000, 0.008, 0.008)	(0.000, 0.000, 0.008, 0.008)	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)
	(0.000, 0.008, 0.016, 0.025)	(0.000, 0.000, 0.008, 0.008)	(0.000, 0.008, 0.016, 0.025)	(0.008, 0.016, 0.025, 0.033)
	(0.000, 0.008, 0.016, 0.025)	(0.000, 0.008, 0.016, 0.025)	(0.008, 0.016, 0.025, 0.033)	(0.008, 0.016, 0.025, 0.033)
	(0.016, 0.025, 0.033, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0.016, 0.025, 0.033, 0.033)
	(0.000, 0.008, 0.016, 0.025)	(0.000, 0.008, 0.016, 0.025)	(0.000, 0.008, 0.016, 0.025)	(0.000, 0.000, 0.008, 0.008)
	(0.008, 0.016, 0.025, 0.033)	(0.000, 0.000, 0.008, 0.008)	(0.000, 0.008, 0.016, 0.025)	(0.000, 0.008, 0.016, 0.025)
	(0.016, 0.025, 0.033, 0.033)	(0.000, 0.000, 0.008, 0.008)	(0.000, 0.008, 0.016, 0.025)	(0.008, 0.016, 0.025, 0.033)
	(0.000, 0.000, 0.008, 0.008)	(0.000, 0.008, 0.016, 0.025)	(0.000, 0.000, 0.008, 0.008)	(0.000, 0.000, 0.008, 0.008)
	(0, 0, 0, 0)	(0.016, 0.025, 0.033, 0.033)	(0.000, 0.008, 0.016, 0.025)	(0.000, 0.008, 0.016, 0.025)
	(0.008, 0.016, 0.025, 0.033)	(0, 0, 0, 0)	(0.000, 0.000, 0.000, 0.008)	(0.000, 0.000, 0.008, 0.016)
	(0.008, 0.016, 0.025, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0, 0, 0, 0)	(0.000, 0.008, 0.016, 0.025)
	(0.008, 0.016, 0.025, 0.033)	(0.008, 0.016, 0.025, 0.033)	(0.016, 0.025, 0.033, 0.033)	(0, 0, 0, 0)

**Table 7.** The defuzzified total-relation matrix as a crisp total-relation matrix.

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12
L1	0.198	0.192	<b>0.257 *</b>	0.164	0.207	0.207	<b>0.253 *</b>	0.219	0.166	0.133	0.219	<b>0.242 *</b>
L2	<b>0.343 *</b>	0.202	<b>0.321 *</b>	<b>0.249 *</b>	0.204	<b>0.329 *</b>	<b>0.269 *</b>	<b>0.250 *</b>	0.230	0.158	0.225	<b>0.260 *</b>
L3	<b>0.251 *</b>	0.190	0.161	0.142	0.130	<b>0.241 *</b>	0.162	0.145	0.177	0.148	0.202	0.205
L4	<b>0.380 *</b>	<b>0.351 *</b>	<b>0.355 *</b>	0.222	<b>0.243 *</b>	<b>0.366 *</b>	<b>0.337 *</b>	<b>0.268 *</b>	<b>0.326 *</b>	<b>0.253 *</b>	<b>0.313 *</b>	<b>0.320 *</b>
L5	0.210	0.212	0.165	0.196	0.102	0.200	0.148	0.166	0.168	0.141	0.161	0.137
L6	0.220	0.163	0.178	0.119	0.111	0.135	0.131	0.123	0.181	0.101	0.150	0.153
L7	<b>0.347 *</b>	<b>0.322 *</b>	<b>0.342 *</b>	<b>0.271 *</b>	<b>0.272 *</b>	<b>0.354 *</b>	0.211	<b>0.241 *</b>	<b>0.299 *</b>	0.175	<b>0.242 *</b>	<b>0.276 *</b>
L8	<b>0.272 *</b>	0.190	0.206	0.199	0.128	<b>0.238 *</b>	0.216	0.123	0.148	0.143	0.142	0.150
L9	<b>0.375 *</b>	<b>0.305 *</b>	<b>0.326 *</b>	<b>0.278 *</b>	<b>0.250 *</b>	<b>0.358 *</b>	<b>0.295 *</b>	<b>0.297 *</b>	0.206	<b>0.256 *</b>	<b>0.242 *</b>	<b>0.250 *</b>
L10	<b>0.306 *</b>	<b>0.265 *</b>	<b>0.284 *</b>	<b>0.262 *</b>	0.162	<b>0.292 *</b>	<b>0.259 *</b>	<b>0.240 *</b>	<b>0.247 *</b>	0.131	0.180	0.196
L11	<b>0.377 *</b>	<b>0.327 *</b>	<b>0.349 *</b>	<b>0.277 *</b>	<b>0.251 *</b>	<b>0.359 *</b>	<b>0.266 *</b>	<b>0.276 *</b>	<b>0.282 *</b>	0.236	0.197	<b>0.252 *</b>
L12	<b>0.380 *</b>	<b>0.329 *</b>	<b>0.373 *</b>	<b>0.297 *</b>	<b>0.270 *</b>	<b>0.386 *</b>	<b>0.334 *</b>	<b>0.294 *</b>	<b>0.304 *</b>	<b>0.252 *</b>	<b>0.312 *</b>	0.222

Notes: This study applied the mean average as the threshold; \* >0.237 (threshold).



Step 7. Final output before designing the cause–effect diagram. Now, on the basis of Equation (12), the sum of each row (D) and each column (R) of the total-relation matrix G is calculated. Subsequently, the centrality (D+R) and causality (D-R) were obtained. and these are the values that have to be discussed in detail.

The greatest centrality (D + R) value appears for L12—cooperation with managers, L4—ability to persuade and L7—taking the lead (see Table 8). Positive values in causality (D – R) were calculated for six criteria: L4—ability to persuade, L7—taking the lead, L9—Result orientation, L10—accurate forecasting, L11—builds interpersonal relationships and L12—cooperation with managers. Negative causality (D – R) values were identified for: L1—representation, L2—conflict resolution, L3—tolerance of uncertainty, L5—clear structure, L6—tolerance and freedom and L8—attention to others. The study results show that L4, L7, L9, L10, L11 and L12 are the criteria that play a causal role and influence L1, L2, L3, L5, L6 and L8. Following the causal relationship analysis of centrality and causality, L12 is the most influential criterion, and the most affected criterion is L6. The lowest identified centrality of L5 led to the conclusion that it was independent. These study results indicate that militaries should consider six criteria—L4, L7, L9, L10, L11 and L12—as priorities for improving their leadership competency. The study results are presented in Table 8.

**Table 8.** The degree of centrality (D + R) and causality (D – R).

Construct	D	R	D + R	D – R	Identity	Rank
L1	2.456	3.659	6.115	–1.203	effect	11
L2	3.040	3.048	6.088	–0.009	effect	7
L3	2.155	3.316	5.471	–1.161	effect	10
L4	3.732	2.675	6.408	1.057	cause	2
L5	2.006	2.330	4.336	–0.324	effect	8
L6	1.766	3.465	5.231	–1.699	effect	12
L7	3.352	2.881	6.233	0.471	cause	6
L8	2.154	2.641	4.796	–0.487	effect	9
L9	3.440	2.733	6.172	0.707	cause	4
L10	2.822	2.128	4.950	0.694	cause	5
L11	3.447	2.585	6.033	0.862	cause	3
L12	3.753	2.662	6.415	1.091	cause	1

Step 8. Design of the cause–effect diagram and the influence–relation map. The calculated values of causality (D – R) and centrality (D + R) presented in Table 8 as the assessment values for the twelve leadership behavior criteria were used to design the cause–effect diagram. Additionally, the influence–relation information specified in Table 8 as identity was used to produce the influence–relation map, which indicates the cause-and-effect relationships among leadership behavior criteria; see Figure 3.

According to the cause–effect diagram presented in Figure 3, each criterion can be assessed on the basis of the following characteristics:

- the horizontal vector (D + R) characterizes the degree of importance between each criterion acting in the whole structure. Therefore, taking into account the (D + R) values can indicate the criterion’s impact on the whole structure and the impact of other criteria in the structure on the criterion in terms of degree of importance:

$$L12 > L4 > L7 > L9 > L1 > L2 > L11 > L3 > L6 > L10 > L8 > L5.$$

1. the vertical vector (D – R) represents the degree of a criterion’s influence on the system. Positive values of (D – R) represent the causal variables L4, L7, L9, L10, L11, while negative values of (D – R) represent the effects L1, L2, L3, L5, L6 and L8.

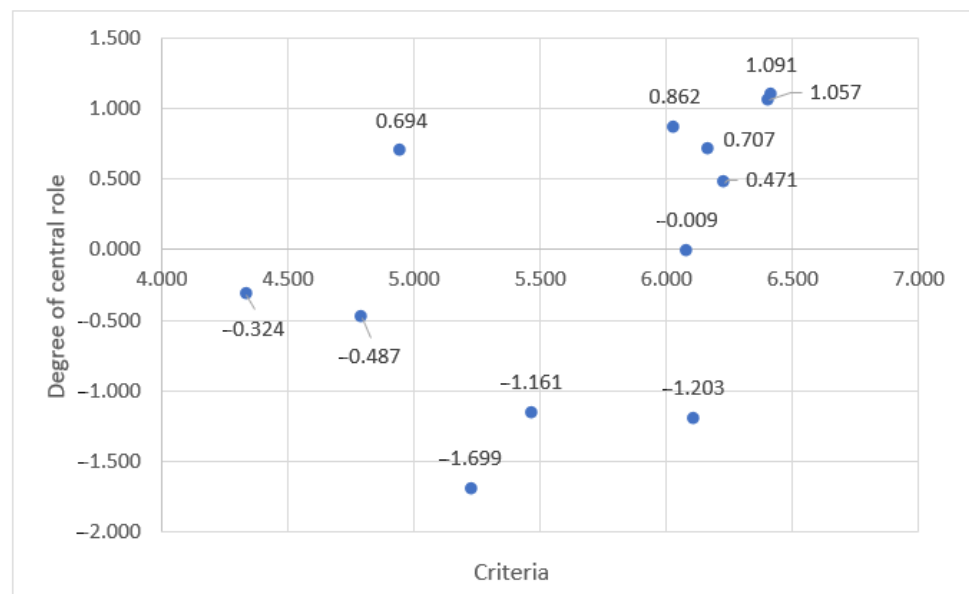


Figure 3. Cause-effect diagram.

Additionally, the model of significant relations between twelve leadership behavior criteria is presented by Table A3 in Appendix A and as influence-relation map in Figure 4.

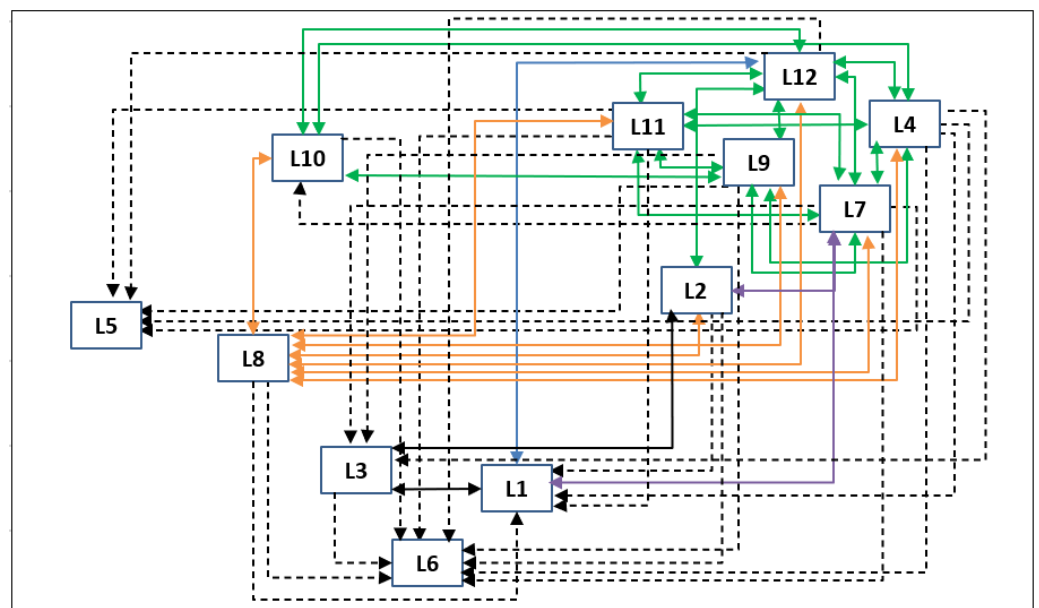


Figure 4. Influence-relation map.

In order to simplify the interpretation of the relationships, all values that were smaller than 0.237 (threshold number) are set to zero in Table A3 (see Appendix A). In Figure 4, constructs that affect one another are identified by a dotted line, and two constructs that affect each other are connected by a double arrow. A detailed analysis of relationships between the twelve criteria made it possible to conclude that the ability to persuade (L4) and cooperation with managers (L12) are the causes that most affect the other construct criteria. Among the effect groups, conflict resolution (L2) had the strongest intensity and represents the final effect of the successful military leadership in the Lithuanian Army.

The (D – R) values of tolerance and freedom (L6), representation (L1), and tolerance of uncertainty (L3) were far lower than other criteria, which means that they were the most

affected criteria, and their impact on leader behavior formation was minor. Additionally, ability to persuade (L4), taking the lead (L7), result orientation (L9), accurate forecasting (L10), builds interpersonal relationships (L11) and cooperation with managers (L12) all interact with each other. This means that the militaries for continuous leadership development have to focus on increasing the indicated commander–leader’s abilities (L4, L7, L9, L10, L11 and L12). Therefore, the fact that military leadership is a process that involves commanders influencing soldiers to accomplish the mission successfully, as well as the commander’s ability to inspire subordinates to perform the mission so as to achieve a timely and quality result presents a challenge. Moreover, the relationship between cooperation with managers (L12) and the ability to persuade (L4) might be overweighted, because a strong effect and high importance was identified between these constructs.

## 6. Discussion

The conducted fuzzy DEMATEL analysis results of the twelve leadership behavior criteria made it possible to evaluate the leadership behavior criteria. The cause–effect diagram was constructed to present the influenced and influence criteria relationships of leadership behavior. The cause–effect results demonstrate that the following belong to the influenced leadership behavior criteria group: L4, L7, L10, L11 and L12. The criteria that are responsible for the effect of leadership behavior are: L1, L2, L3, L5, L6, L8 and L9.

Moreover, the fuzzy DEMATEL analysis helped to rank twelve criteria (see Table 8). The order of the twelve analyzed leadership behavior criteria can be presented as follows: L12 > L4 > L11 > L9 > L10 > L7 > L2 > L5 > L8 > L3 > L1 > L6 (see Figure 5). This study allowed us to identify that the cooperation with managers (L12), the ability to persuade (L4) and to build interpersonal relationships (L11) showed higher strength than the other constructs, because the leadership can stand for a capability to continue a balance of consideration in defining and implementing the specific mission, in constructing, educating and training a group [2,6].

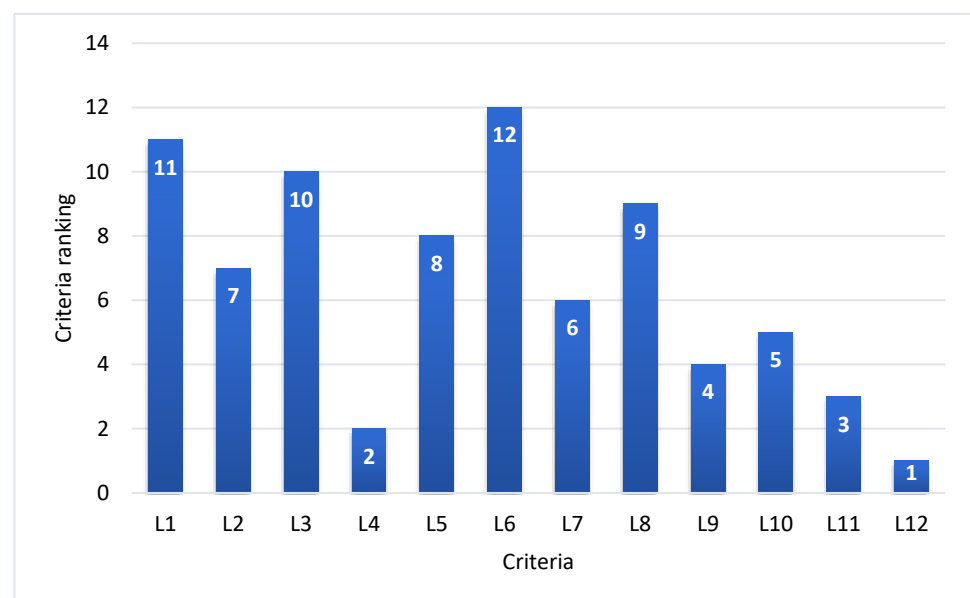


Figure 5. Ranking of twelve leadership behavior criteria.

According to the research findings, the second most important factor of leadership is the ability to persuade (L4) superior levels of customer service and support. According to these research findings, the second most important factor of leadership is the ability to persuade (L4) all levels of soldiers and support them. Moreover, leaders should therefore follow the continuous improvement of leadership skills by learning from own mistakes

and mistakes of others, without being afraid to acknowledge them and take responsibility for oneself and subordinates.

The remaining criteria in order of priority were as follows: being good at result orientation (L9) and accurate forecasting (L10), being good at taking the lead (L7), and conflict resolution (L2) had the strongest intensity and represented the final effect of successful military leadership in the Lithuanian Army. These findings are in line with the results of another research [17,34–36]. The military service soldiers and commander-leaders involved in the case study are generally benefited by our novel approaches. The contribution of study corresponds to previous investigations in which was pointed out that L2, L9, L11, L12 and L8 are important leader's behaviors features because this helps better manage processes among subordinates [36].

Moreover, these study results are similar to those of Snæbjörnsson [30], who stated that simultaneous consideration of the cause–effect relationships among various key factors is vital in designing leadership strategies, because leaders possess a group that needs to act as a team and resolve interpersonal disagreements and differences when they happen [31–35]. Additionally, leaders representing the group, speaking on behalf of it, being a visible representative and spokesperson of the group, are also among the desired behaviors, indicating coherence in desired leader behavior. Therefore, the recommendations for commander-leaders according to these findings are that it is necessary for them to understand their followers' desires and requirements, provide a high level of leadership and support, and also to improve their relationship with the group to gain competitive advantage in this area. Leaders who address these issues can also understand the strengths and weaknesses of their troops and identify effective strategies for achieving their goals in complex military missions.

Furthermore, these investigations differ from previous studies because they show effective usage of the fuzzy DEMATEL technique [46–52] for the assessment of leadership behavior. The outcomes obtained from this study can help to choose appropriate ways of achieving high results not only in the performance of complex military missions, but also in achieving quality leadership results in the day-to-day execution of tasks and to achieve the ultimate goal in order to implement the qualities and abilities necessary for a team leader from the very first stage of a soldier's professional career in accordance with a purposeful leadership model.

However, several limitations can be listed that could help to identify directions for future investigations. Once a judgement has been completed, the outcomes need to be comprehensively analyzed. Additionally, it can be mentioned that the precision and success of a judgement is dependent on the scrupulousness and knowledge of the judges. Additionally, the 12 leadership behavior criteria identified for the military leadership assessment were obtained from literature analysis, so it could be that the actual indicators are not necessarily enclosed. Hence, new aspects can be evaluated depending on the specific features of future studies.

## 7. Conclusions

This research presents military leadership data analyses conducted using the fuzzy DEMATEL method. The validated Leader Behavior Description Questionnaire (LBDQ XII) was used to collect data representing followers' preferences towards desirable commander-leader behavior on the basis of the 12 leadership behavior criteria position assessment. The research was performed in spring of 2020. A total of 220 qualified military service soldiers were questioned from all units of the Lithuanian Armed Forces (LAF) and with various military ranks, representing the general population of professional military service soldiers serving in LAF units during the research. Additionally, 37 commander-leaders were chosen as experts to judge the importance of the twelve leadership criteria on the basis of pair-wise assessment.

At first the preliminary analysis was performed. This allowed us to identify the validity and reliability of the hypothesized leader behavior model constructs. Furthermore,

SEM was used to verify the goodness-of-fit ( $\chi^2 = 53.65$  [df = 33,  $p = 0.093$ ], CFI = 0.945, NFI = 0.934, TLI = 0.886, RMSEA = 0.041, and PCLOSE = 0.867) of the designed leadership model. Later, the Fuzzy DEMATEL method was used for detailed analysis of the causal relationship among the main constructs and indicators of leader behavior constructs, and as a result, finally, a cause–effect diagram and influence–relations map was built.

These research results show that the dimension leadership behavior capabilities, composed of strong leader-officer influence management, cooperation with managers (L12), ability to persuade (L4) and effective human resource management by building the interpersonal relationships (L11). These findings confirmed that leader capabilities cause the greatest influence on the other dimensions, because leadership can be defined as the ability to maintain focus, balance in defining and implementing a specific task, and creating, developing, and educating a group. If a commander's leadership abilities are high, this also leads to high potential for the other dimensions in the group.

Additionally, our adopted technique effectively encompasses the DEMATEL technique by using both linguistic measures and a fuzzy aggregation technique, so that it can effectively deal with ambiguous and imprecise judgments. The conducted case study enabled the conceptualization of a causal map, and the recognition of the importance of the factors that distress military leadership through a trapezoidal fuzzy value. The fuzzy DEMATEL method showed that it is a useful tool not only for determining key success criteria, but also for evaluating the relationships between criteria. In this study, we conducted a case study to construct a causal diagram and identify the importance of the criteria that affect leadership strategy. In particular, the cause–effect map can also effectively separate a set of multifaceted criteria into a cause cluster, and an effect cluster and influence–relations diagram produce an observable causal map. Through the causal chart, the complexity of the difficulties is easier to understand, and profound assumptions can be made. The results of this study can hopefully help militaries choose precisely which strategies are suitable by focusing on the crucial criteria with respect to desired commander–leader behavior training.

Finally, study findings lead to another direction of future research, to use study results in comparing the leadership behavior criteria under different contexts and the measure the generational influence on understanding of leadership phenomena.

**Author Contributions:** Conceptualization, S.B., I.M.-K. and Š.H.-M.; methodology, S.B., I.M.-K. and Š.H.-M.; software, S.B.; validation, S.B. and Š.H.-M.; formal analysis, S.B.; investigation, S.B., I.M.-K. and Š.H.-M.; resources, S.B., I.M.-K. and Š.H.-M.; data curation, S.B.; writing—original draft preparation, S.B., I.M.-K. and Š.H.-M.; writing—review and editing, S.B., I.M.-K. and Š.H.-M.; visualization, S.B.; supervision, S.B. and I.M.-K.; project administration, S.B. and I.M.-K.; funding acquisition, I.M.-K. and Š.H.-M. All authors have read and agreed to the published version of the manuscript.

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**Institutional Review Board Statement:** The study was conducted according to the guidelines of the Declaration of Helsinki.

**Informed Consent Statement:** This research there were not used specific human materials. The research was based on questionnaire and respondents just had express their own opinion. Additionally, we strongly were following the ethical requirements of respondents' anonymity.

**Data Availability Statement:** Data sharing not applicable.

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**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A

Table A1. Leader Behavior Descriptor Questionnaire's measurement scales.

Original Scale Order			<sup>1</sup> Reverse Scale Order		
<sup>2</sup> LM	Statement	Points	<sup>2</sup> LM	Statement	Points
A	behavior is always demonstrated	5	A	behavior is always demonstrated	1
F	behavior is demonstrated frequently	4	F	behavior is demonstrated frequently	2
S	behavior is sometimes demonstrated	3	S	behavior is sometimes demonstrated	3
R	behavior is rarely demonstrated	2	R	behavior is rarely demonstrated	4
N	behavior is never demonstrated	1	N	behavior is never demonstrated	5

<sup>1,2</sup> Notes: <sup>1</sup> Reverse scale order was used for twenty selected statements (q6; q12; q16; q26; q36; q42; q46; q53; q56; q57; q61; q62; q65; q66; q68; q71; q87; q91; q92; q97); <sup>2</sup> LM = linguistic measurement: A = always, F = frequently, S = sometimes, R = rarely, N = never.

Table A2. Description of Leader Behavior Questionnaire.

Criteria	<sup>1</sup> Description	Code
Representation	-speaks and acts as the representative of the group and indicates its importance in an organization: q1, q11, q21, q31, q41.	L1
Demand reconciliation	-reconciles conflicting demands: q51, q61R, q71R, q81, q91R.	L2
Tolerance of uncertainty	-is able to tolerate uncertainty and postponement without anxiety or upset: q2, q12R, q22, q32, q42R, q52, q62R, q72, q82, q92R.	L3
Persuasiveness	-uses persuasion and argument effectively; exhibits strong convictions: q3, q13, q23, q33, q43, q53R, q63, q73, q83, q93.	L4
Initiation of structure	-defines own role, and lets followers know what is expected: q4, q14, q24, q34, q44, q54, q64, q74, q84, q94.	L5
Tolerance and freedom	-allows followers scope for initiative, decision and action: q5, q15, q25, q35, q45, q55, q65R, q75, q85, q95.	L6
Role assumption	-actively exercises the leadership role rather than surrendering leadership to others: q6R, q16R, q26R, q36R, q46R, q56R, q66R, q76, q86, q96.	L7
Consideration	-regards the comfort, well-being, status, and contributions of followers: q7, q17, q27, q37, q47, q57R, q67, q77, q87R, q97R.	L8
Product emphasis	-formulates the team goals; constantly seeks for better results; applies pressure for productive output: q8, q18, q28, q38, q48, q58, q68R, q78, q88, q98.	L9
Predictive accuracy	-displays foresight and ability to predict outcome accurately: q9, q29, q49, q59, q89.	L10
Integration	-maintains a closely knit organization; demonstrates intermember relations: q19, q39, q69, q79, q99.	L11
Superior orientation	-maintains cordial relations with superiors; has influence over their decisions; is striving for higher status: q10, q20, q30, q40, q50, q60, q70, q80, q90, q100.	L12

Notes: <sup>1</sup> Subconstruct consists of 100 statements evaluated in the scale from 5-behavior is always demonstrated to 1- behavior was never demonstrated, and the scores of the twenty selected statements (q6; q12; q16; q26; q36; q42; q46; q53; q56; q57; q61; q62; q65; q66; q68; q71; q87; q91; q92; q97) are calculated in reverse order (scale from 1—behavior is always demonstrated to 5—behavior was never demonstrated).

Table A3. The defuzzified total-relation matrix into a crisp total-relation matrix.

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12
L1	0	0	0.257 *	0	0	0	0.253 *	0	0	0	0	0.242 *
L2	0.343 *	0	0.321 *	0.249 *	0	0.329 *	0.269 *	0.250 *	0	0	0	0.260 *
L3	0.251 *	0	0	0	0	0.241 *	0	0	0	0	0	0
L4	0.380 *	0.351 *	0.355 *	0	0.243 *	0.366 *	0.337 *	0.268 *	0.326 *	0.253 *	0.313 *	0.320 *
L5	0	0	0	0	0	0	0	0	0	0	0	0
L6	0	0	0	0	0	0	0	0	0	0	0	0
L7	0.347 *	0.322 *	0.342 *	0.271 *	0.272 *	0.354 *	0	0.241 *	0.299 *	0	0.242 *	0.276 *
L8	0.272 *	0	0	0	0	0.238 *	0	0	0	0	0	0
L9	0.375 *	0.305 *	0.326 *	0.278 *	0.250 *	0.358 *	0.295 *	0.297 *	0	0.256 *	0.242 *	0.250 *
L10	0.306 *	0.265 *	0.284 *	0.262 *	0	0.292 *	0.259 *	0.240 *	0.247 *	0	0	0
L11	0.377 *	0.327 *	0.349 *	0.277 *	0.251 *	0.359 *	0.266 *	0.276 *	0.282 *	0	0	0.252 *
L12	0.380 *	0.329 *	0.373 *	0.297 *	0.270 *	0.386 *	0.334 *	0.294 *	0.304 *	0.252 *	0.312 *	0

Notes: This study applied the mean average as the threshold; \* >0.237 (threshold).



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