

Article

The Model of Knowledge Management Based on Organizational Climate

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Abstract: Keeping in mind the fact that organizations in the region of Vojvodina are moving from a negotiated to market economy, this study aims to analyze how the dimensions of collaborative climate affect the various activities of knowledge management. The degree to which collaborative climate influences knowledge work is investigated on 190 participants in the region of the Province of Vojvodina (Serbia). Two standardized questionnaires were used to collect data: a knowledge management questionnaire, which included 32 questions, and a collaborative climate questionnaire of 20 questions. To test the hypothesis of the study, the technique used was descriptive statistics, confirmatory factor analysis, and structural equation modeling. The results show that only the organizational culture as a dimension of collaborative climate contributes to the explanation of all the activities of knowledge management, except the activity of leaving knowledge, which fails to achieve a statistical relationship with any dimension of collaborative climate. This study provides useful insights for practitioners wanting to improve an organization's performance and to increase organizational sustainability and learning. It is a useful base to expand further research in a way of better understanding the impact that collaborative climate has on the implementation of knowledge management in a transition towards a knowledge economy.

Keywords: knowledge management; knowledge economy; organizational climate; collaborative climate; model; organizational sustainability; organizational learning

1. Introduction

Knowledge should be managed in an appropriate way since it is the key resource of competitive advantage. The potential of the knowledge of employees in organizations is a determination factor of survival in the competitive business environment [1]. As a consequence, practices and processes employed by organizations in order to manage knowledge are a means to achieve strategic objectives by taking advantage of complexity and creating the best ways of using the existing resources and capabilities [2,3].

In recent years, knowledge management has been recognized as a key factor for improving organizational effectiveness and performances [4,5]. The significance of the concept of knowledge management is growing, taking into account the processes of globalization and the rate of technological change [2,6].

Knowledge management involves converting individual knowledge into collective, organizational knowledge. Knowledge management is an emerging discipline with ideas that should be tested, and questions of which the right answers should be given.

Vojvodina is one of the leading regions in Serbia that is at the forefront in the development of a knowledge-based economy (KBE). In the territory of Vojvodina, there are 45 municipalities

and towns as local self-government units. One of the main objectives of the government of the Autonomous Province of Vojvodina [7] is to develop knowledge-based economy KBE and thus affect the sustainable development of education, science, and economy. The government of the Autonomous Province of Vojvodina has been making substantial investments in educational as well as technological infrastructure to facilitate knowledge-intensive economic activities, particularly in the software industry. Foreign and local firms in Vojvodina are encouraged to take advantage of the opportunities brought by the emerging KBE. However, little is known of how firms in Vojvodina respond to this new economic development. In particular, there is a deficiency in the literature of how organizational climate influences knowledge management in Vojvodina firms, as they strive to achieve their competitive performance [8] and organizational sustainability.

The fact that many researchers and authors in the field of interest emphasize the importance of collaborative organizational climate and knowledge management for the firm's survival on the market has served as a reference framework for the idea of examining the effects of collaborative climate on knowledge management activities. The primary goal of the research is to deepen the understanding of the relationship between collaborative climate as one aspect of organizational climate and knowledge management. The study aims to determine how the dimensions of collaborative climate such as organizational business culture, behavior of immediate superior, personal attitude towards sharing knowledge, and the behavior of the work group [9] influence the activities of knowledge management: getting, using, learning, contributing, assessing, sustaining, building, and divesting knowledge [10]. In other words, the goal is to define the dimensions of collaborative climate that appear to be adequate predictors in explaining knowledge management [11], as well as to define the factors of collaborative climate that contribute to a higher-quality knowledge management. Finally, based on the results obtained, the aim of the research is to develop a new model of knowledge management based on organizational climate.

Section 2 reflects mainly on the theoretical background and literature review. The data sample and research methodology are given within Section 3, followed by research results (Section 4) and further discussion (Section 5). At the end, conclusion and future research directions are given in Section 6.

2. Theoretical Background

2.1. Knowledge Management

According to Davenport and Prusak [12], knowledge is a set of experiences, values, contextual information, which provides a framework for evaluation and implementation of new experiences and information [7]. A holder of knowledge may be an individual, group, or organizational routine. Knowledge is transferred through structured media (books and documents) and direct communication between employees in the organization. Knowledge can be measured by decisions and concrete actions, to which it leads.

We are in the era of the knowledge economy and knowledge is the main strategic resource for achieving a competitive advantage and sustainable development [7,13–15]. More and more companies are turning to the practice of knowledge management [16–18].

A good definition of knowledge management is the one which includes the conquest and the storage of knowledge but also evaluates the intellectual capital of the organization [19].

The knowledge management model provides theoretical fundamentals of knowledge management (KM) for explaining and describing the best way to manage KM [7]. On the basis of the literature review and some empirical studies, it can be concluded that there are many models and measures to evaluate the success of knowledge management [7]: The Spiral Model by Nonaka and Takeuchi [20]; The Wiig Model for Building and Using Knowledge [21]; The Choo Sense-Making KM Model [22]; The KM Model by Botha [23]; and Bukowitz and Williams KM Process Model [10].

Erwee, Skadiang, and Roxas [8] suggested evaluating knowledge management processes using items that describe the degree to which the organization has applied a knowledge management process. Chang, Tsai, and Chen [24] proposed to measure the knowledge acquisition process.

According to Lee, Lee, and Kang [25], measuring knowledge management processes should include knowledge creation, accumulation, sharing, utilization, and internalization. Minonne and Turner [26] proposed measuring knowledge creation and knowledge development. Dobrai, Farkas, Karoliny, and Poór [27] argued that an imperative strategic challenge for multinational enterprises is to develop an organizational framework which improves their knowledge processes. Gholami, Asli, Nazari-Shirkouhi, and Noruzy [28] suggested that knowledge acquisition, knowledge storage, knowledge creation, knowledge sharing, and knowledge implementation have significant and direct influence on organizational performance in small and medium enterprises (SMEs).

Jokanovic, Okanovic, and Lalic [7] in earlier research highlighted what is missing in other models of KM mentioned above, and what the KM process model by Bukowitz and Williams offers is the knowledge divestment. The advantage of this model is in its strategic focus. This model of KM describes the process which determines the strategy for building, divesting, and increasing knowledge assets [7].

Dihl, Horst, de Francisco, and Kovaleski [29] conducted a study in Southern Brazil using the process model and knowledge management diagnostic (KMD) developed by Bukowitz and Williams [10]. Silva, Sicsú, and Crisóstomo [30] applied the KMD method in nine companies. Holanda, Dihl, and Francisco [31] also used the KMD method to evaluate the performance of knowledge management for an industrial manufacturer of wood panels in Brazil [7].

In this framework, knowledge contains knowledge repositories, relationships, information technologies, communication infrastructure, functional skill sets, and the process of know-how, environmental responsiveness, organizational intelligence, and external sources [7,19].

Bukowitz and Williams explain the process of organizational learning through phases, or activities of knowledge management. They state that the promotion of sharing knowledge with others helps establish a climate of confidence and encourages the creation of organizational knowledge. In addition, in a paper from 1999, the authors defined knowledge management as a process in which the organization acquires wealth based on intellectual and knowledge-based capital. They classified the processes of knowledge management to tactical and strategic processes. Tactical activities of knowledge management are related to getting the necessary knowledge, its use in order to create value, and teaching and encouraging employees to share their knowledge. Strategic processes include assessing, sustaining, and building knowledge, and divesting strategically insignificant knowledge. At the strategic level, knowledge management requires the existing intellectual capital to be constantly assessed and compared with the future needs [10].

The first phase of the cycle involves finding information needed for decision making, problem solving, and introducing innovation. Modern technology provides access to a growing base of information. However, it is critical to recognize knowledge that has value and manage it efficiently and effectively [7].

The second phase of the cycle (using) refers to combining information in a new way in order to find innovative solutions. Organizations should ensure such an environment and the best practice that will encourage creativity and use of information [7].

The learning phase involves formal processes of learning from experience in order to achieve competitive advantage. Learning within the organization can be achieved through success (best practice) or mistakes. Learning in the organization is important, since it represents a transitional phase between the implementation of existing and the creation of new ideas. The responsibility of the organization in this activity of knowledge management consists of creating an environment which is able to understand the different learning styles.

In the fourth phase of the cycle (contribute), individuals are encouraged to share their knowledge. Individual knowledge should be visible and accessible at all levels of the business system. Members

of the organization are encouraged to share their best experiences and mistakes, in order to avoid them to be repeated by other employees. The organization should promote a culture which supports collaboration and the sharing of knowledge, ideas, skills, and expertise.

In the phase of assessment, the existing knowledge is measured and assessed in relation to the current and future needs. At this phase of the process of knowledge management, the organization should take into account multiple forms of capital (human, user, organizational, and intellectual) to incorporate knowledge in new products and services which carry a value for customers. Individuals and groups should look for less complex ways of measuring intellectual capital.

The sixth phase of the process of knowledge management (build/sustain) implies providing support to existing knowledge, which is strategically important, so that the organization can maintain its competitiveness and sustainable advantage. As Jekanovic, Okanovic, and Lalic [7] stated in a previous study, individuals and groups should always be looking for new experiments which will contribute to the creation of competitive advantage. The main responsibility of the organization consists of developing and implementing an appropriate plan of action for the promotion of new knowledge.

The last phase of the knowledge management model is divesting, abandoning knowledge. In this phase, organizations should analyze their knowledge. Strategically insignificant knowledge should be set aside or applied in other tasks and positions.

One of the main advantages of the model of the knowledge management life-cycle developed by Williams and Bukowitz consists of introducing a learning phase in which individuals learn from their past experiences, leading to the creation of organizational memory. Another advantage of this model is related to the use of the term 'contributing', which emphasizes sharing knowledge on a voluntary basis. To further stimulate the voluntary exchange of knowledge, the organization may engage various systems and structures which remove potential obstacles to the sharing of knowledge and provide employees the necessary time to perform their tasks and jobs in the best way. In addition, another important advantage of this model lies in the introduction of the phase of divesting, selling, or setting aside knowledge which is strategically insignificant.

2.2. Collaborative Climate

Basically, organizational climate represents the individual's perception of the organization to which it belongs. It refers to a set of properties perceived by employees and serves as the main driving force that affects their behavior. In a broader sense, organizational climate can be seen as a social setting, and as a social and psychological environment by which a specific organization is characterized.

Organizational climate is assumed to contain shared perceptions of organizational norms, beliefs, values, practices, and procedures which can be observed at general or specific levels [32,33].

Organizational climate consists of a series of properties which describe the organization, and which are different from those of other organizations; they are relatively permanent and affect the behavior of individuals [34].

Since collaboration is a specific strategy of the twenty-first century [35] and the age of the knowledge-based economy, and is defined in the professional literature as the wave of the future, the present study will examine the influence of collaborative climate as one aspect of the overall organizational climate.

Collaboration is a process in which individuals who perceive the same problem differently can constructively explore the differences and search for solutions that go beyond their own limited vision of what is possible [36].

Collaborative climate as one of the aspects of the general organizational climate refers to the common elements of organizational culture which inspire the members of the organization to share their knowledge [9]. The authors confirm that the collaborative climate of business units, support of the immediate supervisor, and collaboration among team members are crucial to sharing knowledge.

Most, if not all models of organizational behavior describes the perception of the work environment from the aspect of organizational climate [37]. The concept of organizational climate has inspired

many theoretical and empirical studies aimed at understanding of how employees see and experience their organization.

The assumption of theoretical and empirical research in the field of organizational climate is that the social environment should be described using a limited number of dimensions. Campbell, Dunnett, Lawler, and Weick [38] identified four dimensions of organizational climate: reward orientation, individual autonomy, warmth and support, and degree of structure imposed on the situation. James and his associates [39–41] proposed and determined four dimensions of organizational climate: collaboration in the work group, stress and lack of harmony, leadership and support, and job challenge and autonomy. Based on the review of the dimensions of organizational climate, Glick [42] proposed a narrower scale, which includes: psychological distance of leaders, respect and trust of managers, flow of communication, openness, and orientation towards risk taking, and quality of services, equity, and centrality.

Bearing in mind the numerous shortcomings in measuring organizational climate, this study uses a questionnaire which is culturally and linguistically adapted, theoretically well founded, and empirically valid, while the research sample involves all employees, from operational executives and lower levels, through the top management. The questionnaire developed by Sveiby and Simons [9] is a relatively comprehensive tool, offering researchers an opportunity to assess the experience of employees across four dimensions of collaborative climate (organizational culture, behavior of the immediate supervisor, personal attitude towards knowledge sharing, and support of the work group).

2.3. Linking Organizational/Collaborative Climate and Knowledge Management

Lee, Kim, and Kim [43] emphasized the role of organizational climate in making the concept of knowledge management effective. According to these authors, critical success factors of activities of knowledge management are: awards, top management support, and quality of IT services. Ghorbani, Nia, and Sadri [44] in their research, examined the relationship between knowledge management and organizational climate. Their results suggest that there is a significant correlation between knowledge management and organizational climate in centers of higher education, and that the increase of knowledge of employees leads to the improvement of organizational climate. Davis and Menzer [45] found that negative organizational climate, which is characterized by insufficient leadership support and an inadequate reward system, leads to ineffective knowledge management programs. Nazem, Mozaiini, and Seifi [46] found out that dimensions of organizational climate like structure, responsibility, reward, risk taking, warmth, support, standard, conflict, and identity have a positive impact on knowledge management. According to Jain, Sandhu, and Goh [47], several dimensions of organizational climate and trust have a significant impact on knowledge sharing.

Organizational climate plays an important role in organizational learning [48–50] given that it can encourage and support mutual contacts and communication [51], which is certainly important for knowledge management. Organizational climate plays an important role in shaping the behavior of employees and affects their perception of knowledge management [48,52]. In the context of social capital, organizations can use various aspects of organizational climate, such as a supportive and innovative climate [53]. In order to achieve and maintain competitive advantage, organizations should encourage employees towards free and open communication, sharing opinions and ideas, and exploring non-routine ways to perform tasks by formulating an innovative climate. In an innovative and stimulating environment, employees are more motivated to create and exchange knowledge, openly share their thoughts and ideas, think freely, and take risks. Supportive climate will positively affect knowledge management, since the employees are more involved in activities of knowledge management.

Organizational knowledge begins from the individual who owns tacit knowledge, which is transferred to other members of the organization by sharing and learning. By fostering innovative climate, organizations can increase the readiness and willingness of employees to collaborate with other members. Koskinen, Pihlanto, and Vanharanta [54] believe that there are individuals of different

professions and backgrounds within groups and work teams, and, that members tend to collaborate with competent colleagues in which they have confidence.

Chen and Huang [48] proved that the innovative and collaborative climate is positively correlated with social interactions, and that they are better suited when the organizational structure is more decentralized and not so much formalized, as well as that social interactions are positively correlated with knowledge management. This empirical evidence supports the process-oriented perspective and shows that social interactions play a mediating role between organizational climate, organizational structure, and knowledge management. Janz and Prasarnphanich [55] examined the relationship between organizational climate, collaborative learning, knowledge creation and dissemination, and distinguished four dimensions of climate: risk, rewards, warmth, and support. Zack [2] assumed that successful creation and sharing of knowledge requires an organizational climate and reward system which appreciate and encourage collaboration, trust, learning, and innovation.

In order to better understand the relationship between knowledge management and organizational climate, as well as the research model that will be presented in this study, knowledge dynamics and the holistic interpretation of knowledge should be considered. According to Bratianu and Bejinaru [56], knowledge management is the knowledge entropy management. Knowledge sharing affects the distribution of knowledge within organization, by providing access to employees to use existing knowledge. Knowledge sharing does not represent the creation of new knowledge, yet a diffusion process that increases the overall disorder of organizational knowledge. Thus, as a result of knowledge sharing, the state of organizational knowledge consequently has an increased level of disorder, that is, an increased level of knowledge entropy.

Knowledge dynamics is the core of the learning process and knowledge management. Immediate supervisor and organizational culture represent nonlinear integrators in order to produce organizational rational, emotional, and spiritual knowledge. Organizational culture is based on the field of emotional knowledge [57].

According to the energy metaphor, every form of knowledge can be transformed into another form of knowledge. Based on the energy analogy, Bratianu and Bejinaru [57] proposed the transformation of one field of knowledge into another field of knowledge. Accepting this transformation is essential in understanding knowledge dynamics as the nucleus of motivating employees for innovation and knowledge sharing.

In addition to the above studies, a multitude of evidence can be found in the literature that confirms the link between organizational and collaborative climate and knowledge management [43,53,58].

The contribution of this paper, with regard to the theoretical background and previous findings, will significantly extend previous research. Previous research is mainly based on the codification and systematization of knowledge, while this research has considered the whole cycle of knowledge management, from obtaining to leaving knowledge in organizations. Since earlier publications have mainly focused on examining the impact of culture on knowledge management, this research provides a more comprehensible and comprehensive view to engineering management, including a number of different dimensions of the organizational climate. Additionally, we believe that investigating the relationship between organizational climate and knowledge management is important, considering that this aspect has been neglected in previous research in Serbia. When creating a questionnaire, we had this fact in mind, so the main research question we wanted to answer was how each individual dimension of organizational climate affects each individual knowledge management activity in the region of the Province of Vojvodina.

3. Research Methodology

3.1. Sample

The questionnaire allocation process was organized according to Dillman's approach [59]. Hence, the initial questionnaire dissemination process was supported by a series of follow-up email reminders,

if required. After a 3-month time, out of 212 received, 190 responses were valid. Accordingly, the study included 190 respondents (55.8 % were males). Our objective was to assess perceptions about collaborative climate and knowledge management in the organizations that participated in the research.

In order to obtain a highly representative sample, it was selected in a way to represent managers working in organizations that belong to different economic sectors, and differ in size, number of employees, and location [7]. This research sample can be considered representative of a larger population.

The study involved: top managers, mid-level managers, operational managers, and those who did not belong to a managerial position, in selected organizations in the region of the Province of Vojvodina. Socio-demographic characteristics are shown in Table 1.

Table 1. Socio-demographic characteristics of the sample.

Variable	Variable Level	N	Valid %
Age category	20–30 years	46	24.2
	31–40 years	55	28.9
	41–50 years	42	22.1
	51–60 years	42	22.1
	over 60 years	5	2.6
Educational level	doctoral degree	4	2.1
	masters degree	18	9.5
	specialist	4	2.1
	university	81	42.6
	college education	27	14.2
	secondary education	56	29.5
Position in the organization	top management	45	23.7
	mid-level management	29	15.3
	executive or operational management	78	41.1
	other	38	20.0

Participants were categorized into five age groups based on their age. Most workers in the studied organizations were aged 31–40 (28.95%); they were followed by the participants from the age group of 20–30 (24.21%). Participants of ages 41–50 and 51–60 were equally represented throughout the sample (22.11%), while participants older than 60 were the least represented (2.63%). Regarding their level of education, participants were categorized into six groups. Participants with a university education were the most numerous in the whole sample (42.63%). They were followed by the participants with a secondary school education (29.47%), and college education (14.21%), while the share of those holding PhD, MSc, or a specialist education was 13.69%. Lastly, regarding their position in the organization, participants were categorized into three groups: top management, mid-level management, and operational management (also include participants who belong to “other”). More than half of them (61.05%) were operational managers and those who did not belong to managerial position (“other”), 23.68% of them belonged to top management, while the share of those coming from mid-level management was 15.26% [7].

By examining the structure of the sample in terms of company ownership, considering the type of the capital, most of the participants were from organizations in a private ownership of a single person and state ownership, with the least of them from organizations with a combined ownership structure. Participants from organizations that were domestic regarding the origin of their capital were by far the most numerous in the whole sample with a share of 91.58%. According to the origin of capital of the ownership structure, participants from foreign and co-owned organizations were represented equally with 4.21%. The largest number of participants was from large (over 250 employees) and micro organizations (less than 10 employees), accounting for 34.21% and 32.63%, respectively. The share of participants from small organizations (fewer than 50 employees) in the sample was 24.74%, with

the lowest share (8.42%) of participants being from medium-sized organizations (50–250 employees). Most of the participants were from service providing organizations (71.58%). The share of participants that came from manufacturing/service providing organizations was 24.21%, while the lowest share was that of the participants from manufacturing organizations (4.21%) [7]. Organization characteristics are shown in Table 2.

Table 2. Organization characteristics.

Variable	Variable Level	N	Valid %
Legal form of the company	limited liability company	103	54.2
	joint stock company	42	22.1
	public enterprise	10	5.3
Ownership structure of companies by type of capital	private own. of a single person	80	42.1
	private own. of several persons	50	26.3
	state ownership	57	30.0
	Combined	3	1.6
Ownership structure of enterprises according to origin of capital	domestic 100 %	174	91.6
	foreign 100 %	8	4.2
	co-owned (domestic and foreign)	8	4.2

3.2. Instruments

In this research, the following instruments were used:

(1) Collaborative Climate Instrument (CCI; [9])—this is a 20-item scale, which measures four components of collaborative climate in organizations: Employee Attitude—EA; Work Group Support—WGS; Immediate Supervisor—IS; and Organizational Culture—OS. Each measure was operationalized as a sum score of 5 items (for each subscale), and each item was rated using a 5 point Likert scale (1 = “strongly disagree” 3 = “neutral”, and 5 = “strongly agree”). Metrics of the CCI are shown in Table 3.

Table 3. Descriptive data of CC and KM measures.

		M	SD	Skewness	Kurtosis	α
Collaborative Climate	OS	15.16	2.86	−1.2	1.88	0.84
	IS	18.86	5.06	−1.22	0.94	0.93
	EA	15.33	3.64	−0.94	0.31	0.84
	WGS	16.02	3.12	−1.01	1.43	0.65
Knowledge Management	Get	15.65	3.86	−1.26	1.83	0.89
	Use	9.68	3.54	−0.69	−0.09	0.78
	Learn	13.84	4.57	−0.83	0.05	0.82
	Contribute	7.00	2.26	−0.70	0.24	0.52
	Assess	7.00	2.46	−0.85	0.28	0.82
	Sustain	10.86	3.38	−1.01	0.82	0.86
	Build	12.91	4.96	−0.53	−0.38	0.87
	Divest	12.67	4.95	−0.56	−0.35	0.85

Note. EA—employee attitude; IS—immediate supervisor; WGS—work group support; OS—organizational culture; M—arithmetic mean; SD—standard deviation; α —Cronbach’s coefficient of internal reliability; CC—collaborative climate; KM—knowledge management

(2) Knowledge Management Instrument (KMI; [10])—this is a 32-item scale constructed with a purpose to measure eight types of specific activities of the process knowledge management: *Get*, *Use*, *Learn*, *Contribute*, *Assess*, *Sustain*, *Build*, and *Divest*. Each of the subscales contains 4 items, rated using a 6 point Likert scale (0—“not applied”, 5—“fully applied”). Metrics of the KMI are shown in Table 3.

3.3. Procedure

The research was carried out using the method of surveying the employees in organizations included in the sample using a questionnaire in order to verify the proposed hypotheses. The survey was carried out on a voluntary basis and the answers of the respondents were not used as individual answers, but as part of the statistical sample. The study involved all levels of employees in organizations in the territory of Vojvodina. The survey covered domestic companies, foreign companies located in the country, as well as companies that are based on capital of mixed origin (domestic and foreign co-ownership).

3.4. Data Analysis

The obtained data were analyzed using the Psych [60] and Lavaan software packages [61] written for the R environment. The Psych package was used to calculate the different descriptive parameters of scales. The Lavaan package was used for structural equation modeling (SEM) with the aim of checking the influence of collaborative climate on processes of knowledge management. Previously, a series of confirmatory factor analyses (CFA) were conducted within the same package with the aim of checking the latent structure of the applied questionnaire.

3.5. Research Hypotheses

Based on the relevant literature and for research purposes, we designed a conceptual model (Figure 1), which was used to develop the following research hypotheses:

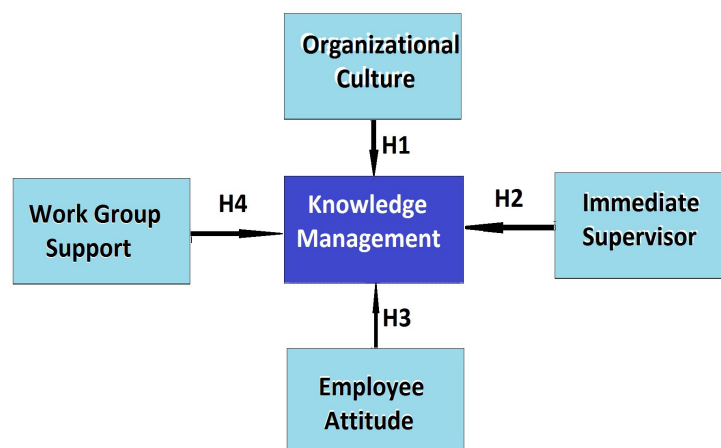


Figure 1. The initial research model.

Hypothesis 0. *There is a relationship between collaborative climate and the activities of knowledge management (getting, using, learning, contributing, assessing, sustaining, building, and divesting of knowledge).*

Hypothesis 1. *There is a relationship between organizational culture as a dimension of collaborative climate and the knowledge management activities.*

Hypothesis 2. *There is a relationship between the behavior of the immediate supervisor as a dimension of collaborative climate and the knowledge management activities.*

Hypothesis 3. *There is a relationship between personal attitude towards knowledge sharing as a dimension of collaborative climate and the knowledge management activities.*

Hypothesis 4. *There is a relationship between work group support as a dimension of collaborative climate and the knowledge management activities.*

4. Results

This study attempted to understand the relationship between collaborative climate and knowledge management in Vojvodina firms using frameworks for knowledge management [10] and for collaborative climate [9]. By analyzing the relationship between different dimensions of collaborative climate and knowledge management activities, a new model of knowledge management based on organizational climate is presented.

The descriptive indicators of scales are shown in Table 3. The results show that none of the scales violates normality of distribution (skewness and kurtosis values are in the range of normal distribution), and that most of the measuring scales (except the OS and Contribute) display satisfactory indices of internal consistency reliability.

Table 4 shows the simple Pearson correlations between the KM and CC dimensions. The results show that all dimensions of collaborative climate are in significant moderate to high correlation with all dimensions of knowledge management ($p < 0.001$). It can also be noted that two dimensions of collaborative climate are in somewhat lower correlation with the dimensions of knowledge management (WGS and EA).

Table 4. Correlations between CC and KM measures.

KM	Collaborative Climate			
	OS	IS	WGS	EA
Get	0.516 *	0.391 *	0.321 *	0.251 *
Use	0.537 *	0.556 *	0.436 *	0.372 *
Learn	0.613 *	0.691 *	0.512 *	0.432 *
Contribute	0.608 *	0.600 *	0.481 *	0.420 *
Assess	0.624 *	0.610 *	0.491 *	0.429 *
Sustain	0.594 *	0.611 *	0.486 *	0.422 *
Build	0.639 *	0.651 *	0.548 *	0.526 *
Divest	0.595 *	0.563 *	0.501 *	0.501 *

Note. EA—employee attitude; IS—immediate supervisor; WGS—work group support; OS—organizational culture; * $p < 0.001$.

4.1. Confirmatory Analysis of the Model of Collaborative Climate

Table 5 shows the values of fitness indices of the model of collaborative organizational climate, with a 4-dimension solution. It can be noted that the first tested model, which was set to match the Sveiby and Simons model [9], fails to display good indicators of fitness. A review of the modification index (MI) indicates that the residuals of individual items achieve high correlations with residuals of many other items, so they were eliminated in the following tested model. In addition, after the elimination of items, in the following tested model, free correlations were allowed between the residuals of 3 item pairs (items 1 and 2, items 12 and 13, and items 15 and 16). A review of their content indicates that these items are quite similar, and therefore, their residuals achieve high correlations. After introducing these modifications to the model (elimination of item 3, and allowing free correlations between residuals of 3 item pairs), much better indicators of fitness were obtained for the model of organizational climate.

Table 5. Fit parameters of collaborative climate dimensions.

Model	χ^2/df	CFI	TLI	RMSEA	SRMR	AIC
Model with 4 dimensions	553.61/164 *	0.85	0.83	0.112 (0.102–0.122)	0.073	7685.451
Model with 4 dimensions—Corrected	230.13/110 *	0.94	0.93	0.055 (0.042–0.069)	0.051	7629.451

Note. χ^2/df —Satorra–Bentler Chi-square/degrees of freedom; CFI—comparative fit index; TLI—Tucker–Lewis index; RMSEA—the root mean square error of approximation; SRMR—standardized root mean square residual; AIC—Akaike information criterium; * $p < 0.001$

Table 6 shows the standardized factor loadings of items of collaborative climate dimensions.

Table 6. Standardized regression loadings of collaborative climate dimensions.

Scale	ITEM	λ
Organizational Culture	1. I receive information from leaders to whom I report on results of my activities.	0.502
	2. Knowledge sharing in my organization/organizational unit is encouraged by acting, not just by words.	0.801
	3. Employees are continually encouraged to contribute with new knowledge they bring to the organization/organizational unit.	0.903
	4. Subordinates are encouraged to say what they really think, even when they disagree with their leaders.	0.765
Immediate Supervisor	1. Encourages you to come up with new innovative solutions regarding the current problems in the workplace.	0.848
	2. Regularly holds meetings to inform all stakeholders about the existing activities.	0.819
	3. Regularly informs in person, and not only on meetings.	0.859
	4. Encourages open communication in your organizational unit or team in which you participate.	0.896
	5. Setting personal example (not just by words) he shows how to share knowledge with others.	0.847
Employee Attitude	1. Sharing information in your organization/organizational unit has increased your knowledge.	0.759
	2. Most of your professional knowledge is developed in the course of collaboration with your colleagues.	0.598
	3. Sharing information contributes to better understanding of knowledge in your organization/organizational unit.	0.752
	4. Combining knowledge among the employees in the organization/organizational unit has resulted in many new ideas and solutions.	0.850
Work Group Support	1. You can learn a lot from your colleagues.	0.695
	2. You often share experiences with other members of the team/organizational unit in an informal way.	0.241
	3. All team members are regularly informed about current events and trends related to business activities.	0.467

4.2. Confirmatory Analysis Model of Knowledge Management

For the purpose of testing the 8-dimension solution for knowledge management, the confirmatory factor analysis (CFA) has been conducted across the entire area of items (32 items, 4 for each dimension). The results (Table 7) show that this model fails to show good indicators of fitness, so the model has subsequently been modified. By reviewing the modification index (MI) values, it has been noted that residuals of 6 items realize significant correlations with residuals of a large number of other items, which led to their elimination from further analysis. In addition to the elimination of these items, free correlation in the modified model was allowed between residuals of 4 item pairs (items 2 and 4, items 7 and 26, items 28 and 29, items 30 and 31). After these modifications, the model of knowledge management, operationalized through 8 dimensions, showed satisfactory levels of fitness indicators (Table 7).

Table 7. Fit parameters of knowledge management dimensions.

Model	χ^2/df	CFI	TLI	RMSEA	SRMR	AIC
Model with 8 dimensions	1257.16/436*	0.84	0.83	0.100 (0.093–0.106)	0.063	13572.977
Model with 8 dimensions—corrected	415.92/267*	0.94	0.93	0.054 (0.045–0.063)	0.047	13395.334

Note. χ^2/df —Satorra–Bentler Chi-square/degrees of freedom; CFI—comparative fit index; TLI—Tucker–Lewis index; RMSEA—the root mean square error of approximation; SRMR—standardized root mean square residual; AIC—Akaike information criterium; * $p < 0.001$

The standardized factor loadings of items of knowledge management dimensions are shown in Table 8.

Table 8. Confirmatory factor analysis loadings of knowledge management dimensions.

Scale	Item	λ
Get	1. People know where to find knowledge they need.	0.809
	2. People have the tools they need to find and capture information.	0.810
	3. People with clearly established roles support information seekers.	0.844
	4. People can access information sources they need to get their work done.	0.734
Use	1. Our physical environment encourages cross-fertilization of ideas.	0.827
	2. We treat information as an open resource that flows freely to all parts of the organization.	0.728
	3. We collaborate on a routine basis with stakeholders.	0.717
Learn	1. We consider failure as an opportunity to learn.	0.586
	2. Our organization supports group activities that promote mutual learning.	0.699
	3. Reflecting on lessons learned is an established practice in our organization.	0.881
	4. When we have a big success, we talk about what we did right.	0.737
Contribute	1. There are few barriers to sharing knowledge in our organization.	0.525
	2. We have explicit policies about the use of other people's information.	0.665
Assess	1. People see how knowledge contributes to the value of our products/services.	0.781
	2. We measure our knowledge management process and its results.	0.895
Sustain	1. We safeguard our critical knowledge.	0.777
	2. We recognize that what we know about our products and services might be as valuable as the products and services themselves.	0.799
	3. We review our knowledge management practices on a periodic basis.	0.873
Build	1. We provide resources to build new knowledge that supports business goals.	0.832
	2. We look for ways to connect key stakeholders and expand our capabilities.	0.687
	3. We create processes and roles that focus on building new knowledge.	0.898
	4. Our policies, procedures, and cultural norms ensure that people who contribute their knowledge are rewarded.	0.803
Divest	1. We can tell the difference between knowledge that can be leveraged and knowledge that has limited uses.	0.856
	2. We routinely look for ways to get rid of non-strategic knowledge.	0.825
	3. We routinely look for alternative uses of non-strategic knowledge.	0.516

4.3. Confirmatory Analysis of the Unified Model of Knowledge Management

The knowledge management model which analyzes the relationship between dimensions of the collaborative climate model and their predictive contribution to the explanation of the knowledge management model was verified using structural equations modeling (SEM). As indicated by the results, this model, in which all CC dimensions were presented as a predictor set, and the KM dimension as a criterion set, displays satisfactory model fit indexes (Satorra–Bentler $\chi^2/\text{df} = 1161.62/786$, $p < 0.001$, CFI = 0.909, TLI = 0.895, RMSEA = 0.055 (0.045–0.055), SRMR = 0.058, AIC = 20864.711). The model is shown in Figure 2.

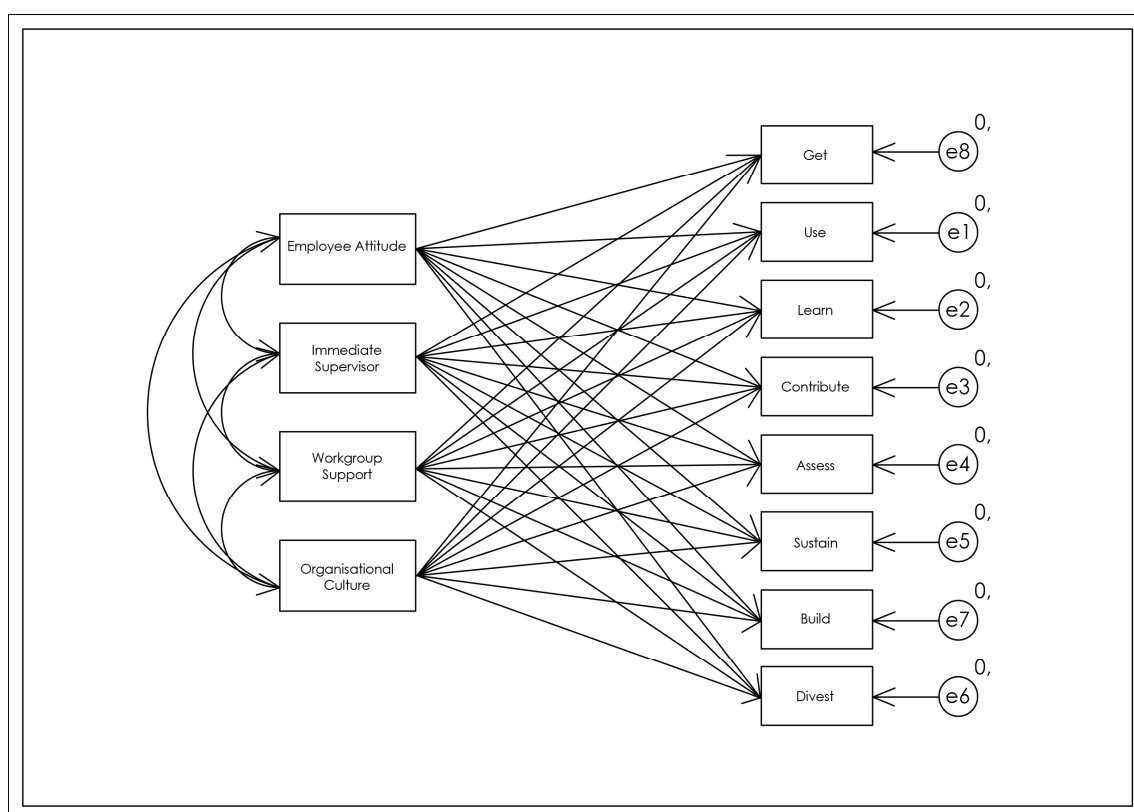


Figure 2. Path model of knowledge management.

Values of standardized regression coefficients are shown in Table 9. All organizational collaborative climate dimensions were presented as a predictor set, and the knowledge management dimension as a criterion set. The results show a significant contribution of organizational culture ($p < 0.01$ – 0.05) in the explanation of all dimensions of knowledge management, except in the case of divesting the knowledge, which is not statistically associated with any dimension of collaborative climate ($p > 0.05$). The behavior of the immediate supervisor has been proven to be the second dimension that participates in the explanation of many dimensions of knowledge management, except use, get, build, and divest. Other predictors or dimensions of collaborative climate (personal attitude towards knowledge sharing and support of the work group) do not seem to contribute and affect significantly the dimensions of knowledge management ($p > 0.05$).

Table 9. Significant regressions.

Regressions:						
	B	SE B	t-value	P(> t)	Std.lv	β
km_get ~						
oc_organizational culture	1.309	0.508	2.576	0.010	0.681	0.681
oc_immediate supervisor	−0.009	0.238	−0.039	0.969	−0.009	−0.009
oc_employee attitude	1.952	4.542	0.430	0.667	1.519	1.519
oc_workgroup support	−2.179	4.883	−0.446	0.655	−1.597	−1.597
km_use ~						
oc_organizational culture	1.350	0.426	3.166	0.002	0.543	0.543
oc_immediate supervisor	0.299	0.200	1.500	0.134	0.224	0.224
oc_employee attitude	1.151	3.234	0.356	0.722	0.694	0.694
oc_workgroup support	−1.216	3.477	−0.350	0.727	−0.690	−0.690
km_learn ~						
oc_organizational culture	0.457	0.200	2.285	0.022	0.307	0.307

Table 9. Cont.

oc_immediate supervisor	0.340	0.105	3.241	0.001	0.426	0.426
oc_employee attitude	−0.368	1.509	−0.244	0.807	−0.371	−0.371
oc_workgroup support	0.529	1.620	0.327	0.744	0.501	0.501
km_contribute ~						
oc_organizational culture	0.843	0.254	3.325	0.001	0.603	0.603
oc_immediate supervisor	0.239	0.118	2.026	0.043	0.319	0.319
oc_employee attitude	−0.279	1.645	−0.170	0.865	−0.299	−0.299
oc_work group support	0.389	1.765	0.220	0.826	0.392	0.392
km_assess ~						
oc_organizational culture	0.823	0.369	2.227	0.026	0.405	0.405
oc_immediate supervisor	0.355	0.183	1.940	0.052	0.325	0.325
oc_employee attitude	−1.289	3.302	−0.390	0.696	−0.950	−0.950
oc_workgroup support	1.517	3.545	0.428	0.669	1.053	1.053
km_sustain ~						
oc_organizational culture	0.837	0.291	2.881	0.004	0.406	0.406
oc_immediate supervisor	0.371	0.144	2.583	0.010	0.335	0.335
oc_employee attitude	−0.562	2.145	−0.262	0.793	−0.408	−0.408
oc_workgroup support	0.697	2.302	0.303	0.762	0.476	0.476
km_build ~						
oc_organizational culture	0.933	0.410	2.274	0.023	0.426	0.426
oc_immediate supervisor	0.271	0.199	1.360	0.174	0.231	0.231
oc_employee attitude	−1.466	3.808	−0.385	0.700	−1.003	−1.003
oc_workgroup support	1.891	4.092	0.462	0.644	1.218	1.218
km_divest ~						
oc_organizational culture	1.056	0.776	1.360	0.174	0.436	0.436
oc_immediate supervisor	0.303	0.382	0.795	0.427	0.233	0.233
oc_employee attitude	−3.551	7.947	−0.447	0.655	−2.193	−2.193
oc_workgroup support	4.099	8.537	0.480	0.631	2.385	2.385

Note. SE—standard error; B—unstandardized regression coefficient; t—t-statistic; Std.lv, β —standardized regression coefficient; km—knowledge management; oc—organizational collaborative climate.

5. Discussion

This study focuses on the effects of dimensions of collaborative climate, which are considered to be essential for successful implementation of knowledge management. Since human resources are one of the most important advantages in the region of Vojvodina, this study was aimed to investigate how collaboration, trust, and communication, i.e., collaborative climate affects various activities of knowledge management. We were looking for answer to following research question:

Which dimensions of organizational collaborative climate appear to be an adequate predictor in explaining knowledge management in Vojvodina.

We examined the results of the research based on one general and four specific hypotheses. The results presented in this research show that organizational collaborative climate with its four dimensions has a divided influence on knowledge management activities, so it can be concluded that hypothesis H0 is partially confirmed.

This study confirms that organizational business culture contributes to the explanation of all activities of knowledge management, as defined by Bukowitz and Williams [10], except for the activity of divesting (p-value of 0.174), which has no statistical correlation with any dimension of collaborative climate. Sveiby and Simons [9] perceive and define this dimension of organizational climate as a set of factors beyond the immediate work environment. This aspect of organizational culture includes values, beliefs, and assumptions which inspire the members of organizations to share their knowledge. It is a culture of trust and collaboration, which improves effective knowledge work and knowledge sharing. Hence, the first specific hypothesis (H1—There is a relationship between organizational culture as a dimension of collaborative climate and the knowledge management activities) has been confirmed, and we can deduce that this result is in line with previous research.

The second specific hypothesis (H2—There is a relationship between the behavior of the immediate supervisor as a dimension of collaborative climate and the knowledge management activities) is partially confirmed, since our research supports the existence of a weaker connection between the behavior of the immediate supervisor and knowledge management activities.

The third specific hypothesis (H3—There is a relationship between personal attitude towards knowledge sharing as a dimension of collaborative climate and the knowledge management activities) and the fourth specific hypothesis (H4—There is a relationship between work group support as a dimension of collaborative climate and the knowledge management activities) are rejected, indicating that it should be discussed in future studies.

Starting from the initial research model (Figure 1), we concluded that our results do not support the hypotheses that personal attitude towards knowledge sharing and work group support affects the knowledge management activities. Therefore, we propose a new model shown in Figure 3.

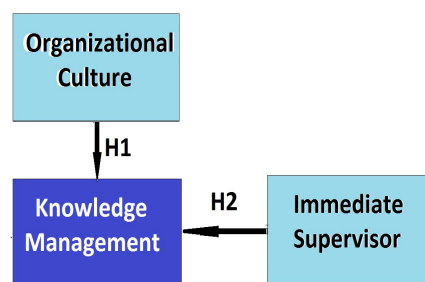


Figure 3. The research model.

Numerous studies have shown that there is a direct positive influence of organizational culture on the effectiveness of knowledge management [62–64]. Culture can also influence knowledge management indirectly in the case when it has an intermediary role as joint learning which further leads to innovation [55,65], or facilitating a role to improve efficiency of knowledge management technologies [66]. Jarvenpaa and Staples [62] indicated that common organizational values significantly influence the willingness of the owner of knowledge to share it with other members of the organization. Lee and Choi [63] found that there is a positive correlation between organizational culture, which includes trust, learning, and collaboration on one hand, and improving the process of knowledge creation on the other. In a similar manner, Lee and Cole [67] perceived culture as a mechanism of social control that stimulates or hinders the creation and sharing of knowledge in the organization, determined by if it encourages critical awareness and open behavior or is focused on sanctioning the individual who acts in an unconventional manner. Auernhammer and Hall [68] identified that an organizational culture which support openness and knowledge sharing is more suitable for KM implementation. Tan [69] showed that a university with strong organizational culture increases knowledge sharing attitudes among academic staff.

It can be concluded that before establishing an appropriate system of knowledge management, organizations should consider their own cultural environment. Organizations that want to capture the knowledge of their employees need to establish a culture of knowledge sharing, collaboration, coordination, and teamwork. An essential element of the success of knowledge management certainly lies in the creation of a business culture that motivates, supports, and encourages acquisition, creation, sharing, codification, and reuse of knowledge at the individual, group, or organizational level.

The behavior of the immediate supervisor proved to be the second dimension that participates in the explanation of many dimensions of knowledge management, except for the activities of using (p-value of 0.134), getting (p-value of 0.969) building (p-value of 0.174), and divesting knowledge (p-value of 0.427). Many scholars proved that leadership is positively related to the knowledge management process [70–72].

The perception of being supported by the immediate supervisor is based on the theory of organizational support and represents the degree to which members of the organization perceive the support of supervisors, their care for employees, and their well-being [73]. Immediate leaders are directing and evaluating the work of their employees.

In some way, supervisors represent the first line of representatives of the organization towards the employees. Therefore, values or standards being fostered in the organization are maintained through the direct supervisor. Janssen [74] argued that employees exhibit higher levels of innovation in performing their tasks when perceiving that their efforts are rewarded by supervisors. Thus, individuals who perceive the presence of balance between the received support and encouragement from the supervisor and invested personal efforts are responding with more innovative behavior. Oldham and Cummings [75] believed that immediate supervisors who do not exert constant control but provide constant support to their employees are creators of work environment that fosters creativity. Open communication and successful communication with supervisors, as well as their support, leads to increased creativity in the workplace [76], increased creation and exchange of knowledge, and increased overall effectiveness of knowledge management. As Kim, Kim, and Yun [77] showed that how supervisors treat their employees is of a great importance to stimulating or obstructing individuals' knowledge sharing. The ethical supervisor's behavior is important for the exchange of knowledge [78].

On the other hand, the results of this study (see Table 9) suggest that neither personal attitude towards sharing knowledge nor the support provided by the work group fails to contribute and does not significantly affect the dimensions of knowledge management ($p > 0.05$). Support within the team or workgroup can be of great importance for knowledge management in the organization, since the creation of the sense of belonging and brotherhood with other members within the group removes the barriers which prevent knowledge management from being effective. Collective responsibility for sharing knowledge within the work group is valued higher than individual contributions. These interactions often lead to the creation of new knowledge. Ingram and Desombre [79] pointed to the fact that the work group is a friendly community. According to their research, these friendly relations are an essential part of job satisfaction, while employees are socializing and communicating also beyond the workplace. A team-oriented work environment allows individuals to learn from their more experienced colleagues, exchange information, and help each other by working together. Collaboration, coordination, and collective approaches to work are becoming more and more desirable characteristics of creating and sharing knowledge, as well as the overall learning process [55].

In an environment where employees cooperate with each other, share their knowledge and experiences with other members of the organization, new and innovative knowledge is more likely to be generated than in an environment of distrust and tendency towards independent work. If an individual is faced with a difficult and new task with a not readily available solution, the colleagues from the workgroup with a high level of mutual collaboration will share their knowledge and expertise needed for better work [80].

Fishbein and Ajzen [81] defined individual stances as individual positive or negative feelings about sharing knowledge. The research conducted by Hislop [82] points out that the most important factor of sharing knowledge with others is rather the employees' attitude but not motivation. Xue, Bradley, and Liang [83] suggested a positive relationship between the behavior and attitudes towards knowledge sharing. Accordingly, a negative attitude reduces the likelihood of knowledge sharing and successful knowledge management. This research, however, does not indicate that there is a significant influence of personal attitude towards activities of knowledge management, given the $p > 0.05$ value.

6. Conclusions

This research paper attempts to highlight the influence of collaborative climate on knowledge management in the era where organizations are moving from a negotiated to market economy. We suggest that a proper organizational collaborative climate is very important for implementing knowledge management practice and for building KBE. If specific organizational conditions are

properly established by managers, the knowledge-based firms will significantly be improved and more successfully utilized, pulling away the whole region in a desired direction.

Knowledge management and engineering management are closely related [84]. Successful product design depends on the efficient management and sharing of engineering knowledge.

Information technology is certainly one of the basic sources of a knowledge-based economy and organizational sustainability. In software projects, appropriate communication infrastructure contributes to the development of knowledge networks. Software development depends on sharing knowledge between developers working in different parts of the world [85]. In their research, Harper and Utley [86] examined the impact of organizational culture on IT implementation and concluded that the most significant impact is the culture and the internal environment oriented on people more than on production. In project organizations, group culture contributes significantly to performance and performance improvement, through budgetary goals, project execution time, and customer expectations. Group culture has the effect of reducing costs, increasing competition, and increasing sales [87].

Our study aimed at developing a model of knowledge management based on organizational collaborative climate also has practical implications. The research results could motivate engineering managers to place more emphasis on collaboration, trust, and communication. They should focus on the development and preservation of internal skills and capabilities, which includes both the creation of new and improvement of existing knowledge within the company in order to achieve competitive advantage [88]. Many companies are investing in technical infrastructure that enables the acquisition and dissemination of knowledge, while others are focused on quality and inventory control. However, as a result of excessive orientation to technical problems rather than social aspects, these companies are unsuccessful [89].

We propose that in order to enable knowledge to bring value to the organization and promote knowledge-based activities, developing and implementing an appropriate collaborative climate is required. One of the key factors of creating new and improving existing knowledge is creating an atmosphere of trust and security that encourages innovation, experimentation, and risk taking.

Employees will lose their interest in being promoted unless there is no friendly and supportive climate in the organization. Organizational climate affects all members of the organization. If employees experience organizational climate as closed, they will most likely be indifferent in increasing and sharing their knowledge with other members and unlikely show any commitment. They will act and perform their tasks in a routine manner, as instructed, with no interaction with the management. As a result of this adverse climate, there will be neither creativity nor innovation. On the other hand, with open organizational climate, employees will be more willing to collaborate and share knowledge and skills.

Practical implications which are related to the results suggest that different knowledge management programs should be enforced. For more successful implementation of knowledge management programs, attention should be focused on establishing a caring organizational climate based on trust and collaboration, that supports people and encourages good relationships. Employees will have a more positive attitude towards knowledge sharing if they feel they belong to the organization.

Research results are not entirely satisfying, so this analyzed phenomena requires a more attentive approach of managers in Serbia. One of the reasons for such a result can be the economic situation in Serbia, which has a severely harmful effect on knowledge management. Whatever the reason, the relationship between organizational climate and knowledge management within the transition economies merits additional investigation. One of the main goals that managers in Vojvodina and throughout Serbia should strive for is the implementation of organizational culture that fosters knowledge sharing among employees.

An immediate supervisor should promote the importance of knowledge as a determining factor for organizational sustainability in a modern knowledge-based economy and competitive environments. Therefore, training for supervisors and managers should address areas like this.

Companies in Vojvodina should focus on good practice examples in organizations which have improved their performance through successful implementation of knowledge management programs.

Unfortunately, our research has shown that companies in Vojvodina do not sufficiently understand the importance of a supportive organizational climate for knowledge management. Thus, this research should be conducted in some future period to identify the implications of successful implementation of knowledge management.

Summarizing our research methods, we can say that it certainly contributes to a better understanding of how organizational climate affects knowledge management. However, there is always the possibility for improvement.

For future research, it would be desirable to include respondents from different countries.

This is a survey-based method of research. Future research should include questionnaires which allow access to broader experiences, as well as interviews with respondents in order to create a deeper perception and understanding of data obtained.

Future studies are recommended to be carried out across a larger number of respondents. They should also determine the influence of demographic properties of respondents, as well as those of the organization, as mediators between the collaborative climate and knowledge management.

Some further research should go towards examining how different economic sectors, organizational characteristics, and mentality affect the examined link between the collaborative climate and knowledge management.

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