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Modelling OCB and CWB by combined Fuzzy Signature model

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ABSTRACT

Globalization and its challenges for organizations led to the understanding that employees can be a critical factor contributing to the organization's performance. Therefore, various studies sought to understand employee's behaviour that in itself encompasses various forms of engagement. One of the constructs defining engagement is citizenship behaviour (OCB) and counterproductive work behaviour (CWB). Based on previous researches, the study aims to contribute to the knowledge on the correlation between OCB and CWB considered as a behavioural engagement, from one side, and interplay of these constructs with the related constructs such as a trait engagement, perception of organization, state engagement, from another side. Since the empirical studies typically tend to concentrate on one or several factors separately, it is difficult to get a better understanding of relationship of all forms of engagement in corpore. To address this gap, we create a complex model of investigation developed to describe the linkage of the factors - OCB, CWB and related constructs under one umbrella and, by employing a combined statistical and Fuzzy Signature (FSig) model, we investigated the link with behavioural engagement. The present study covered one region of the northern part of Lithuania. It is based on 144 completed questionnaires from 35 companies. Findings support the assumption of the relationships of behavioural engagement (i.e. OCB and CWB) and the remaining multifaceted factors, and make a step forward by offering a new model for investigation the multifaceted phenomenon of employee engagement.

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1. Introduction

In response to the challenges of the globalized world, organizations look for new, more efficient and sustainable ways in boosting their performance. Growing understanding of the fact that the greatest asset of any organization is its human resources

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establishes new strategic guidelines with the focus on employees, and their role in achieving the organization's goals. Managements have an intensive interest in how their employees feel and think about their jobs, as well as what and how much employees are willing to dedicate to the organization (Ariani, 2013). Employee performance has emerged as a critical factor contributing to the overall organizational performance. Therefore, over the last decades, researches have sought to better understand employees behaviours to organizational effectiveness (Bolino et al., 2012) and organization managements have become proactive in finding the best solutions for employee engagement as employees can demonstrate their caring at work when employed in companies that are good corporate citizens, and thus have a stronger sense of engagement at work.

Employee engagement is the level of commitment and involvement of employees having towards their organization and its values. Employee behaviour at work and engagement are covered by many academic constructs defining the phenomenon. Among these, probably the most widely used construct is organization citizenship behaviour. OCB can be defined as a voluntary behaviour that goes beyond the job tasks and responsibilities and contributes to the effective social and psychological context of the organization, that supports task performance (Fehr et al., 2017). The opposite of OCB is called counterproductive work behaviour (CWB) and can be interpreted as destructive voluntary behaviour that violates an organization's norms and threatens the well-being of the organization and its members.

There are several workplace features that in combination are vital to fostering high OCB. Therefore, to drive employees towards achieving high involvement in and firm commitment to their job and organization roles, it is crucial to identify the main factors that can motivate the employees to carry out their functions effectively and efficiently. Various researchers (Ariani, 2013; Babcock-Roberson & Strickland, 2010; Chompookum & Derr, 2004; Farrell & Finkelstein, 2007; Podsakoff et al., 2009, 2011; Shen et al., 2014) present evidence showing that there are many factors influencing OCB (such as organizational culture, personal characteristics, communication, gender, age, perception of the organization, etc.) that engender positive or negative outcomes in work performance and employee behaviour (mainly, career/job satisfaction, organizational citizenship behaviour or counterproductive behaviour, and commitment towards the organization).

To date, the literature lacks research on the relationship between OCB, CWB and the wide array of employee engagement factors mentioned above. Thus, as OCB and CWB can be related to these factors, it is intuitive to refer to research on the relationship between OCB, CWB and a wide array of factors *in corpore* in order to disclose their interplay and significance. To date, findings on the association between organizational citizenship behaviour, counterproductive behaviour and our mentioned influencing factors are inconsistent.

The aim of this study is to contribute to the knowledge on the relationship between OCB and CWB, from one side, and the factors influencing them in business organizations based on the data from companies of North Lithuania, from another side. The database used comes from the Lithuanian stream of a worldwide cross-cultural management research project started by D. A. Ralston, L. Trevino and F.

Weinberg, based on questionnaires filled in at various organizations covering different types of industries. While the overall evaluation of these questions and answers still has to be published, the data obtained from the Lithuanian answers (this part of the project being carried out by the first author and her group) provide a good starting point for presenting an entirely new modelling approach, and thus deliver some interesting, if not surprising results concerning the attitudes of Lithuanian employees.

In order to obtain the proposed new type of model, first we will examine the statistical relationships of the answers given to the mentioned questionnaire concerning OCB and CWB attitudes, and then construct a FSig based model that properly reflects the various degree interrelationships and mutual influences of the individual factors included in this study. Fuzzy Signatures are hierarchically structured multi-component descriptors with uncertain elements. For details of FSig, and for the antecedent concept, Vector Valued Fuzzy Sets, cf. (Koczy, 1980; Vamos et al., 1999; Wong et al., 2007). Another study by the same authors (Koczy et al., 2019) is focusing on the details of the methodology.

In order to set up the correct FSig model, a preliminary statistical analysis is carried out. Many studies have been conducted in the attempt to establish the relationships among OCB, CWB, and other separate factors related to job performance, but there has been no (published) attempt to find the correlation among them *in corpore*. Especially the hierarchical structure of these factors and their partial interdependence is important to note – this is the main motivation why the FSig model was proposed. Therefore, the goal of this study is to examine whether and to what degree OCB and CWB, and their component factors, respectively, are interrelated by the remaining engagement factors. A combination of FSigs and a statistical approach based on multiple correlation analysis was applied to investigate the above-mentioned relationships.

The paper is structured as follows. First, we present theoretical findings on the phenomenon under research. Second, we present the research method and results of its application, and thereafter we explain our empirical findings. The paper concludes with the discussion of the results and some ideas for further research.

2. Theoretical background

The concept of employee or work engagement is a comparatively recent idea in the human resource management practice and it has been present in academic discussions for only close to two decades (Markos & Sridevi, 2010; Piccolo & Colquitt, 2006; Purvanova et al., 2006). The term “employee engagement” encompasses different concepts depending on the context and the usage. Employee engagement prospers in milieus with strong connections among corporate and individual values. This implies two ways of communication: companies promote their values among the employees and alternatively, take into account their employees’ values in the work procedure. In this way, the conformity of individual and corporate values inspires diverse perspectives.

Kahn (1990) defined engagement as “the harnessing of organization members’ selves to their work roles; in engagement, people employ and express themselves physically, cognitively, and emotionally during role performances”. Engagement

promotes the efficient and effective functioning of the organization as well as employee performance (Ariani, 2013). In other words, employee engagement is a positive employee attitude towards the organization and its values. With the increase of engagement, efficient and effective functioning of the organization increases as well. Such engagement can be defined as individual behaviour that is autonomous, self-sustaining and non-obligatory, and it is not directly and explicitly recognized by the formal reward system. Consequently, the opposite construct would be employee disengagement that is described by Kahn (1990) as “the uncoupling of selves from work roles; in disengagement, people withdraw and defend themselves physically, cognitively, or emotionally during role performances”. These positive and negative aspects of engagement in the management literature are called organizational citizenship behaviour and counterproductive behaviour, respectively. OCB and CWB are extremes and thus they should have strong negative correlation.

Several studies show that employee engagement can be treated as a possible predictor of OCB (Rich et al., 2010). The explanation of the relationship of employee engagement and OCB is based upon social exchange theory and the principle of reciprocity (Ariani, 2013). Employees show OCB because it incorporates a positive emotional component. The correlation of social exchange and the emotion-based behaviour can be tracked, because positive feelings and wish to reciprocate are both the result of favorable treatment from one’s organization (Rhoades & Eisenberger, 2002). Therefore, it can be stated that employee engagement is the potential predictor of OCB. A person with high employee engagement is more inclined to engage in productive and responsible behaviour at work (i.e. OCB).

Konovsky and Organ (1996) identified five dimensions of OCB: altruism, courtesy, sportsmanship, civic virtue, and generalized compliance (conscientiousness). Altruism means voluntary helping; courtesy includes helping others to prevent interpersonal problems; sportsmanship denotes tolerating inconveniences without unnecessary complaining; civic virtue refers to willingness to participate in organizational affairs. Finally, generalized compliance is a discretionary behaviour going beyond the minimum requirement level of the organization in areas of regulation and attendance.

CWB, as an opposite behaviour of OCB, is a voluntary, antisocial, counterproductive and dysfunctional behaviour in organizations. It is also a conscious behaviour though not always malicious, but it violates organizational norms and can cause potential harm to an organization and its members. Such low engagement undermines the goals of organization and produces adverse effects on the well-being and the performance of employees, as well as creates negative tendencies in organizational culture and career satisfaction.

We argue that these two important behavioural aspects are not enough to get the whole situation of engagement in the organization, as there are many more different factors influencing employee behaviour. Trying to conceptualize the construct Macey and Schneider (2008) treated “engagement” as an umbrella term for different types of engagement (i.e. trait engagement, state engagement, and behavioural engagement) each of which entails various conceptualizations; e.g., proactive personality (trait engagement), involvement (state engagement), and OCB (behavioural engagement). Therefore, it is important to take into account all these forms of engagement to have

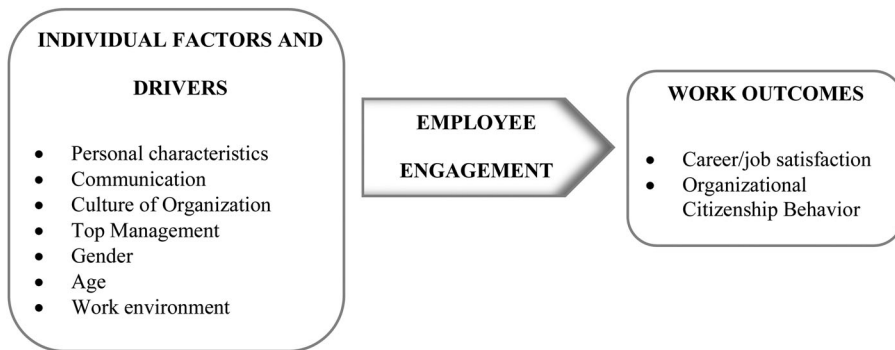


Figure 1. Conceptual model of interlinked factors.

Source: Authors' own work.

a clear view of the employee behaviour in organization and to understand how these different forms interact and what steps should be taken to create more efficient and effective employee performance.

Many studies have been conducted in an attempt to establish the relationship between:

- CWB and OCB (Griep & Vantilborgh, 2018; Miles et al., 2002).
- OCB, CWB and organizational culture (Ebrahimipour et al., 2011).
- OCB, CWB and employee engagement (Ariani, 2013; Babcock-Roberson & Strickland, 2010; Bhatnagar & Biswas, 2010; Hakanen et al., 2006; Reina et al., 2018; Rurkkhum & Bartlett, 2012).
- OCB, CWB and gender (Ariani, 2013; Carter et al., 2014; Farrell & Finkelstein, 2007).
- OCB and career satisfaction (Chompookum & Derr, 2004; Harter & Blacksmith 2010; Kim et al., 2018).
- OCB and age (Avery et al., 2007).
- various personal characteristics (Borman et al., 2001; May et al., 2004)
- work environment and top management/leadership (Boerner et al., 2008; Cheng & Chiu, 2008; Shin et al., 2017, Gaudet & Tremblay, 2017).

but there has been no attempt to find correlation between OCB, CWB (i.e. behavioural engagement), and related constructs such as styles of communication, gender, age, personal characteristics (i.e. trait engagement), perception of organization (i.e. work environment and top management), culture of organization and career satisfaction (i.e. state engagement) (Figure 1).

Employees decide whether to engage themselves depending on what support they get from their respective organizations. It is a reciprocal relationship when support is manifested in the culture of the organization, work environment, communication, and top management attitude towards their employees and this influences the employees' contribution to organization performance. Such emotional and psychological relationships between organization and employees contribute to the level of engagement that leads to enhanced job satisfaction, OCB and organizational commitment.

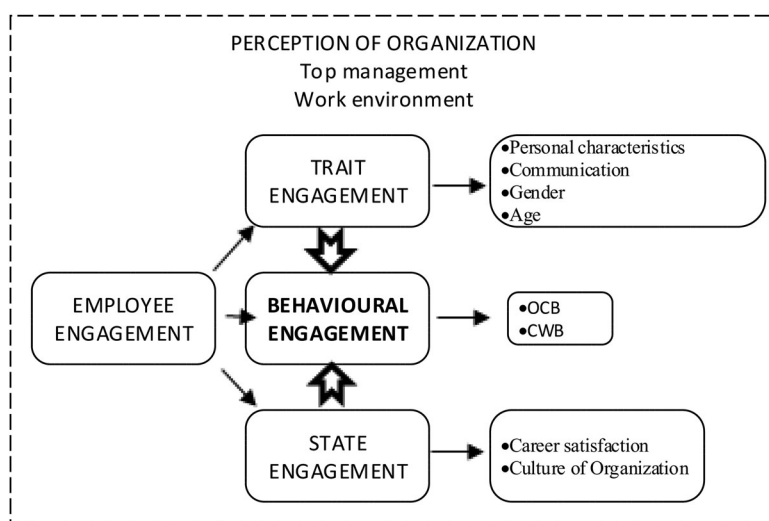


Figure 2. Theoretical framework of the constructs under research.
Source: Authors' own work.

Based on the literature review and previous research about the relationship of above-mentioned constructs, it can be stated that disclosure of them is still inconsistent, especially giving the emphasis on their interplay and their impact on OCB (Figure 2).

To address this gap, we create a complex investigation model developed to describe the linkage of the factors - OCB, CWB and related constructs under one umbrella and, by employing a combined statistical and FSig model, we investigate the link with behavioural engagement (both OCB and CWB). To address the issue, the study offers theoretical contribution by analyzing the umbrella term “Employee engagement” at micro level by introducing a FSig model to encompass all three Employee engagement elements – trait engagement, state engagement, and behavioural engagement - and to explore their interplay in order to get a holistic view of the phenomenon. Our focus on this interplay follows from our interest in behavioural engagement and its significance to other related factors discussed above. They constitute overall employee engagement, and by extending the prior research of various scientists (Carter et al., 2014; Podsakoff et al., 2014; Shin et al., 2017), we argue that it is important to know the wider panorama of factors that can be important in fostering OCB and eliminating CWB as they produce the outcomes of two contradictory engagement forms. Therefore, we aim to contribute to the solution of the above-mentioned problem and fill the research gaps of previous studies by analyzing how behavioural engagement (both OCB and CWB) correlates with the trait and state engagement and employee perception of the organization.

It is worth mentioning that this study concentrates more on a conceptual model development and its testing, in our case testing on the sample of the companies from a small region (Panevezys) in North Lithuania (totally 35 companies were involved). This is the first step before starting a future wider application and research

investigating more companies in different countries, cultures, and/or contexts. The data obtained from the questionnaire analysis is more used to find possible inconsistencies of the model in order to improve it.

3. Research context and methods

3.1. Data collection and setting

This research is a part of a worldwide cross-cultural management research project started by D. A. Ralston, L. Trevino and F. Weinberg, based on questionnaires filled in in various countries, at various organizations. The ultimate goal of this research is to include all regions of the world relevant to global business - giving emphasis to cross-cultural assessment and differences. Accordingly, a questionnaire was designed including the issues on organizational culture and trust in top management, job satisfaction, OCB, gender differences, and styles of communication. The questionnaire was originally developed based on pilot testing. To accommodate the research questions, the questionnaire consisted of the following eight sections:

1. Communication style;
2. Work experience, type and size of company, gender composition
3. Personal characteristics
4. Work environment and top management team
5. Culture of organization
6. OCB and CWB
7. Career satisfaction
8. Individual variables

3.2. Sample and procedure

During the Spring of 2018, we distributed questionnaires to employees at various companies representing different types of industries (agriculture or forestry, manufacturing, finance, insurance or real estate, services, transportation, communication or utilities, construction, public administration and other) in North Lithuania. Before distributing the questionnaires, all employees received an e-mail informing them about the objectives of the study, the confidentiality of participation, and the requirements for participation. We collected data regarding the following control variables: age (the sample contained respondents with work experience who are still in their active years of employment (23-65)); gender (the sample represents the workforce population in Lithuania where the proportion is 53,9 per cent of women and 46,1 per cent of men. Our collected questionnaires approximately keep this proportion – 58 percent of women and 42 per cent of man. It is representative also in respect to work experience (it was important that all respondents were currently working in a full-time position); position at work; company under investigation (there were no more than three respondents from any company as not to create impression of case study of several companies); company size (the samples represented different size of companies). A total of 144 completed valid questionnaires were received out of 165 potential

respondents (with a response rate of 92%). The respondents were asked to respond on a nine-point Likert-type scale.

Section 6 of the questionnaire comprises fourteen questions that are denoted here by Q01, Q02 ... Q14. Responses to questions Q01 – Q10 together were meant to describe the respondent's OCB, where Q01-02 represent altruism, Q03-04 – courtesy, Q05-06 – sportsmanship, Q07-08 – civic virtue, and Q09-10 – compliance. Questions Q11-Q14 disclose CWB. The questions for measuring OCB and CWB were taken based on the researches carried out by Lee and Allen (2002). Thus, based on the 14 answers to these specific questions, the behaviour feature of each respondent could be characterized by a complex 14-dimensional vector. Obviously, the responses may be considered intuitive, subjective and imprecise. The primary responses assigned scores to each question from the interval [1, 9]. It must be appreciated that it is certainly not easy, if possible at all, to fully evaluate the citizenship behaviour using such raw data.

3.3. Fuzzy signatures as the modelling tool

Fuzzy sets, as extensions of traditional (“crisp”) sets were introduced by L.A. Zadeh (1965) in order to have a mathematical tool that precisely describes non-precise concepts, statements and relations. The basic definition of fuzzy set A is as follows:

$$A = \{X, \mu_A\}, \mu_A : X \rightarrow [0, 1] \quad (1)$$

Here μ_A is called “membership function” that assigns a value from the closed unit interval to every element of the universal set (“universe”) A . The meaning of 1 is that the given element x does belong to set A in the classic sense, while 0 indicates that x is not an element. All intermediate values mean partial belonging to A . As answers to the questions in the questionnaire were given using a scale in the interval [1, 9], it was an obvious idea to transform these values (in a linear way) to the unit interval (i.e., to normalize the scale) and thus to obtain fuzzy degrees expressing the truth degree of a certain statement:

$$f : [1, 9] \rightarrow [0, 1] \quad (2)$$

That way each answer is assigned a fuzzy membership degree and further manipulation by fuzzy operations will be possible.

Returning to the modelling tools, it is important that a straightforward mathematical extension of fuzzy sets was proposed by Goguen (1967), that he called L-fuzzy sets. The definition is similar to the original fuzzy set concept:

$$A^L = \{X, \mu_A^L\}, \mu_A^L : X \rightarrow L \quad (3)$$

but here L stands for a possible rather wide extension of the unit interval [0 1], an arbitrary algebraic lattice. Algebraic lattices (see Birkhoff (1979)) might be defined in two ways leading to equivalent abstractions. One is based on a partial ordering relation, while the other, more convenient for the present work, uses a pair of dual

binary operations. These operations with dual (in a way symmetric) properties are called join and meet, and they are very similar to the well-known logic operations “or” and “and” (in the mathematics referred to as disjunction and conjunction, or as union and intersection, resp.). The formal binary logic based on the principles of Aristotelian logic, and later formalized by G. Boole (1854), is but a special case of the algebraic lattice (where, compared to the basic definition of lattice, some additional properties of the two operations hold (such as distributivity, and negation or complement is also defined).

The algebraic lattice is defined as follows. If given are a set $Y = \{y_i\}$ and a pair of binary operations: join (\vee) and meet (\wedge) for which the axiomatic properties of commutativity, associativity and absorption laws hold:

$$y_1 \vee y_2 = y_2 \vee y_1, \quad y_1 \wedge y_2 = y_2 \wedge y_1 \text{ (commutativity)}$$

$$y_1 \vee (y_2 \vee y_3) = (y_1 \vee y_2) \vee y_3, \quad y_1 \wedge (y_2 \wedge y_3) = (y_1 \wedge y_2) \wedge y_3 \text{ (associativity)}$$

$$y_1 \vee (y_1 \wedge y_2) = y_1, \quad y_1 \wedge (y_1 \vee y_2) = y_1 \text{ (absorption)}$$

Y is a lattice for \vee and \wedge .

Lattices have further important properties (which however may be derived from the above three pairs), such as

$$y \vee y = y \text{ and } y \wedge y = y \text{ (idempotence).}$$

For bounded lattices even the following are true:

$$y \vee 0 = y, \quad y \wedge 1 = y \text{ (identity laws)}$$

$$y \wedge 0 = 0, \quad y \vee 1 = 1 \text{ (boundary conditions)}$$

It is easy to see that join is the lowest upper bound and meet is the greatest lower bound of any pair of elements of Y . For practical applications it is important to consider complete lattices, a special class of bounded lattices, in which all subsets have both a supremum (join) and an infimum (meet).

Real life applications often require extensions of the original fuzzy set concept, and some time ago, we were motivated by an industrial project to introduce the concept of Vector Valued Fuzzy Sets Koczy (1980).

$$A = \{X, \mu_A\}, \mu_A : X \rightarrow [0, 1]^n \quad (4)$$

Later this concept was further extended to the idea of Fuzzy Signatures and Fuzzy Signature Sets Vamos et al. (1999), Wong et al. (2003),

$$A = \{X, \mu_A\}, \mu_A : X \rightarrow [m]^n, m = \begin{cases} [0, 1] \\ m_i \end{cases}, \quad (5)$$

m_i being defined in a similar iterative way as m itself. Thus, the values assigned by an FSig to any element of the universe X are nested vectors of membership degrees from the unit interval.

It is important to note that in the FSig approach some values are arranged within the same sub-vector (or sub-sub-vector), and this is an indication of those values being closer related in the semantics and meaning of the corresponding features, in the importance played within the interpretation of those features, or simply, by the subjective interpretation of the respondents. In our proposed model the respondents' replies are interpreted as fuzzy values, because these replies are subjective and imprecise – as all replies of this kind are always. It is however not obvious, which of the questions mentioned in Section 2 should form sub-vectors within the FSig model, except that OCB and CWB related answers should form separate sub-trees, one branch of the FSig each. Thus, the overall structure is

$$Q_{FSig} = \begin{bmatrix} Q_{OCB} \\ Q_{CWB} \end{bmatrix}. \quad (6)$$

It should be mentioned however that negative tendencies, such as the CWB attitudes cannot be directly combined with the positive ones (OCB) in a FSig, instead the complementary values (which express the degree of *not being negative in the attitude*) may be combined directly with the positive answers. How to build up the remaining sub-structures of the FSig Q_{FSig} may be based on the assumption that a statistical analysis of the answers, especially a correlation analysis among the them will reveal the deeper structure and the closer interrelationships of the questions and corresponding answers. Thus, the final FSig structure will be determined after the correlation analysis of the replies.

Our proposed approach is to develop a FSig that describes the citizenship behaviour features, including the hierarchical interdependencies of the components. The imprecise responses are considered as elements from the value set [1,9], which is transformed (normed) into the unit interval [0,1] of fuzzy membership degrees. Each respondent is characterized by fuzzy valued 14-dimensional signature, in the form of a nested vector. These fuzzy values may be then aggregated into smaller sub-signatures, following the hierarchical FSig structure, given in Figure 3, by executing the fuzzy aggregation operations assigned to the internal nodes. Hierarchical Fuzzy Signatures are generalizations of the vector valued set concept introduced in (Koczy, 1980), cf. also (Mendis et al., 2006; Wong et al., 2003). The FSigs assigned to each response form together a Fuzzy Signature Set (FSigS) over the universe of discourse consisting of all the responding persons. This FSigS models the complex structured problem of employees' attitude towards their respective employer, via the hierarchically structured FSigS

$$A = \{X, \mu_A\}, \mu_A : X \rightarrow Q_{FSig} \quad (7)$$

In the next, alternative FSig structures will be constructed based on various considerations.

The first Fuzzy Signature contains three levels and is given in Figure 3. These levels, nodes and weights were constructed by management expert assessment taking

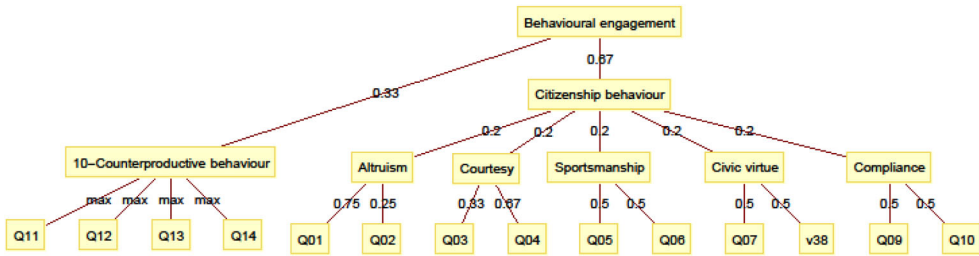


Figure 3. Fuzzy Signature structure and aggregation weights of questions Q01-Q14 of Section 6 based on management considerations. The scale 1 to 9 was used. Source: Authors' own computations.

into account the meanings of the questions. The aggregations chosen for the second level within the OCB sub-tree are weighted arithmetic means where the weights reflect the relative importance of each factor within the group. The aggregations at the first and zeroth level (in the root) are similar to these latter ones.

For instance, the node *Altruism* comprises two original factors Q01 (*Willingly given of my time to help co-workers*) and Q02 (*Taken time out of my own busy schedule to help with recruiting or training new employees*). It is critical how the fuzzy aggregations in the internal nodes are constructed. In this particular case three times more weight was given to Q01 than Q02, as Q01, according experts' opinion, is approximately three times more important in the daily work and company operations and thus the aggregation

$$Altruism = 0.75Q01 + 0.25Q02 \tag{8}$$

is calculated by a weighted arithmetic mean aggregation of the degrees assigned to the answers to the two questions on hand. Similarly, Q04 was ranked twice higher than Q03 because this implied particular action/result as compared to Q03 that reflects discussions/consultations with others (colleagues/management). It was assumed that each node of the set *Sportsmanship*, *Civic virtue* and *Compliance* are made up of two factors of equal importance; therefore, their components were assigned equal weights 0.5. Factors Q12 –Q14 were aggregated into *Counterproductive behaviour* using the max operator as it was assumed that this factor is equal to the most important indicator which got the highest score from the respondents. Then the value assigned to the node (*10-Counterproductive behaviour* was computed in order to obtain a factor in the same scale [1,9] that should have positive influence on *Behavioural engagement*. When the normalised to the interval [0,1] factors were considered, then the complements were calculated according formula 1-normalised factor.

The node *Citizenship Behaviour* was assumed to consist of five equal importance nodes: *Altruism*, *Courtesy*, *Sportsmanship*, *Civic virtue* and *Compliance*, and therefore each of them was assigned the same weight 1/5.

The nodes *Citizenship Behaviour* and *10-Counterproductive behaviour* were ranked 2/3 and 1/3 accordingly, taking into account the experience that behavioural engagement is twice more influenced by *Citizenship Behaviour* than the other (negative) factor.

Table 1. Significant pairwise correlations.

Question	Correlation with Behavioral engagement
Gender	0.10
Age	0.19
1-11 (<i>Understanding of their perspectives</i>)	0.28
1-13 (<i>Support for others at work</i>)	0.31
1-23 (<i>Harmonious connections with others</i>)	0.26
2-01 (<i>How many years of full-time work experience do you have</i>)	0.27
2-04 (<i>What is the size of the company in which you presently ...</i>)	-0.08
2-06 (<i>How would you describe the gendered composition of people in your organization who are at your job level</i>)	-0.12
3-11 (<i>Leadership abilities</i>)	0.02
3-13 (<i>Willing to take risks</i>)	0.24
3-15 (<i>Dominant</i>)	0.22
4b-07 (<i>Top management is very concerned about my welfare</i>)	0.23
4b-10 (<i>Management tries hard</i>)	0.02
5-02A (<i>Leaders in my organization are generally considered to be mentors, facilitators, or parental figures</i>)	0.26
5-05A (<i>My organization emphasizes human development. High trust, openness, and participation persist</i>)	0.24
7-01 (<i>Satisfied with what I have achieved</i>)	0.46
7-02 (<i>Satisfied with my progress</i>)	0.49
7-03 (<i>Satisfied with the income</i>)	0.44
7-04 (<i>Satisfied with the advancement</i>)	0.43

Source: Authors' own table.

In the case of the complemented CWB answers (degrees) it was decided that the worst of those negative attitudes, i.e. the maximum of the values would dominate the effect, therefore here the classic union aggregation was chosen.

As it was mentioned above, because monotonicity is one of the basic axioms of aggregation operators, it was necessary to use only increasing factors. Thus, the decreasing factors of CWB from 9 to 1 were transformed into increasing ones from 1 to 9, applying the transformation to the complement $\text{increasing factor} = 10 - \text{decreasing factor}$

or in terms of fuzzy membership functions $\text{membership degree of increasing factor} = 1 - \text{membership degree of decreasing factor}$.

It has been established, that behavioural engagement can be correlated with other factors (Ariani, 2013; Rurkkhum & Bartlett, 2012). Therefore, in this study the first approach was the application of the multiple correlation coefficient R of the computed *Behavioural Engagement* with answers to the questions given in Table 1 was calculated. Then the initial weights were changed to track the corresponding changes R . It appeared that the assigned weights (see Figure 3) ensured correlations close to the maximal possible. The actual maximal $R = 0.685$ was obtained by repeated calculations with applying small steps in changing the weights.

3.4. Data analysis

This result testifies that the multiple dependence between *Behavioural engagement* and the factors given in the Table 1 is almost strong. However, pairwise correlations

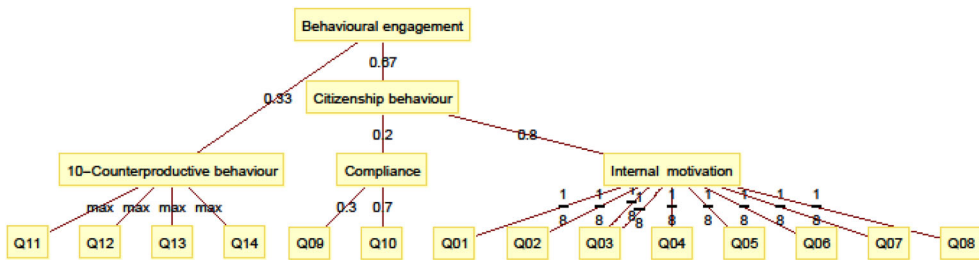


Figure 4. Fuzzy Signature structure and aggregation weights of questions Q01-Q14 according to the factor analysis. The scale 1 to 9 was used.

Source: Authors' own computations.

of all factors with *Behavioural engagement* (Table 1) are weak. Therefore, it must be concluded that the engagement of employees is defined by many factors, and no small subset is determining the attitude. Between these factors the strongest influence was shown in the seventh section (Satisfaction with the job), with Pearson correlation coefficients between 0.44 and 0.49.

Factors that are not included in Table 1 turned out to have even weaker pairwise correlations with *Behavioural Engagement* and therefore they were excluded from further research.

The second approach was to apply factor analysis to the questions Q01-Q14. The analysis taking into account correlations between answers revealed that all the questions could be divided into three groups – *Compliance* (Q09 and Q10), *Internal motivation* (Q01-Q8) and *9-Counterproductive behaviour* (Q11-Q14), and so the FSig corresponding to these groups is given in Figure 4. The meaning of the weights is similar to the first approach (cf. Figure 3), i.e. greater weights assigned correspond to greater influence, equal weights correspond to equal importance and all weights at each node sum up to 1, in order to define some weighted average aggregation.

The third approach is somewhat surprising. The factor analysis regarding question Q12 (*Found fault with what the organization is doing*) revealed that it had significant loadings in two quite different groups - *Internal motivation* and *10-Counterproductive behaviour*. Therefore, the membership of Q12 in these two groups should be regarded as *fuzzy*. The reason of this fuzziness is that some respondents regarded the noticing of faults as a positive attitude, and future efforts to improve the situation, while others regarded it as a negative feature. This ambiguous nature of Q12 is considered in the alternative FSig model given in Figure 5, i.e. Q12 belongs to both the nodes *10-Counterproductive behaviour* and *Internal motivation*. The partial membership of Q12 in the node *Internal motivation* was assigned twice lower weight $1/17$ than the other factors Q01-Q08, which have weights equally $2/17$. It is obvious that these weights also sum up to 1.

4. Findings

As the evaluation of the results of the analysis the following may be stated:

1. Each factor given in Table 1 has weak or almost weak influence on the behavioural engagement, but together they define the correlation almost strongly.

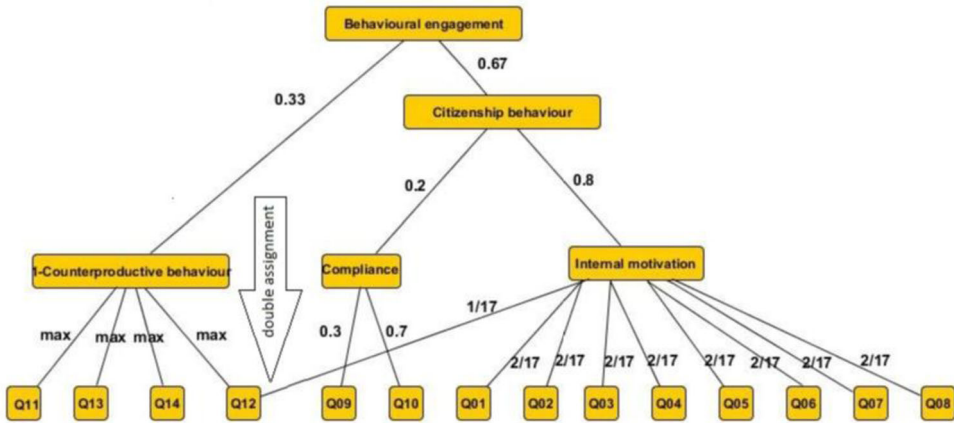


Figure 5. FSig structure and aggregation weights of questions with Q12 fuzzy membership. The scale 1 to 9 was used. Source: Authors’ own computations.

Therefore, it must be concluded that the engagement of employees is defined by a combination of many factors. Between these factors the strongest influence was shown in the seventh section (*Satisfaction with the job*), with Pearson correlation coefficients between 0.44 and 0.49.

2. It appeared that the sub-signatures *Altruism, Courtesy, Sportsmanship, Civic virtue, Compliance,* and *Counterproductive behaviour* had the most noticeable connections with answers of Section 7 (*Career satisfaction*). However, *Gender, Age, Work category* and other responses had no noticeable connections with the same sub-signatures: *Altruism, Courtesy, Sportsmanship, Civic virtue, Compliance,* and *Counterproductive behaviour*.
3. Though *Citizenship behaviour* and *Counterproductive behaviour* are distinct constructs, they can overlap and therefore should be treated as fuzzy factors due to the ambiguous meaning of question Q12 (*Found fault with what the organization is doing*). The ambiguity was revealed by applying factor analysis.

At this point, it may be remarked that in the future the formulation of this particular ambiguous question could be modified, as obviously, it was not the intention of the researchers putting up the questionnaire that this item should be a fuzzily interpretable one.

5. Conclusions and discussion

Proactive and prosocial behaviour that is typical for OCB are vital for innovative and progressive organizations. Better understanding of organizations and their influence on the employee engagement can give the leaders instruments for running organizations more effectively. In this research, we sought to establish how various forms of engagement as well as the perception of the respective organization interplay and influence behavioural engagement. This is obviously very important for any organization in order to boost their overall performance. Combining insights from the

management literature on engagement and the novel Fuzzy Signature approach, it was possible to gain insight that supported our primary conjectures on the relationships of behavioural engagement (OCB and CWB) and the remaining factors, such as trait engagement, perception of organization and state engagement (communication style, work experience, type and size of company, gender composition, personal characteristics, work environment and top management team, culture of organization, career satisfaction, age, work category).

Our findings suggest that engagement of employees is defined by a combination of many factors, but the strongest and unambiguous relationship is between career satisfaction and OCB. Career satisfaction—or the lack of it—can lead to important behavioural and organizational outcomes. Different studies (cf. Hakanen et al., 2006; Markos & Sridevi, 2010; Miles et al., 2002) have found that employee engagement is related to increased job performance. Based on our recent findings by applying the combined FSig and statistical models, it turned out that, indeed, without positive degrees of citizenship behaviour, the efforts to achieve efficiency and effectiveness in the organization's performance may face great difficulties. Only committed employees can fulfil the organization's goal and objectives, by demonstrating constructive behaviour in contributing their knowledge and ideas for the improvement of products and services.

It is worth to mention here, too, that our research revealed the ambiguity of question 12 (*Found fault with what the organization is doing*) in Section 6. It is unclear to which group Q12 should be properly assigned. According to its maximal loading, it should belong to the OCB or *Internal Motivation* (Figure 5), rather than to CWB. On the other hand, Q12 might also be considered as counterproductive behaviour and, therefore, should belong to this group, as well. It should be pointed out, that according to the factor analysis Q12 belongs to the CWB group with just by a slightly smaller loading than it has in the *Internal Motivation* group. This supports the idea that the low values of the complemented *Counterproductive behaviour*, i.e. the high values of the same, belong to the same cluster as *Altruism, Courtesy, Sportsmanship, Civic virtue*, and generalized *Compliance*. This interesting result can be explained as follows. Respondents who are satisfied with their career are apt to raise questions or indicate real problems at work in order to improve them. This strongly suggests that Q12 can be treated twofold - as a positive behaviour (*"I criticize the organization in order to give push for changes, I want changes"*) or as a negative behaviour (*"I criticize the organization and do nothing, I just purposely want to cause negative feelings, negative atmosphere at work"*).

Our theoretical framework contributes to the wider understanding of the umbrella term Employee engagement at micro level by investigating employee engagement elements (trait, state, and behavioural) in corpore in order to disclose the interplay of different elements and their significance to OCB. In that way, we fill the research gaps of previous studies by analyzing how behavioural engagement (both OCB and CWB) correlates with the trait and state engagement and employee perception of the organization and in that way we make a step forward by offering a holistic view of the multifaceted phenomenon of employee engagement. The study develops a complex method starting with expert domain knowledge and classical statistical approach,

but focusing on fuzzy signatures. That was the study's intention to contribute to the management science itself, by extending the knowledge on the relationship between OCB and CWB, from one side, and the factors influencing them in business organization from another side.

In terms of management practice, the paper has direct implications for managers and organizations who wish to maintain and enhance effective social and psychological context of the organization that supports task performance. Organizations should be cognizant of how their activities may influence their employees' work behaviours. Our research shows that such factors as styles of communication, gender, age, personal characteristics (i.e. trait engagement), perception of organization (i.e. work environment and top management), culture of organization (i.e. state engagement) influence OCB, CWB (i.e. behavioural engagement) and especially career satisfaction. Managers should pay particular attention to OCB as it contributes to the efficiency of company's performance and engenders proactive and prosocial behaviour. This gives an additional reason for organizations to address these issues on strategic level in order to manage the processes of employee engagement. To attain OCB, jobs can be structured in a way that employees find their work more meaningful and demonstrate more positive outlook to their task performance, organizational goals and overall commitment.

In terms of data analysis, our empirical findings suggest that the employment of the fuzzy signature model is a rather useful instrument in revealing a holistic panorama of the multitude of factors influencing OCB. The combination of these various mathematical tools is completely novel and there is no similar approach in the literature.

The main limitation of this research is the dependence on a small sample that may limit the generalization of these study results. The respondents represented a variety of organizations from different industries in Lithuania and future studies may benefit by involving more respondents, possibly from other countries, and continue to explain the relationship between OCB and CWB, and the factors influencing them in business organizations in order to make better decisions for the improvement of company performance.

Furthermore, the interaction of *Behavioural engagement* and other factors may give rise to further research with a similar approach to the other questionnaire sections.

Finally, our findings point to important practical applications in terms of how the research should be conducted.

In future research, we should address the limitations of this study, i.e. test the model using a larger population and sample. From a practical perspective, it should be replicated to investigate and test organizations' employee engagement in different settings, context locations/countries, and/or culture and give guidelines for managers and organizations how to maintain and enhance an effective social and psychological context of organization to support the task performance.

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Appendix

The formulation of the 14 questions was as follows.

In the space before each statement, write the number (1, 2, 3, 4, 5, 6, 7, 8, or 9) to indicate the degree to which each of the following statements is true about you. When responding, please try to use the full range of numbers on this scale (1 to 9).

There are no right or wrong answers to these questions.

1. Willingly given of my time to help co-workers who have work-related problems.
2. Taken time out of my own busy schedule to help with recruiting or training new employees.

3. “Touched base” with others before initiating actions that might affect them.
4. Taken steps to try to prevent problems with co-workers and any other personnel in the organization.
5. Encouraged others when they were down.
6. Acted as a “peacemaker” when others in the organization have disagreements.
7. Acted as a stabilizing influence in the organization when dissention occurs.
8. Attended functions that were not required but which helped the organization’s image.
9. Attended training/information sessions that employees were encouraged but not required to attend.
10. Attended and actively participated in organizational meetings.
11. Consumed time complaining about trivial matters.
12. Found fault with what the organization is doing.
13. Tended to make “mountains out of molehills” (make problems bigger than they are).
14. Focused on what was wrong with my situation rather than the positive side of it.