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# Error optimization of 3D digitisation of flat surface by artificial neural network usage

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**Abstract**

Business conditions on the global market puts a more and more complex conditions in front of manufacturing companies that deal with the development and production of products and their market placement. One of the conditions that is from the particular importance is the shortening of time in all aspects of the product life cycle, and the adequate application of RE (Reversible Engineering) as a tool in the process of product development / shaping represents a logical choice for fulfilment of the said condition. The RE process implies the realization of a series of steps that enable a generation of a 3D CAD (Computer Aided Design) solid model from a starting real 3D physical object, through its immediate 3D (Three-Dimensional) digitization and the elimination of digitalisation errors. Although the RE process of has a significant potential to shorten the time of product development/shaping, it is very important to ensure that the result of implementation of RE process has the appropriate qualitative characteristics, which primarily relate to achieving the required tolerances of geometric measures that represents the object of digitalisation.

In order to point out the possibilities of achievement of the required qualitative characteristics of the object of digitization, in the paper is presents the method for error optimization of 3D digitisation of flat surface by ANN (Artificial Neural Network) usage. In the paper are presented and compared the existing methods for data processing that represent a 3D digitized flat surface, as well as newly developed method for processing the collected digitized data using adequately structured and trained ANN

## 1. Introduction

Creating 3D CAD forms of objects that takes into account its aesthetic and ergonomic aspects with increasingly demanding requirements versus the individualization of certain geometric characteristics of the product are a very complex task that is difficult and in some cases virtually impossible to implement with the tools offered by existing commercial CAD systems. Applying the RE approach in the process of developing of new and / or redesigning forms of existing products is a powerful tool for overcoming this problem [91]. The immediate implementation of reversible engineering with the corresponding phases in the process of designing / redesigning of products is presented on the Figure 1.

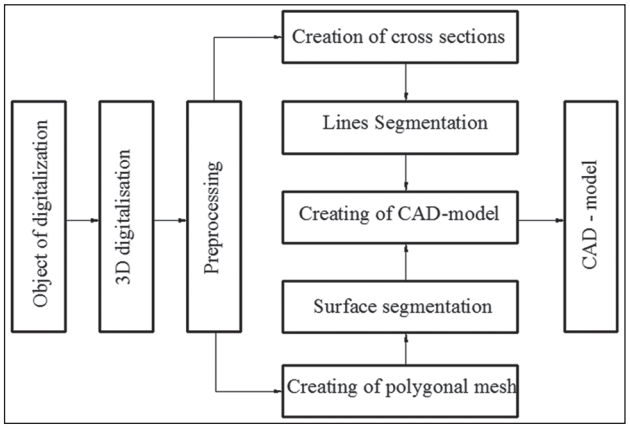



*Figure 1. The phases of RE process with the associated sub-phases*

All phases of the RE process, presented on the Figure 1, have their own characteristics that must be taken into account in order to ensure shortening of total processing time and achievement of adequate qualitative characteristics of the results of implementation of RE process i.e. generated 3D CAD solid model. This model in the initial phase, just after 3D digitization, is presented through a smaller or larger number of spatially distributed points that essentially describe in the virtual space the 3D geometry of the digitized object. This set of points is known as the "raw" cloud of points. During the 3D digitization process, certain errors of measurement can occur and according to its characteristics this

errors can be systematized into two groups: random and systemic. Random errors are the result of certain disorders in the system of measurement and their appearance cannot be explained, and are reflected in the appearance of a points outside the range i.e. outliers or impulse noise. System errors occur in accordance with some rules and their cause can almost always be detected. They can occur as a consequence of: applied 3D digitization process (calibration, sensor sensitivity, etc.), characteristic of objects (surface roughness, glare, softness of material, etc.), ambient conditions (temperature, humidity, noise, vibration, etc.) or as a result of the operator's activities. System errors are manifested in spikes, which are the cause of inadequate smoothness of the generated surfaces. Additionally, the immediate realization of 3D digitization can result in the problem of too many collected points. This problem is particularly characteristic of the contactless methods while in contact methods of 3D digitalization this problem is not significantly expressed. Regardless of the potential problems, for an adequate description of the complex surfaces of 3D digitalized objects and their reconstruction, a large number of points may be required. This may negatively affect subsequent processing of data through: slowing down the process itself, requirements for powerful hardware, and in extreme cases it can disable preprocessing the collected data itself. For these reasons, before being redirected to some of the software for surface reconstruction it is necessary to reduce a number of digitalized data. The level of data reduction must be sufficient to ensure the preservation of the geometric quality of the reconstructed surfaces, because any wrongly reduced point can increase an error of resulted CAD model i.e. the generated 3D CAD solid model will not be adequate because it will not match to the original object [4]. According to some studies, 85% of total time needed for realization of all phases the RE process is spent on generation of the surface model [12] and the partial or complete automation of this activity will significantly increase the productivity of the process in a whole. However, to fulfil the above mentioned condition it is necessary to provide a well prepared data – cloud of points, i.e. perform high-quality data preprocessing [12].

Problems that occur with the "raw" cloud of points may differ significantly depending on: the applied 3D digitization equipment, measurement procedures, geometric complexity of the object, the RE goal, the applied RE methodology, etc. The modern practice today applies different methods of preprocessing of "raw" cloud of points, among which are almost a standard: errors filtering and realignment of points. In addition to the above mentioned methods for additionally improvement of qualitative characteristics of "raw" cloud of points, depending on the type, purpose and specific requirements of the RE system, the following approaches to the processing of digitalized data are encountered: direction analysis, regression analysis and regeneration of data/points [12, 23, 34], as well as extraction of data on cross-sections and generation of transverse and outline curves which are approaches characteristic to systems based on cross-sectional methodology [45].

On the other hand, in the RE processes based on polygonal approach, additional improvement of "raw" clouds of points can be done through the selection of group of triangles for triangulation, as well as splitting of cloud of points in segments - segmentation for easier implementation of preprocessing [45]. In this respect, the first step in the preprocessing of "raw" cloud of points is filtering of errors whose basic function [12] is to eliminate impulse noise i.e. measurement errors in the form of points "beyond the scope". Some of the available methods that are applied in practice are [45, 12]: the method of volume filtration, angle method, line filtering method, noise filtering method across controlled limits (statistical ratings). In the next step, the quality of 3D digitized results can be further improved by alignment of digitalized points. This eliminates large oscillations of the points which results in "smoother" distribution of points and provides preconditions for creating a better CAD surface [76]. There are two methods available for alignment of data-points [45]: the mean value method and the median method. It is important to point out that the results of preprocessing of digitalized data using by any of the two above mentioned methods are largely dependent on the reducing the impulse noise i.e. reducing of data set. Reduction of the data set can lead to a reduction in the number of "raw" digitalized points, what can results in an increase of error between the real initial and resulting CAD digitalized object.

## 2. Application of ANN in the preprocessing of digitized data

In order to avoid first phase of preprocessing of "raw" cloud of points directly obtained by the 3D digitization by contact method i.e. to avoid data reduction (reduction of number of digitalized points) a new approach to preprocessing of "raw" data based on usage of ANN is developed. By applying of this approach direct realignment of data/points is possible, whereby the previous phase of data preprocessing, i.e. reduction of data number (the biggest cause of random errors) is excluded. The ANN used for preprocessing of "raw" data are trained by implementation of technique of early stopping of the training. That training approach required adequate data preparation, which in essence represents the technique of dividing of the initial set of data into three sub-groups. The data division was performed by arbitrary data selection from the initial data set. The first subset of data is the data used for training of ANN i.e. for calculation of the gradients and update of the weight coefficients and bias of trained ANN. The second subset of data is a validation subset of data. During the training of the neural network, the average quadratic error of the validation data set is usually monitored, which usually drops in the initial training phase as well data set error used for training of the ANN. However, when overfiting occurs, a validation error increase during the iterations and if it reaches some critical value the training of the ANN stops. After stopping, the weight coefficients and the activation thresholds gained the values they had when minimum validation error value occurred. The third subset is a testing data set. It is not used during the process of training of ANN, essentially serves to verify the design of ANN [45]. After performing the above mentioned operations of preprocessing of data sets, those data sets are presented to the Feed - forward Back Error Propagation ANNs characterized by: variable structure (different number of neurons by layers and different number of layers), different activation transfer functions by layers, different methods of updating the weight coefficients and the activation thresholds, as well as with different ways of learning of ANN i.e. different training algorithms such as: elastic – *Train RP, Levenberg-Marquardt– Train LM, Polak – Ribiere* conjugated gradient – *Train CGP, Powell – Beale* conjugated gradient – *Train CGB,* Quasi *Newton – Train BFG,* gradient drop– *Train GD,* gradient drop momentum – *Train GDM,* step semantic – *Train OSS,* decreasing - *Train BR,* gradient decay adaptive, *Train GDA.*

## 3. Object of digitalization and measurement preparation

With the aim to point out the possibilities of usage of ANN in preprocessing of a digitized data, a "raw" cloud of points of a real reference object by contact method of 3D digitalization was generated. That real reference object i.e. the object of research is a flat panel previously prepared for the digitalization. The preparation includes the premarking of the measuring points that represents the metering coordinates on the flat surface. The distance between the measuring points is 5 [*mm*] and in every point its coordinates are measured (Figure 2).

*Figure 2. Positioning the flat panel on the measuring table as a preparation for digitalization by tactile scan*

Before the immediate digitization of the object, the operating parameters of the measuring device - the tactile scanner were adjusted. It means, a relative coordinate system is defined in relation to which the spatial determination of the position of the measuring points on the digitization object will be performed, as well as, the orientation of the measuring head in the working area (Figure 3).

*Figure 3. Contact scanner - device for digitalisation with the appropriate calibration gauge mounted on the measuring table*

These operations of setting up of the operating parameters of the tactile scanner require a considerable involvement of the operator, thus increasing the cost of digitization. On a quality of the results obtained by contact methods of 3D digitalization is significantly influenced by the characteristics of the measuring head used (by usage of thinner measuring head more precise is data acquisition, i.e. with the thinner measuring head is easier to access to the measuring points), which additionally increases the cost of applying of this approach.

### 3.1. Digitalization of real object and creation of "raw" cloud of points

After the positioning of the measuring object i.e. flat surface on the working-measuring table, as well as, the setting of the tactile measuring device, 3D digitization was performed (Figure 4).

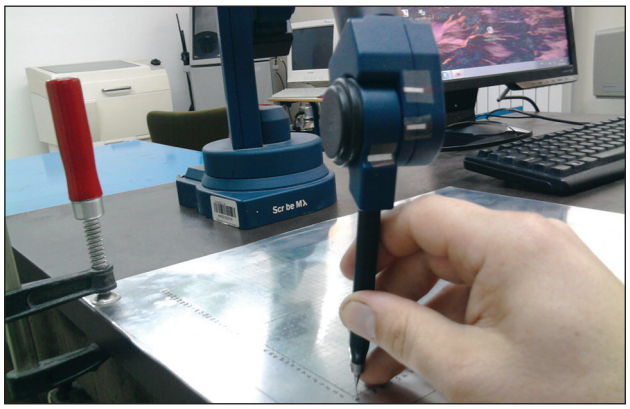
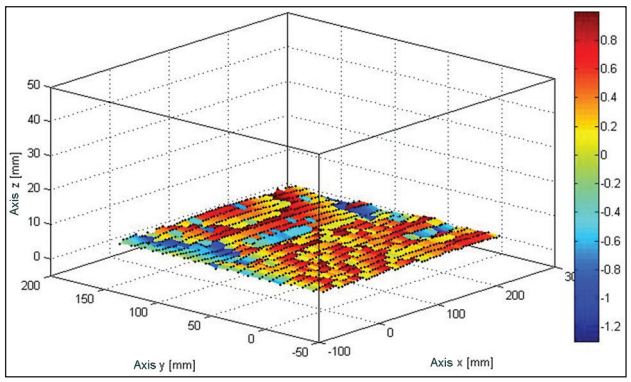


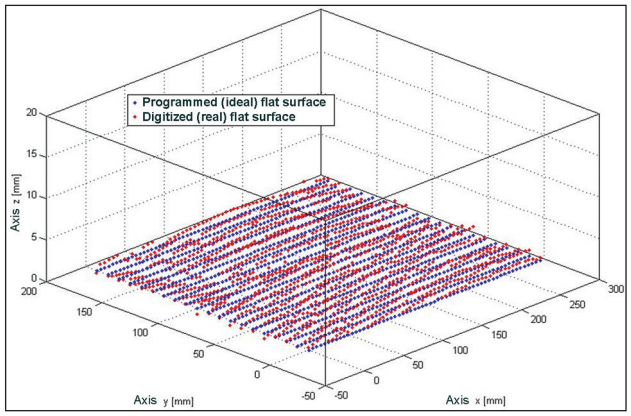
*Figure 4. Presentation of 3D digitalization of flat surface*

Obtained data are memorised in **.txt* format of data and represent object of digitalization in virtual space. This type of data is well known as "raw" cloud of points. Digitalized "raw" cloud of points obtained by contact method of 3D digitalisation of real physical object of digitalization i.e. adopted flat surface is presented in 3D virtual environment in *Matlab* software (Figure 5.a).

As a results of errors that occurs as a result of 3D digitalization process there are certain deviations of data from "raw" cloud of points in comparison to the data values that represents points on initial real object of digitalization, Figure 5.b.




*a)*




*b)*

*Figure 5. a) flat surface generated from the "raw" cloud of points in the Matlab software, b) comparisons of the ideal surface (blue colour) and the digitized values i.e. "raw" cloud of point (red) with a tactile scanner*

In this case on Figure 5.b is presented absolute error that appears per *x*, *y* and *z* axis.

## 4. Preprocessing of digitalized points by existing methods

In order to improve the qualitative characteristics of the digitized data set - the "raw" cloud of points through the reduction of the maximum absolute error between the data describing the ideal flat surface and the data describing the real digitized flat surface, preprocessing of "raw" cloud of points was made. For the preprocessing of "raw" cloud of points, existing methods have been used: the method of volume filtration, the method of linear filtration and the angle method. The preprocessing results by above listed methods are shown on the Figure 6.

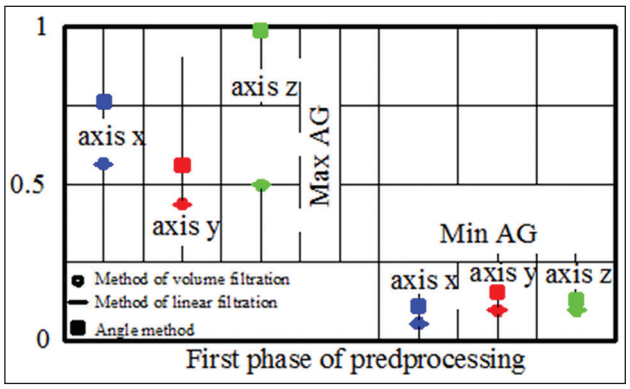



*Figure 6. Review of results of preprocessing of "raw" clouds of points by existing methods*

In order to minimize the absolute error between the ideal programmed and real digitized data set, besides the filtering of the data carried out with the aim to eliminate the impulse noise, further preprocessing of the collected data by application of some of methods for data alignment is necessary.

In this specific case following methods for data alignment were applied: medium value method, median method and method of significance level of points.

The results of data preprocessing by methods for data alignment are shown on the Figure 7.

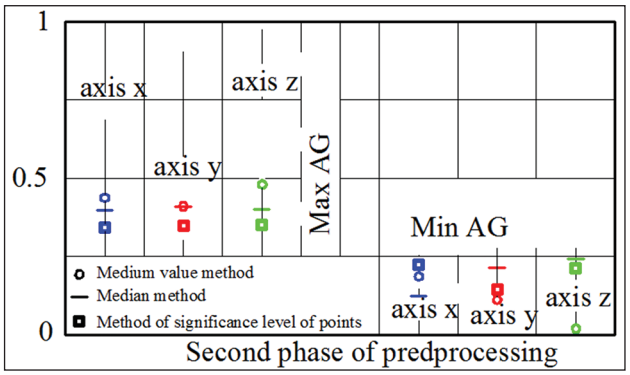



*Figure 7. Review of the results of preprocessing of "raw" cloud of points by the existing methods*

### 4.1. Preprocessing of "raw" cloud of points by ANN

With the aim to achieve qualitative and quantitative product characteristics, a new approach for preprocessing of collected digitized data based on the application of ANN has been developed. Namely, the application of intelligent software algorithms (generic algorithms, ANN, fuzzy logic, etc.) for processing of large number of data having the appropriate structure is increasingly applied in a wide variety of applications. Given the characteristics of the "raw" cloud of points, existence of the initial accurate model and taking into account the mode of operation of ANN, it is possible to assume that the application of ANN in this particular case will yield adequate results from the aspect of qualitative characteristics of the preprocessed data. Since in this case is arbitrarily selected flat surface its 3D digitization by *Microscribe Immersion Corporation* scanner right one by one straight-line was performed. This approach is selected because it enable adequate presentation of digitized data - "raw" cloud of points to the ANN i.e. it provides such a data structure that will enable adequate training of ANN. In addition, the immediate digitized data are sorted in the way that enable its presentation to the trained ANN. The data are sorted from the first to the *n*-th line in order to adequately present the digitized flat surface i.e.:

$$x_1,y_{1,}z_1; x_{2,}y_{2,}z_2; x_{3,}y_{3,}z_{3,} \ldots, x_{i,}y_{i,}z_i, \ldots, x_{n,}y_{n,}z_n,$$

where are:

$x, y, z$ – coordinates of digitalized points;

$n$ – number of digitalized lines whose joining gives a flat surface.

By generating a set of series input-output data a sequence of ANN training with variable structure (different number of layers - single and dual layer, and different number of neurons per layers), based on *Backpropagation* (stands for Back Error Propagation) and Elman's training algorithm, usage of different training functions (Newton training algorithm, *Powell-Beale* conjugate gradient training algorithm, *Polak-Ribiere* conjugate gradient training algorithm, *Levenberg-Marquardt* training algorithm, gradient decreasing training algorithm, gradient decreasing adaptive training algorithm, etc.) was carried out. In order to improve the generalization of ANN i.e. to prevent overfitting phenomenon by application of early stopping technique - stopping of training process of developed ANN, preprocessing of initial data set was carried out, as follows: scaling of input and output data values, normalisation of averages values and standard deviations of training data sets and reduction of dimension of large input data vectors with redundant components [87]. After accomplished preparation and preprocessing of input-output data sets, forming of ANN (structures, training algorithms, etc.), and training procedures of ANN were performed. The result of the previously carried out activities is adequate structure of the trained ANN (Figure 8), presented by the mathematical model:

$$a^2 = purelin\,(LW_{2,1}\,tansing(IW_{1,1}p_1+b_1)+b_2),$$

with corresponding characteristics presented in the Table 1.

*Table 1. The structure of the ANN used for preprocessing of "raw" cloud of points obtained by 3D digitization*

| ANN name | *Net 2* |
|---|---|
| ANN type | *Feed-Forward* |
| Training algorithm | *Bayesian* |
| Training algorithm ANN | *Learngdm* |
| Number of Layers | *2* |
| Number of neuron | *5* |
| Exit layer – number of neurons | *1* |
| Activation transfer function | *Tansig, Purelin* |

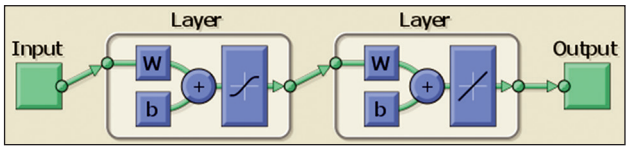



*Figure 8. Schematic review of ANN used for preprocessing of "raw" cloud of points obtained by 3D digitization*

This ANN is applied for preprocessing of a concrete "raw" cloud of points which describe a digitized flat surface.

After processing of "raw" cloud of points by selected ANN obtained results are compared with the ideal programmed data - points with the aim to determinate value of maximum absolute error. The values of that error are shown in the Table 2.

*Table 2. Overview of the results obtained after preprocessing of the "raw" cloud of points using the appropriately trained ANN*

| Alignment of data (new approach) $a^2=purelin(LW_{2,1}\,tansing(IW_{1,1}p_1+b_1)+b_2)$ | | |
|---|---|---|
| The maximum absolute error per axis [*mm*] | *x* | 0,305 |
| | *y* | 0,342 |
| | *z* | 0,315 |
| The minimum absolute error per axis [*mm*] | *x* | 0,012 |
| | *y* | 0,101 |
| | *z* | 0,001 |
| Standard deviation per axis [*mm*] | *x* | 0,132 |
| | *y* | 0,121 |
| | *z* | 0,147 |

From the presented results of carried out preprocessing of the "raw" cloud of points, it can be seen that a different methods and approaches give different error values. In order to determine which of the used preprocessing methods yields better results from the aspect of minimal absolute error between the preprocessed and "raw" data, a comparative factor has been created and named as the *Factor for Selection of PreProcessing Method* (*FSPPM*) [45]. It is important to emphasize that the smaller value of *FSPPM* indicate better results of associated preprocessing method, i.e. the absolute - maximum error is smaller. *FSPPM* can be analytically express as follows:

$$FOMPP = \frac{\sum_{i=1}^{n} |M_i|}{N},$$

where are:

$\sum_{i=1}^{n} |M_i|$ - sum of all measured values of errors;

$N$ – number of measured values.

After the calculation of *FSPPM* for used methods of preprocessing of "raw" cloud of points obtained results are shown on the Figure 9.

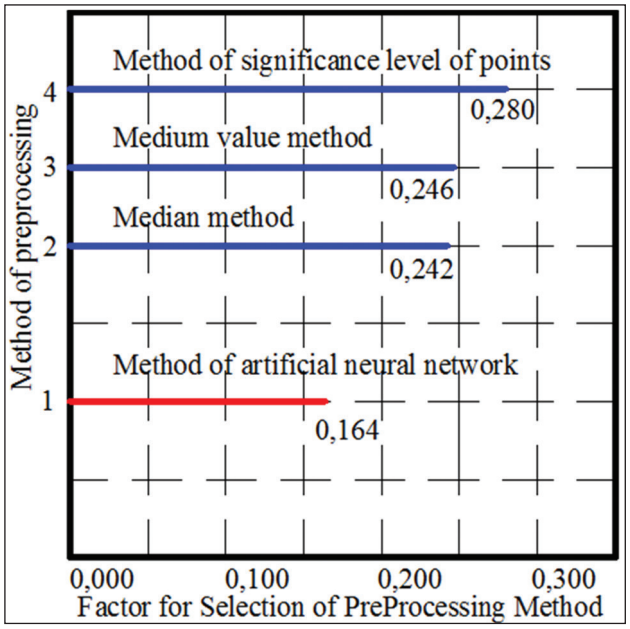



*Figure 9. An overview calculated values of FSPPM*

## 5. Conclusion

With the development of contact and contactless RE methods, there was a need to develop adequate ways for preprocessing of the gain data, with the aim to fulfil of qualitative requirements of resulting 3D CAD solid model. For these purposes, a large number of methods have been developed. According to the preprocessing goals those methods can be categorized in two phases:

- the first phase directed to the elimination of the impulse noise (data that are beyond the scope of measurement), and performs reduction of the number of data in accordance with the given criterions,
- the second phase executes data alignment i.e. convergence of digitized data to the ideal plane.

It is important to note that the success of the second phase of preprocessing of the 3D digitization data largely depends on the adequately performed first phase, i.e. from the preparation of the 3D digitization data for the process of alignment. Although the implementation of the above mentioned methods for preprocessing of 3D data provides the appropriate results, there are still some problems with their implementation, which are primarily reflected in: a relatively long time of preprocessing, achieving the required quality of the obtained geometric information is questionable and depends on many factors, a large number of iterations of preprocessing, numerous personnel necessary for realisation of preprocessing activities, etc. In order to overcome some of the disadvantages of the above mentioned methods, a new method for preprocessing of 3D digitalized data based on the application of ANN was presented, as well as a comparative analysis of the existing methods and new method on a concrete example was performed. Comparative analysis was done in several steps. On the first step CAD inspection (Figure 5) between the set of points representing the ideal flat surface and corresponding set of points digitalized with a tactile scanner on real flat surface – "raw" cloud of points (Figure 4) was performed. The results of accomplished CAD inspection indicates certain deviations, with the values of the maximum absolute error, the minimum absolute error and the standard deviation for $x$, $y$ and $z$ axes represented on the Figure 6. On the second step, the "raw" cloud of points is preprocessed by the volume filtering method and the linear filtering method and corresponding maximum absolute error per $x$, $y$ and $z$ axis is presented on the Figure 6. Application of the angle method in preprocessing of "raw" cloud of points in this stage did not result in changing of error because the condition is not met (the boundary angle between two adjacent points should be equal to or less than 20%). In addition, it has to be emphasized that the number of data was reduced by 47% due to the elimination of a certain number of points. On the third step, previously obtained set of data, preprocessed cloud of points was additionally processed with the aim of data alignment by following methods: medium value method, median method and method of significance level of points. Results of completed preprocessing operation in this stage are presented on the Figure 7 and it can

be seen that the maximal absolute error per *x*, *y* and *z* axis is smaller than it was in previous stage. Additionally, from presented results on the Figure 7, it can be seen that applying the mean value method and the method of significance level of points in comparison with application of the median method obtained minimum absolute error per x axis increases its value. That means the median method in this case gives the best results. In this stage previously obtained set of data, preprocesseed cloud of points, was additionally processed by adequate structured and trained ANN. Results of this operation i.e. corresponding maximum absolute error per x, y and z axis is presented in the Table 2.

On the last, forth step is introduced new comparative factor named as the *Factor for Selection of PreProcessing Method – FSPPM*. By this way it was possible to compare results obtained by different preprocessing methods. Obtained FSPPM values are presented on the Figure 9. Results presented on the Figure 9 shown smallest value of FSPPM factor for data preprocessed by new preprocessing method i.e. method based on application of well-structured and trained ANN in comparison with other "conventional" preprocessing methods on the same data set. It indicate better geometric quality of obtained data set preprocessed by implementation of ANN method. In addition to improvement of the qualitative characteristics of the resulting geometric model i.e. the post-processed set of points by usage of ANN in the preprocessing of digitized data in the second stage of preprocessing, other advantages of applying of this approach are apparently related to the simplicity of usage and shorter time needed for its implementation. In spite of the above-mentioned positive results, it is necessary to carry out further research with a view to a more complete picture of the potential advantages, but also the disadvantages of the new method of preprocessing data based on the application of ANN.

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# Detection And Categorization of Fault in Series Compensated Transmission Line Utilizing Discrete Wavelet Transform and Support vector Machine

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**Abstract**

This paper proposes a precise and quick fault detection and classification technique in series compensated transmission line using discrete wavelet transform and support vector machine .in this strategy diverse kind of fault are made utilizing MATLAB and the disturbed segment of voltage and current waveform which having non-fundamental segment are separated and pass through DWT. at that point their high frequency part are extracted. After that the extracted feature are applied as a input to the SVM, for identifying a type of fault. The possibility of proposed method tested on 300 km, 400 kv series compensated line for all type of fault by simulation, the possibility of the proposed technique is tested using matlab. The consequences of the proposed fault component extraction, recognition and classification method demonstrated that different sorts of flaws in a power system can be identified and arranged precisely.

**Key words:** wavelet transform (WT), fault detection, fault classification, series compensation of line, support vector machine (SVM)

## 1. Introduction

The consistently expanding power market requirement leads to increment in power transmission limit, enhancing the voltage profile and lessening the line voltage [1]. This compel the power engineers to transmit most extreme conceivable power through transmission lines without losing stability. To this end the power area is required to introduce Series Compensator in transmission lines. Series Compensation is simply an introduction of capacitor in series with the transmission line to compensate the same. Series capacitor require metal oxide varistor (MOV) to reduce or eliminate over voltages across the capacitor. MOV clamps the voltage level and change the capacitor impedance in non linear manner without fully removes the capacitor (Figure). The MOV bypass the series capacitor when MOV energy exceeds a threshold. Figure shows a series compensation unit.

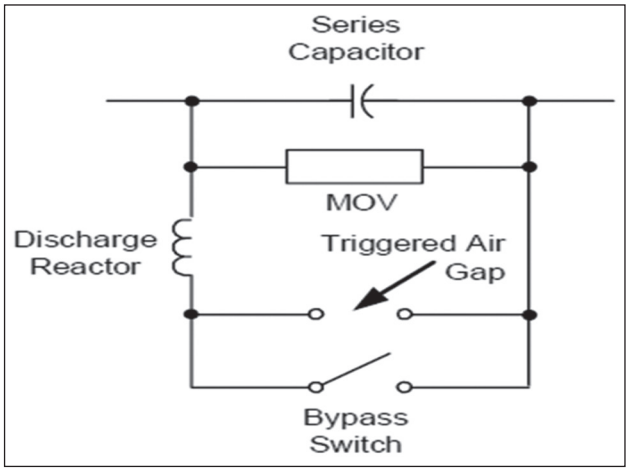


*Figure Series Compensator unit*

Now apart from several advantages, security of arrangement remunerated line is much troublesome assignments because of below given reasons [2], [3]. Due to series compensation, Inversions phenomena of voltage and current signals occurs.

The enduring state current is expanded vitally which may surpass the line-ground current fault against the edge of line. The signal originates on transmission line contain distinct Frequency component [2], which include non fundamental deteriorating. Harmonics produced, because of MOV conduction whenever fault occurs. Hence traditional techniques, like full and half cycle DFT or least square error (LSE), decline to process the signal correctly, and hence waveform appear with

large error, therefore these methods are not effective for series compensated lines.

To rectify the above issue diverse investigator have recommended various approach in writing. fault can be identified in view of correlation of contrast between the incentive in current for two successive cycles being more noteworthy than edge esteem and stage examination scheme[4], [5]. In any case it has impediment because of the issue in displaying fault resistance. The moving aggregate based fault location plot has been talked about in [6]. Neural system based plans for settled series capacitor remunerated line and for TCSC remunerated line is proposed in [7], [8] respectively. Yet in these [7], [8], the execution of neural system based plan has been inspected over constrained experiments. Kalman sifting based system [9] and wavelet change (WT) based techniques [10] is recommended in writing. In which some constrained experiments have been utilized for approving the execution of created procedures. Additionally in [10] the testing recurrence is very high (200 khz), which may demonstrated badly designed for useful execution. A calculation in light of high recurrence signals is described in [11], in which particular estimation unit comprising of stack tuner and line trap is utilized to extricate the high recurrence segments of fault signs. Additionally in these paper, not very many experiments have been utilized to assess the execution of proposed conspire. A fault identification technique in SSSC line talked about in literature [12] v. malathi proposed an intelligent approach for vector machines for grouping and finding deficiencies on transmission lines [13]. Proposing effective and quick methods for fault component extraction and distinguish is main task which is discussed in [14]. Support vector machine disused in [15]. In present paper, a technique called wavelet transform is used to identify the fault and SVM is utilized to categorized the fault. DWT has been executed utilizing WT tool kit in MATLAB. The execution of created calculation has been tried over a vast test informational index considering wide variety in working conditions. Figure 1 shows the basic scheme of our approach.

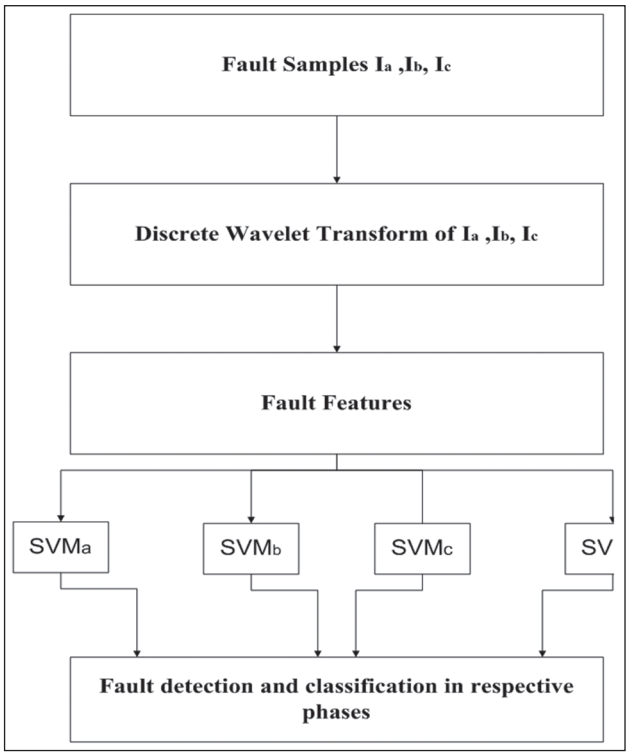


*Figure 1. Basic scheme*

## 2. Principles

The proposed approach having two phases. a DWT procedure is utilized to extract the features from sampled version of these three line streams (Figure 1). For these reason, tests for samples of just half cycle have been utilized. In the second phase, these specimens are give to a SVM to choose the kind of fault. The basic scheme is appeared in Figure 1. In next two segments some short prologue to SVM and WT are described.

### *a) Discrete wavelet transform*

The WT is an instrument which performs time confinement of various recurrence segments of given signal. In this way by utilizing WT, both time and recurrence determination of signal is proficient. WT plays out this capacity by utilizing mother wavelet. Mathematically DWT of discrete signal x[n] is defined as

$$DWT(m,n) = a_0^{\frac{-m}{2}} \sum_k x(k)\Psi\left(\frac{n - k_{b0}a_0^m}{a_0^m}\right) \quad \text{.....(1)}$$

Where, the parameter $a_0^m$ and $ka_0^m$ are the scaling and translation constant respectively, k and m being integer variables and Ψ is wavelet function.

The DWT decomposes the signal in the way, $d_1[n]$ and $a_1[n]$ where $a_1[n]$ is the smoothed version and $d_1[n]$ is detailed version of original signal.

$$d_1[n] = \sum_k h[n-2k].\mathrm{x[k]} \quad \text{..... (2)}$$

$$a_1[n] = \sum_k g[n-2k].\mathrm{x[k]} \quad \text{..... (3)}$$

Here, h[n] and g[n] are the analogous route coefficients that break down x[n] into d1[n] and a1[n] separately. The coefficients of the channel h[n] and g[n] are related with the chosen mother wavelet and a novel channel is characterized for each. Subsequently the division procedure can be iterated, with progressive approximations being decay thusly, so that unique signal is separated into many lower determination parts. In these way we obtained a wavelet division tree [13], shown in Figure 2.

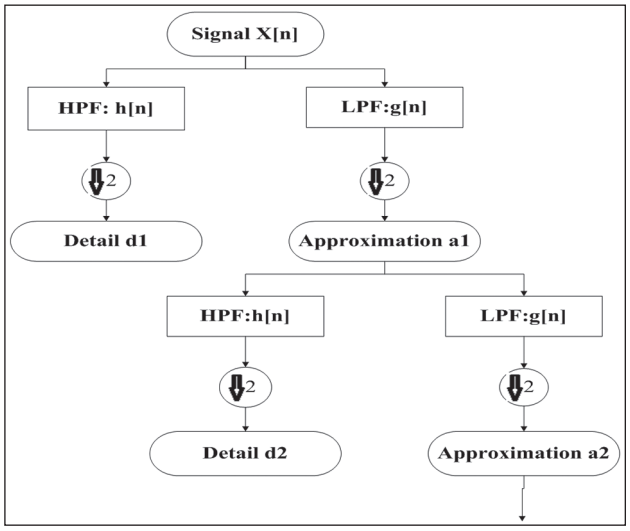


*Figure 2. Wavelet Decomposion Tree*

*Table 1. Recurrence Bands of Coefficients At different Decomposition Levels*

| Decomposition level | Frequency Ranges (hz) |
|---|---|
| D1 | 20,000-40,000 |
| D2 | 10,000-20,000 |
| D3 | 5,000-10,000 |
| D4 | 2500-5000 |
| D5 | 1250-2500 |
| D6 | 625-1250 |
| D7 | 312.5-625 |
| D8 | 156-312.5 |
| D9 | 78-156 |
| Dn | 20,000-40,000 |

From the table 1, the SC harmonics may cover D8 and D9. Therefore to maintain a strategic distance from any disturbances it is attractive to utilize the low-level point by point components, D1 for example.

***b) Support vector machine***

In present scenario SVM have risen as an powerful equipment to take care of the grouping and relapse issue. The SVMs attempt to discover a hyper-plane to isolate the information indicates agreeing their classes with the end goal that the partition between the classes is most extreme. All things considered hyper -plane is said to be ideal hyper-plane.

**Support vector classification**: - consider n dimensional inputs

$X_i$ ( i= 1_ _ _ _ _ M)

Where M is no. of samples, X belongs to either class I or II.

Training data D (set of n points)

$D=\{X_i, Y_i\}, \quad X_i \in R^P, Y_i \in (-1,1)$

Hyper-plane is derived by following equation

$$f(x) = w^T.x + b \quad \text{..... (4)}$$

For calculating hyper line f(x) =0.

$$w^T.x + b = 0 \quad \text{..... (5)}$$

here $\frac{b}{\| w \|}$ determine offset of hyper line.

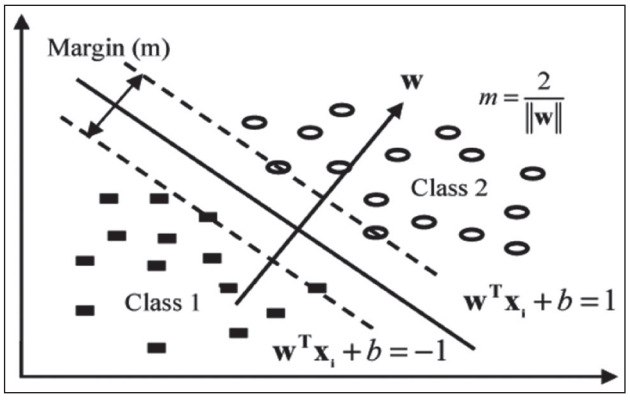


*Figure 3. SVM as a classifier*

If we consider that sampling data are linearly separable. For finding maximum margin we can take two more hyper- line such that no data should be between these lines by taking

$$w.x + b = -1 \quad \text{..... (6)}$$

$$w.x + b = 1 \quad \text{..... (7)}$$

From geometry maximum distance of two hyper line=$\frac{2}{\| w \|}$

Where **w** weight vector.

## 3. Test system

The test framework comprising of three-stage voltage source, transmission line, three stage load, series compensator has been given in Figure 4. The three stage resistive inductive load is consider in this investigation. The length of transmission line is 300 km long, it splits up into two equal parts i.e. 150 km each denoted by TR1 and TR2. And the arrangement consist of a series compensator (SC) in middle of the 400 kv transmission line.

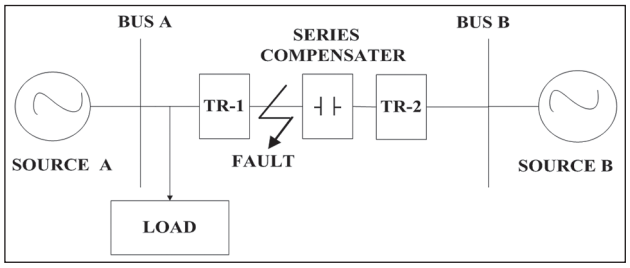


*Figure 4. Proposed system for study of system fault*

To access the issue associated with series capacitor compensated transmission lines and to further validate the proposed DWT based simulation strategy, single line diagram of series compensated line model as shown in fig 4. is used. The system accommodates three phase series compensated line fed by three phase source of 400 kv,60 hz,300 km in length. Fault data are generated by using MATLAB software package. Simulation was carried out with different type of transmission line faults.

## 4. Algorithm for detection and classification of fault

The calculation for fault identification and grouping depends on testing the signal at high recurrence .This data is handled and broke down to extricate the important data from c1. Figure 5 demonstrates the calculation structure.

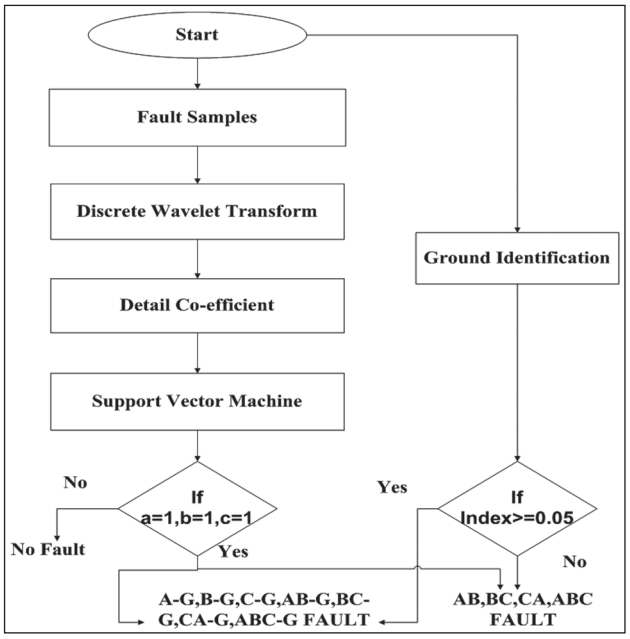


*Figure 5. Fault Detection and classification algorithm*

## 5. Simulation results

Simulation studies were carried out on a typical simulink model of series compensated transmission line of 400 kv, 60 Hz, 300 km line. A variety of fault operation with different fault position and fault categories had been simulated in MATLAB environment different fault waveform are shown below.

### *1. No fault*

When the system is simulated under normal condition, the recorded fault voltage of the bus and voltage across phase A of series compensator waveform has been shown in Figure 6,and Figure 7 respectively .

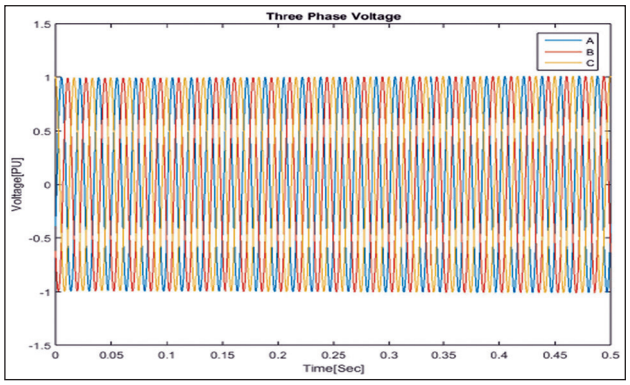


*Figure 6. Three phase voltage waveform*

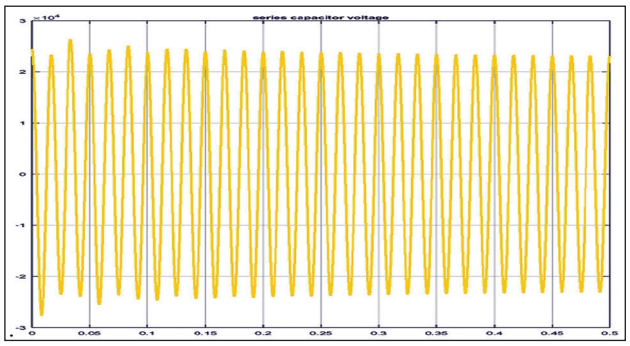


*Figure 7. Series capacitor voltage at phase A*

### *2. Single line to ground (LG) fault*

At the application of LG fault, the fault current and voltage signal recorded has been displayed in Figure 8 and Figure 9 respectively.

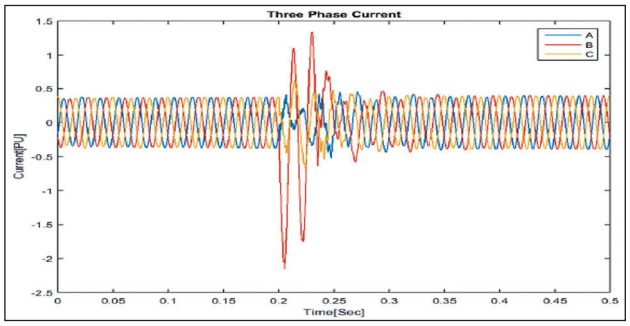


*Figure 8. Three phase fault current*

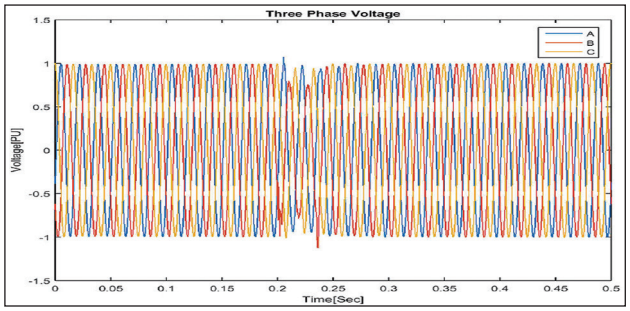


*Figure 9. Three phase voltage waveform of LG fault*

### *3. Three phase line to line (LL) fault*

The fault current and voltage of line to line fault of transmission line has been recorded as shown in Figure 10 and Figure 11.

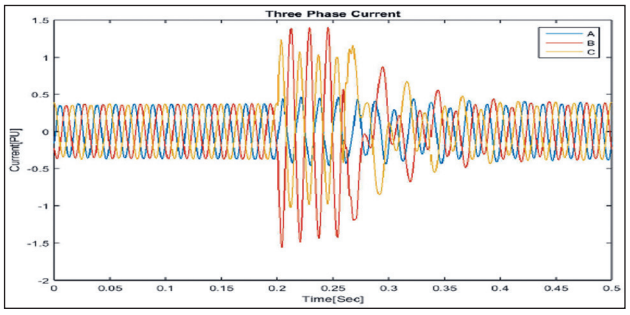


*Figure 10. Three phase line to line current fault waveform*

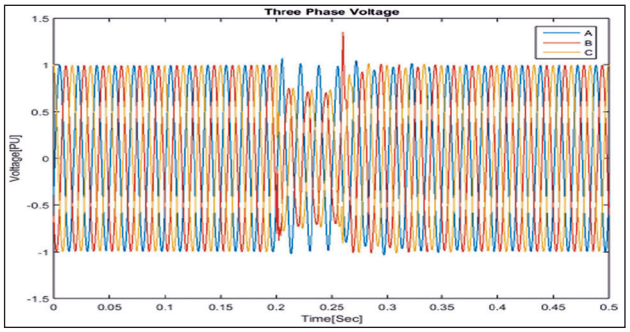


*Figure 11. Three phase line to line voltage fault waveform*

### *4. Double line to ground (LLG) fault*

The fault current and voltage of double line to ground fault of transmission line has been recorded as shown in Figure 12 and Figure 13

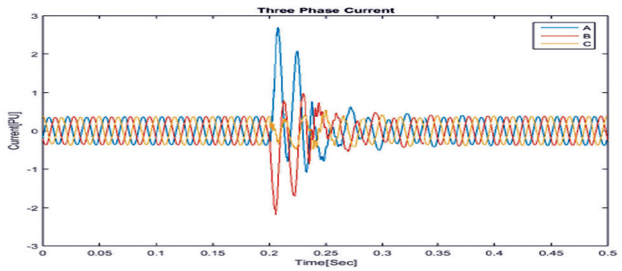


*Figure 12. Three phase double line to ground fault waveform*

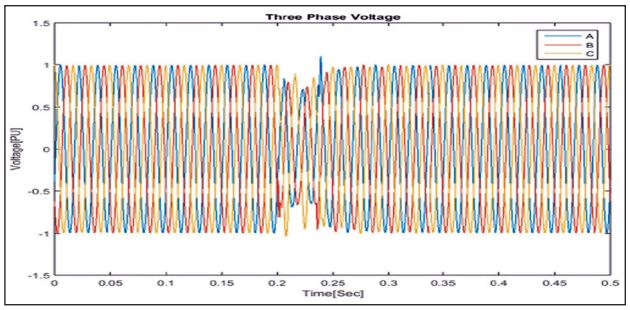


*Figure 13. Three phase double line to ground fault voltage waveform*

### *5. Three phase fault*

The fault voltage and current of three phase fault of transmission line has been recorded as shown in Figure 14

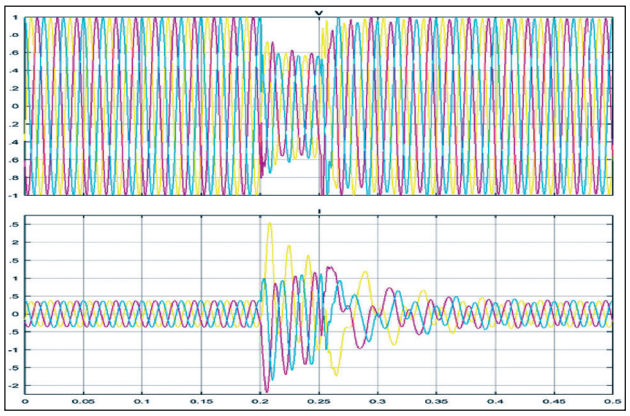

*Figure 14. Three phase fault current and voltage waveform*

### *6. Three phase to ground (LLLG)fault*

The fault voltage and current of three phase to ground fault of transmission line has been recorded as shown in Figure 15 and Figure 16.

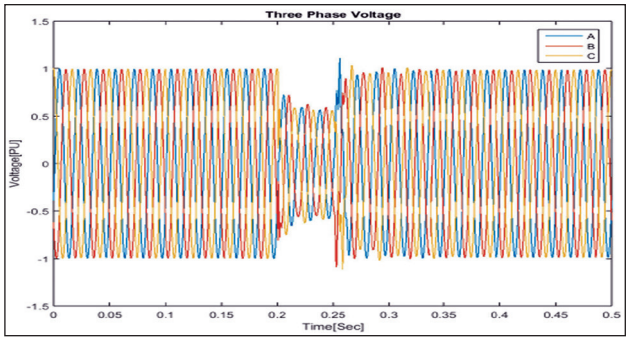


*Figure 15. Three phase to ground voltage waveform*

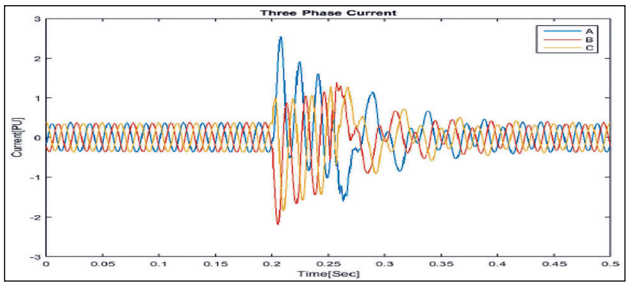


*Figure 16. Three phase to ground current waveform*

*Table 2. SVM fault classification accuracy*

| S. NO. | Fault type | SVM a | SVM b | SVM c | SVM g | (%) accuracy |
|---|---|---|---|---|---|---|
| 1 | AG | +1 | - 1 | -1 | +1 | 100 |
| 2 | BG | -1 | +1 | -1 | +1 | 100 |
| 3 | CG | -1 | -1 | +1 | +1 | 100 |
| 4 | AB | +1 | +1 | -1 | -1 | 100 |
| 5 | BC | -1 | +1 | +1 | -1 | 100 |
| 6 | AC | +1 | -1 | +1 | -1 | 100 |
| 7 | ABG | +1 | +1 | -1 | +1 | 100 |
| 8 | BCG | -1 | +1 | +1 | +1 | 100 |
| 9 | ACG | +1 | -1 | +1 | +1 | 100 |
| 10 | ABC | +1 | +1 | +1 | -1 | 100 |
| 11 | ABCG | +1 | +1 | +1 | +1 | 100 |
| 12 | NO FAULT | -1 | -1 | -1 | -1 | 100 |

The output of each SVM is either +1 or -1, where +1 shows the presence of fault and -1 shows a healthy condition. The result detecting the presence of various faults are shown in table II. The results indicate that all four SVMs were able to correctly detect the existence of Varity of faults.

## 6. Conclusions

Discrete Wavelet Transform is utilized to detect a fault and support vector machine is used for categorization of different kind of fault . High frequency parts are utilized for fault categorization, which is extracted by Discrete Wavelet Transform. DWT works both in time area and frequency area. Also It has good time allotment for high frequency. DWT give better frequency determination for low scale and great time determination for high scale. Support Vector Machine is utilized as classifier. It is superior to different classifiers because train-

ing data requirement in SVM for classification of fault is much smaller. since SVM utilizes support vectors for this reason, Due to which complexity and memory requirement is also less. The consequences of the proposed fault element extraction, identification and characterization system demonstrated that different sorts of deficiencies in a power conveyance system can be recognized and ordered precisely.

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# An Efficient Vector Space Model for Tweet Classification

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**Abstract**

Twitter enjoys enormous popularity as a microblogging service largely due to its simplicity. It not only used as a social networking platform but also as a rich source of real time news coverage. Twitter is being used by a number of news houses, organizations, and companies to get and analyze data which may be of their use. Twitter data or tweets may relate to various subjects and may be grouped together so that they can be analyzed for finding patterns and other valuable information. Identifying subjects from the tweets and to categories them according to their subject is an important research issue and various models has been proposed like probabilistic model or vector space model. Vector space model is commonly used model for tweets classification and sentiment analysis. So in this vector we propose a modified vector space model that enhanced the existing traditional vector space model in terms of accuracy, error rate and cost. Our propose model perform better than existing vector space as well as probabilistic model.

**Keywords:** Twitter, Apache Spark, Data Mining, Big Data, Cloud Computing

## 1. Introduction

With the advancement in information technology people are more connected and share their ideas through various platforms. Social media sites such as Facebook, Twitter, Google+, Instagram etc and various blogs, microblogs and many such platforms allow users to share and express their collective interest. People get motivated on receipt of different feedback from their friends, relatives and colleagues once they share something. The volume and rate of data generated by these social networks is very high and enters to the era of big data which allows extraordinary investigation and insights about various domains of society [1-3]. Among various social media sites, Twitter is a popular microblog service and is quite trendy in almost all parts of the world. Twitter is founded in 2006 and is designed for small text messages known as tweets and it is estimated that 250 billion tweets posted daily with an approximation of 100,000 tweets per minute [4]. Twitter is a good source of repository for data analysis tasks which could be used by practitioners in various domains like marketing, finance, education, healthcare and many more for extracting opinions, moods, attitude and views of people [5].

The network of Twitter is expanding so much that it is now becoming a source of information network rather than just a social networking platform such as Google+, Facebook, Instagram and Tumblr. This is one of the reason why news and other information media follow activities and trends on Twitter so as to enhance and update their news reports. Almost all the news media have their Twitter page and they broadcast their news updates and full news story so that readers can find full updates to any particular news in real time basis. Also sometimes breaking news first posted on Twitter before they published on traditional news platforms [6-7]; For example the news related to the death of famous American pop star Whitney Houston was posted on Twitter first before it was broadcasted by the traditional news houses [8]. In spite of all the knowledgeable content on Twitter it also contains a lot of noise and irrelevant data which need to be processed and filter out noise in order to find the relevant content or news about a particular subject from Twitter.

Finding news about a particular subject or event is an important research area which is defined as topic detection. Topic detection or subject

identification allows identifying trendy opinion tweets which helps in dividing content or users on Twitter based upon their interest. I also help users to catch up with the latest trending and their interest driven topics. Also it can be used by the organizations and companies to create their own data marts based on their interest so as to analyze the performance of their product or services. In order to do so several approaches in short text mining has been proposed so far. There are two main approaches in common for short text classification one is probabilistic model [9] and the second is vector model [10]. The probabilistic approach like Naive bayes method is used for short text classification but it suffers from problems like data scarcity, feature independence, continuous features etc [11-12]. Also the amount of training data require for better accuracy is too high for Naive bayes classification. The vector space model like traditional vector space model or support vector machine are widely used for text classification. But it is mainly used for binary classification only also it is computationally expensive.

To overcome the drawbacks of existing classification models, in this paper we propose a modified vector space model for text classification that overshoot other existing classification models in terms of accuracy and error rate and cost. The paper is organized as, section 2 describes the related work, section 3 presents a brief introduction of traditional vector model and their drawbacks then section 4 explains our propose model for tweet classification. Section 5 gives experimentation and result and in section 5 presents a comparison of our model with other model. Then section 6 dealt with the discussion and section 7 presents the conclusion of paper.

## 2. Related Work

Topic detection or subject identification research began with its initiation instilled back down many years in the history of research with its prime aim set at ordering categories or groups of similar information. The method of topic detection can be used to knowledge extract interesting topics from streaming data volumes of Twitter and also to detect and drive meaning out of real life events. Information which has been there persistently, converting it into knowledge is what the long term objective targets. The velocity and volume of Twitter stream is so high in intensity that there arose a dire need of the hour to organize that huge volume of data into meaningful categories that can be later comprehended for meaningful research. Although researches on topic detection from Twitter stream is a budding research arena, contributors in this field are still striving to put together the bits and come up with concrete algorithmic approaches. Topic or subject identification from Twitter streams comes in the area of short text classification as the maximum permissible limit of a tweet is only up to a maximum of 140 characters in current times. The globe is on internet these days and people have an opinion of their own about everything going around. From kids, to teens to adults, everyone is catching up with the fast pacing world of technology and the millennial generation relates more to the virtual connected world rather than the reality in which they live in. Tweets widely range in topics from the ancient to current spaces of politics [13, 14], sports [15], stock market [16] and many more.

The popular BOW (Bag of Words) representation is a common favourite when it comes to quoting an example for extensive use of text mining, clustering, information retrieval and text classification [17]. The BOW approach transforms on an individual basis each set of sentences into individual words and assign weights to them for the further purpose of analysis. A lot many term weighing schemes are growing popularity in text classification like TF, TF-IDF [18], alongside a huge number of variants of these weighing schemes [19, 20] are popularly dependant on the type of application using these scheme. With more number of schemes hitting the market space, it becomes more convenient to draw concrete analysis results based upon different scenarios of considerations. More so these results can be validated by applying different schemes to them and checking for different parameters. The feature extracted using word-based method in high dimensional space is being used in many text classification techniques like Bayesian model, k-nearest neighbour, artificial neural network (ANN), support vector machine (SVM), decision tree and hidden Markov models. It is a widely accepted approach which is stable in

its execution. The BOW approach has been further extended and word co-occurrence methods have been derived from it to find the text snippet similarity. Such extensions aid in existing algorithm enhancement with minor amendments for achieving greater accuracy.

Hatzivassiloglou et al. [21] coined the first native approach of homogenizing primitive features (such as word co-occurrence, noun phrase matching, WordNet synonyms, common semantic classes for verbs, and shared proper nouns) and a list of coagulated feature dictionary for (ordering, distance, and primitive). However, this in actuality is a co-existence of already existent and proven approaches, and their experiments bringing to light that it only gives accurate results where the text length is pretty large, in general cases spanning up to a paragraph. Okazaki et al. [22] devised and put forth a method to compute the length of two sentences by using a lexical database. In this method, sentence similarity is computed by aggrandizing the similarity values of all pairs of words. 'Sahami' and 'Heilman' [23] conjoined an approach which focuses on text sizes that are small, generally less than a paragraph. Their method makes use of search engines, to the likes of Google, to put forth a wider context for the shorter text length snippets than a paragraph, like some query expansion techniques.

The process of creating word vectors brought in by language models used the approach of representing [24-27], each word by a vector which is made to conjoin or average out with 110 other word vectors in a context and the resulting vector is used to predict other words in the context. Keeping into consideration the word vector representations, the text level vector formulation can be achieved through a number of ways. Maas et al. [28] made use of the average of all the word vectors falling at different levels in to the document under consideration. The word vectors are an important parameter of this approach determining the accuracy of results post analysis. Socher et al. [29] combined all recurrent word vectors in the order formulated by a parse tree of a sentence, using matrix-vector operations. Le et 115 al. [30] devised from his leanings that if the document vector and word vectors are combined together by with all recurrent word vectors in the document under consideration and prediction is then made for the following word in the given context. All the approaches so far focus on the word vector mathematics and how to device analysis from the same whereas in this paper, we will focus on keeping our analysis centred on vectors of both words and topics. Compared to the TWE models [31], our methodology of learning and growth to result focuses more on interactions between120 words and topics. Keeping into view a varied angle of interactions, we try and overcome the shortcomings of the approaches in place along with holding strong grounds with the new methodology of research and demands of the times posing as research challenges in the near future.

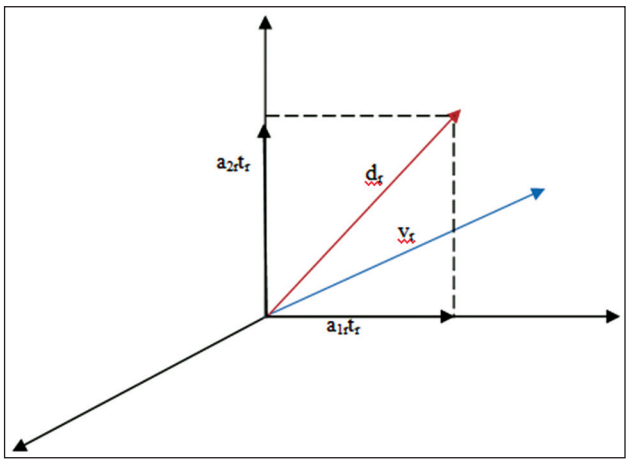


*Figure 1. Vector Model*

## 3. Traditional Vector Model

Vector space model is one of the popular models used in information retrieval and text classification [32]. Various elements in text mining and information retrieval are represented as a vector and it is one of the reasons of adopting vector space model in this domain. Documents, queries, terms, concepts and almost everything as a vector. In a system of vector space every element possesses linear properties such as addition of two elements results third element; any vector element could be multiplied by a scalar. Furthermore, the algebraic rules and axioms holds in case of vectors (e.g. $a + b = b + a$, for any vector $a$, $b$). Now let's demonstrate vector space model for text classification and information retrieval (Figure 1).

Let $D$ denotes the set of n-documents $D = \{d_1, d_2, d_3.....d_n\}$ and suppose $d_r = \{a_{1r}, a_{2r}.....a_{mr}\}$ is the $r^{th}$ document where $1 \leq r \leq n$ and $a_{mr}$ =weight of $m^{th}$ term.

Now each document contain terms or individual words. Let $T$ denotes the set of terms and $t_{ik}$ is the $k^{th}$ term of $i^{th}$ document.

$T = \{t_1, t_2 ..... t_m\}$ where $1 \leq k \leq m$.

Now, $d_r$ can be equivalently expressed as:

$$d_r = \sum_{i=1}^{m} a_{ir} \cdot t_i$$

Let $C = \{c_1, c_2 ..... c_N\}$ be set of classes and each class are reported as a vector. Let $C_p$ be the $p^{th}$ class

where $1 \leq p \leq N$. Each $C_p$ can be expresses as:

$C_p = \sum_{j=1}^{L} v_{jp}$ where $v_j$ = set of vocabulary.

In order to classify a document $d_r$ in a class $c_p$, the similarity of two vectors is calculated as [15]:

$$d_r \bullet c_p = \sum_{i,j=1}^{n} a_{ir} \cdot t_i \bullet v_{jp}$$

Drawbacks of Traditional Vector Space Model:

1. Suffers from synonymy and polysemy [33] which affect the classification accuracy.
2. Long documents are poorly represented because they have poor similarity values (a small scalar product and a large dimensionality)
3. Search keywords must precisely match document terms; word substrings might result in a "false positive match"
4. Semantic sensitivity; documents with similar context but different term vocabulary won't be associated, resulting in a "false negative match".
5. The order in which the terms appear in the document is lost in the vector space representation.
6. Theoretically assumed terms are statistically independent.
7. Weighting is intuitive but not very formal.

## 4. Proposed Framework

This paper proposes a classification framework for classifying tweets into various categories using modified vector space mode (Figure 2). The approach automatically classifies Twitter messages which could be used for various purposes like opinion mining, polarity finding and popularity finding. The key features of the proposed framework are:

- More accurate system for classifying Twitter data using vector space model.
- The main focus is to classify short text by contextual verification.

Following definitions are taken care by our proposed framework:

**Definition 1.** *Knowledge Base:* Knowledge base is the collection of terms/words that defines a topic in real world. It consists of list of words collected from various sources.

Let $w$ be the set of words that defines various topics in the knowledge base. Let $t_i$ denotes $i^{th}$ topic from the available topics in knowledge base and $w_{ti}$ represent set of words for specific topic $t_i$.

**Definition 2.** Let $T$ be the set of tweets collected from Twitter's source based on geolocation as a parameter. Let $G_j$ be the $j^{th}$ geolocation. Let $T_{Gj}$ be the set of tweets from $j^{th}$ geolocation.

Now each set $T_{Gj}$ can be represented as:

$$T_{Gj} = \{ \tau_1, ..... \tau_k \}$$

Also each tweet $\tau_k$ contains some terms or words which can be represented as:

$$\tau_k = \{m_1, ....., m_p\}$$

**Definition 3.** Let $\omega_k$ be the weight of terms used in tweet $\tau_k$. So, the weight vector of $\tau_k$ can be represented as column vector:

$$\tau_k = (\omega_{1k}, ..... \omega_{pk})'$$

**Definition 4.** Let $S_{yk}$ be the set of synonyms for a for different terms of tweet $\tau_k$. That is each $S_{yk}$ can be represented as:

$$S_{yk} = \{s_1, .....s_p\}$$

Taking into account the above definitions, following are the different steps that need to follow in order to classify various tweets:

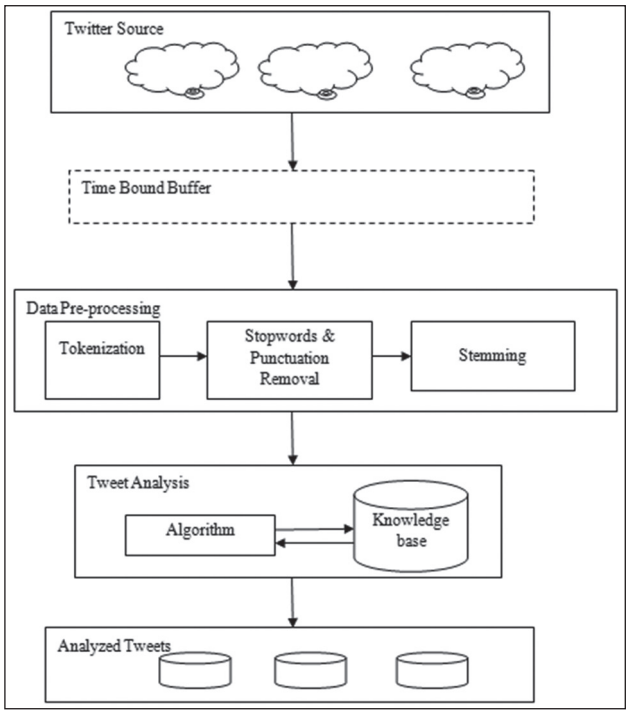


*Figure 2. Proposed Framework*

4.1 Data Collection

In this process we collect the tweets from twitter's source. Twitter source provide API's(Application Programming Interface) for collecting tweets either offline or online based on different parameters. There are two main API's commonly used REST API and STREAMING API [34-35] for collecting tweets.

In case of REST API the server will get HTTP request from the user and it respond once when it receives response. In this case server receives a number of requests from so many users and it respond accordingly. (Figure 3)

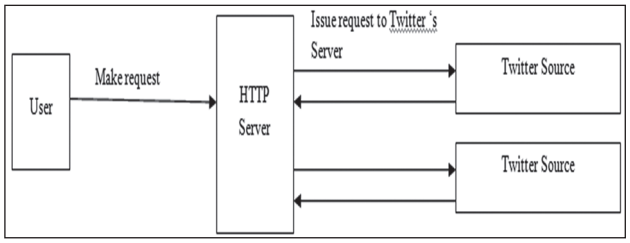


*Figure 3. REST API Request*

In case of STREAMING API the user first request for connection and once the connection is established the server will respond to the user as and when new data packet is received till the connection is open (Figure 4). It is different from REST API where only one response will be received per request.

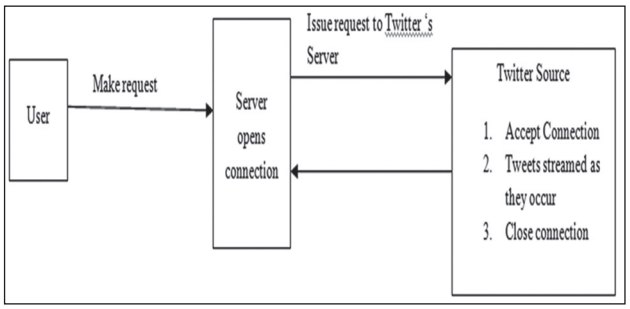


*Figure 4. Streaming API Request*

In our framework we are using the STREAMING API of tweeter in order to collect the data. Once we receive the data we will collect it onto some time-bound buffer.

4.2 Data Pre-processing

It is one of the essential steps in tweet analysis before the data is ready for analysis. Tweets are unstructured data and it contains noise or the content which may not be useful finding insight from the data like stopwords, expressions, URL's etc. In order to analyse or classify text data it is highly desirable to clean the data before applying any analysis algorithm onto that. Following steps are needed to pre-process the tweets text:

1. **Tokenization**: Tokenization is a process of converting a stream of text into individual words, symbols or phrases that are commonly known as tokens. So every tweet will be converted into appropriate set of tokens by using python.
2. **Stopwords Removal**: Stopwords are the commonly used words that occur frequently in text data. In order to clean the data and to make proper analysis these words should be removed from the text. Stopwords can be removed by using language specific predefined libraries or by creating a long list of stopwords. In our case we have created a file that consists of a long list of stopwords.
3. **Punctuations Removal**: Tweets contains a maximum of 140 characters and all the punctuation marks need t o be removed to make a tweet clean.
4. **Emoticons Removal**: Since we are interested in classifying the tweets we do not require

human expressions (emoticons). So they need to be removed from the tweets.

5. **Stemming**: Stemming is a method of converting each word to its root word like the words connecting, connected, connections are derived from the root word 'connect'[8]. It is useful for removing the prefixes and suffixes from the word to save memory and time. We use PorterStemmer from NLTK library of python for stemming.

### 4.3 Tweet's Subject Identification

In this step each tokenized tweet is extracted from the buffer of pre-processed and converted into tweet vector. Since each tweet is represented as:

$$\mathcal{T}_k = \{m_1,.....,m_p\}$$

where $m_p$ is the $p^{th}$ term of $k^{th}$ tweet.

Each term of tweet $t_k$ has some weight associated with it so the tweet weight vector can be represented as:

$$\mathcal{T}_k = [m_1,.....,m_p] \bullet [\omega_1,..... \omega_p]'$$

Once we get the word vector we will find its semantic distance with our knowledge base. Now our knowledge base consists of several topic/subject vectors and in order to find whether a tweet belongs to a particular subject we find average distance of each component of tweet vector with the subject vectors [**write 9**].

Let $S = \{S_1, S_2, S_3,.....S_n\}$ be the set of available subjects. Now each subject will be converted to the subject vector and as each tweets is already converted to the tweets vector we find the semantic distance between the tweet vector $t_i$ and subject vector $S_j$ (Figure 5)

Subject = sim ($t_i$, $S_j$)

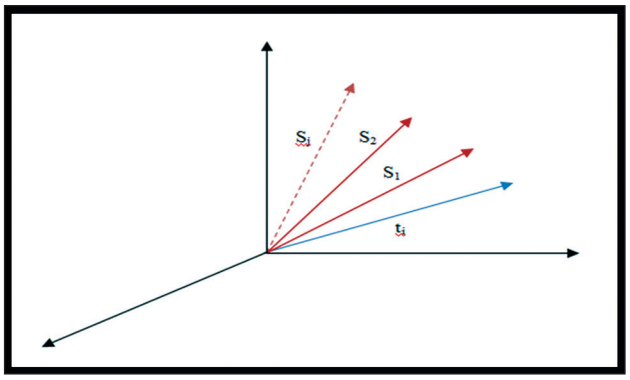


*Figure 5. Tweet's Subject Identification*

Following are the steps which need to follow in order extract the subject of the tweet:

1. Extract tweets from twitter and store them into time-bound buffer.
2. Tokenize and pre-process Tweets
3. Find semantic similarity of each token of the tweet with the knowledge base using Wu-Parker similarity [36] described below.
4. Find average semantic similarity.
5. Extract nouns from the tweets where average similarity is greater than threshold.
6. Check for the topics of the extracted nouns in Wikipedia.
7. If the topic is same as the desired subject add that noun in knowledge base and mark the tweet.

Wu-Parker has defined the similarity of two concepts c1 and c2 as how closely they related are in the concept hierarchy using the formula:

$$\text{sim\_score}(c1, c2) = \frac{2 * N3}{N1 + N2 + 2 * N3} \quad [36]$$

Where $N1$ = Number of nodes in on the path from c1 to $c3$ (where $c3$ is the least common superconcept of $c1$ and $c2$)

N2 = Number of nodes in the path from c2 and c3

N3 = Number of nodes in the path from c3 to root.

The value of sim_score ranges from 0< sim_score<=1

Now in order to find whether a tweet belongs to a particular subject we use the algorithm given below.

Algorithm
//$S_j$ = jth subject in the knowledgebase
// $\delta$ = Minimum threshold
// $N$ =Total number of words in knowledgebase

1. $V \leftarrow knowledgebase(S_j)$
2. $T \leftarrow ExtractTweets()$
3. For each $t_i \in T$
4. $t \leftarrow Tokenize(t_i)$
5. $t \leftarrow PreprocessTweet(t)$
6. $n \leftarrow ExtractNouns(t)$
7. $s1=0$
8. For each $k \in t$ and $v \in V$
9. $s1 \mathrel{+}= wup\_similarity(k, v)$
10. $s1=s1/N$
11. $w = wikipediasearch(n)$
12. $s2 = wup\_similarity(w, v)$
13. $avg = avg(s1,s2)$
14. if $(avg > \delta)$
15. $t_i \in S_j$
16. $n \cup knowledgebase(S_j)$

**wup_similarity(Synset, verbose=False, simulate_root=True) [37]**

**Parameters**:
Synset = the synset term which compared with other synset
Verbose = Boolean parameter
Simulate_root = Boolean parameter

**wikipedia.summary(query, sentences=0, chars=0, auto_suggest=True, redirect=True) [38]**

**Parameters:**
Sentences= if set, return the first sentences sentences
chars = if set, return only the first chars characters
auto_suggest = let Wikipedia find a valid page title for the query
redirect = allow redirection without raising RedirectError

## 5. Experiment

We have used python 2.7 programming language for data collection and tweet's subject identification. We use twitter's streaming API [35] for data collecting tweets using geolocation as a parameter. For this experiment we have collected data of Delhi region on time-bound buffer. The time used for data collection on time-bound buffer is 2 minutes for this experiment. The time-bound buffer switches after every 2 minutes and the tweets will be processed during this interval for subject identification.

First of all the tweets are extracted from the time-bound buffer and are tokenized. We have used python NLTK library for various purposes of tweet's processing. Once the tweets are tokenized we remove stopwords, URLs, punctuation marks etc then we used stemming to convert the words of tweets to their stem words using PorterStemmer. Then we have applied our algorithm on preprocessed tweet. In order to find the semantic similarity we have used Wu-Parker similarity and is implemented using NLTK wup_similarity() function. Also for wikipedia search we have used the API of Wikipedia in python.

We conducted our experiment on the three parameters and they are accuracy, precision and error rate derived from confusion matrix [39] which are explained below (Figure 6):

| | **Predicted No** | **Predicted Yes** | **Total** |
|---|---|---|---|
| **Actual No** | TN | FP | Total Actual No |
| **Actual Yes** | FN | TP | Total Actual Yes |
| | Total Predicted No | Total Predicted Yes | |

*Figure 6. Confusion Matrix*

Accuracy: Accuracy is defined as the correct classification rate of the classifier.

$$Accuracy = (TP + TN) / Total$$

Precision: Precision is defined as the rate of corrected prediction made by the classifier.

$$Precision = TP / predicted\_yes$$

Error Rate: Error rate is defined as the rate of misclassification made by the classifier.

$$Error = (FP + FN) / Total$$

Following are the results obtained once we applied our algorithm on the tweets extracted from time-bound buffer taking time t = 120sec.

In order to find the threshold ($\delta$) we have conducted our experiments for different values of $\delta$ to find the maximum accuracy and minimum error rate (Table 1) and we have obtained the threshold at 0.32.

*Table 1. Threshold for average semantic similarity*

| Threshold $\delta$ | Accuracy | Error Rate | Precision |
|---|---|---|---|
| 0.22 | 64.5 | 35.4 | 39.3 |
| 0.24 | 64.5 | 35.4 | 39.3 |
| 0.26 | 66.6 | 33.8 | 44.8 |
| 0.28 | 70.9 | 29 | 44.8 |
| 0.30 | 72.5 | 27.4 | 46.1 |
| 0.32 | 74.1 | 25.8 | 47 |
| 0.34 | 72.5 | 27.4 | 41.6 |

## 6. Comparison

We have performed experiments on various algorithms to compare the results in terms of accuracy with our proposed algorithm. For our experimentation we have trained Naive bayes and SVM classier with 2000 tweets for two subjects Entertainment and Politics as follows (Table 2):

*Table 2. Training and Testing*

| Algorithm | Training | Testing |
|---|---|---|
| Naive Bayes | 2000 | 574 |
| SVM | 2000 | 574 |
| Modified Vector Algorithm | 2000 words | 574 |

Following are the results which are obtained in terms of accuracy and error rate (Table 3).

*Table 3. Average Accuracy and Error Rate of different algorithms*

| Algorithm | Accuracy | Error Rate |
|---|---|---|
| Naive Bayes | 56.9 | 43.07 |
| SVM | 62.5 | 37.4 |
| Modified Vector Space | 71.6 | 28.3 |

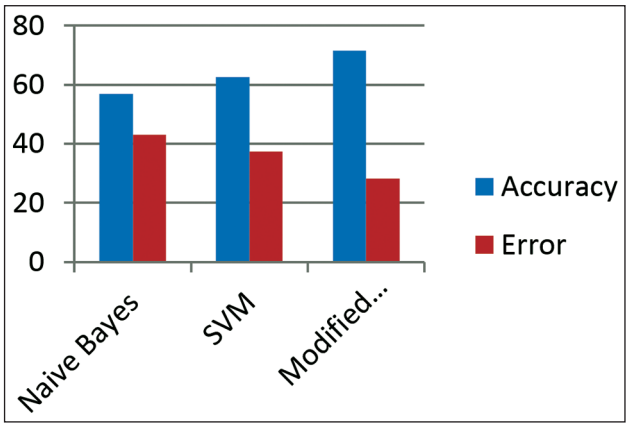


*Figure 7. Accuracy and Error rate*

## 7. Discussion

Our proposed model has overcome the following drawbacks of traditional vector model:

*Term Independence*: In traditional vector space model it is assumed that all the terms in the vector are independent which is not true always as in a sentence terms may be related to each other to make a proper concept. In our model we have taken the semantic similarity among the terms as well.

*Synonymy and Polysemy*: The traditional vector space model suffers from the problem of synonymy and polysemy. Synonymy refers to the similarity in the meaning of different terms. In traditional vector space model synonymy problem was not addressed due to which the number of false positive increased. As the two documents which have same concept but different terms were considered to be different. Polysemy refers to the association of words with two or more distinct meanings. In traditional vector space model due to direct matching of words may sometimes refers to different concept but in case of our proposed model the rate of false positive is quite low.

*Precision and Accuracy*: Our proposed model have better precision and accuracy as compared to the traditional models like(SVM, Naive Bayes etc.) due to the presence of so many false positives (Figure 7).

## 8. Conclusion

Twitter is an import source of information for various organizations in multiple domains. Unlike other social networking platforms Twitter is being used for so many purposes like news detection, popularity finding and other useful information extraction. Twitter stream contains subject and may be grouped based on the type of subject they belongs to. Various models and algorithms have been proposed earlier but still we lack in having a robust, cost effective and reliable model that can do so. In this paper we propose a tweet classification model that enhances available vector space model for text classification. Results shows that our model outperforms the existing traditional model in terms of accuracy, error rate and cost.

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# Effectiveness of the AMOVIE Model in the Implementation of the Partnership Program of Vocational School Teachers with Industrial Community

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**Abstract**

This article concerns a certain piece of research whose objective was to know the effectiveness of the model called AMOVIE, as short for Achievement Motivation Training (AMT), On-the-Job Training (OJT), Visual Exhibition, and Evaluation, in the implementation of the partnership program of vocational school teachers with industrial community held by the Sub-Directorate of Human Resource Development (HRD) of vocational education. The research used a quasi-experimental method with the principle that there would be effectiveness when the results of the treatment (or experimental) group were better than those of the control group. The research population consisted of 236 participants in the partnership program of vocational school teachers with industrial community, with those involved in the program in 2015 serving as the treatment group that had used the AMOVIE model and those involved in 2014 serving as the control group that had not used the model. By means of simple random sampling, 180 of the population were taken as sample. The data were collected by means of observation and evaluation of participants' performance during OJT by mentor, of the participants' post-OJT performance by the principal, and of the program results at the time of the visual exhibition by the program facilitator team. The data were analyzed by using the independent sample t-test. The research results indicate that the AMOVIE model proves to be effective in being used to implement the program of the partnership between vocational school teachers and industrial community because (a) the mean score for participants' performance during OJT of the treatment group has been slightly better than that of the control group (the respective mean scores being 9.2 and 9.0) since the independent sample t-test has resulted in $t_{obtained}$=1.092 with sig.=0.276, indicating no difference in performance between the treatment group and the control group; (b) there has been difference in post-OJT participants' performance between the treatment group and the control group since $t_{obtained}$=-6.7 with sig. = 0.00; and (c) the mean score for program results of the treatment group has been better than that of the control group, with the respective mean scores being 7.7 and 7.1, and the independent sample t-test resulting in $t_{obtained}$=5.996 with sig. = 0.00, indicating difference in program results between the treatment group and the control group.

**Key words**: partnership, achievement motivation training, on the job training

## Introduction

The? 'vocational school' graduates' absorption power into the world of work is still relatively low in degree or, in the case of such graduates, there is a possible misallocation of human resources. The Central Agency of Statistics' notes that vocational school graduates' rate of open unemployment is reflected in the fact of 1,348,327 of them being unemployed in February 2016 while data in 2015 indicate unemployed vocational school graduates 1,174,366 in number in February and 1,569,690 in number in August [1]. The high unemployment rate is caused by, among others, a mismatch between the supply of workforce and the demand from the world of business or industry. Sgobbi and Suleman cite Guiness' opinion that long-lasting educational mismatch is justified only by heterogeneity in the ability of employees with the same educational qualification, an issue increasingly explored by the-

oretical and empirical contributions, and the growing awareness of the heterogeneous distribution of capabilities among employees has progressively re-focused the research questions on educational mismatch on whether educational qualification is an acceptable proxy of skill mismatch [2].

The development of science, technology, and art the industrial community often occurs faster than that occurring at vocational education. It often causes a gap between the competence possessed by vocational education graduates and that required by the industrial community. To prevent the occurrence of misallocation of human resources, the Directorate of HRD (human resource development) of 'Secondary or Middle Education' in the period from 2009 to 2015 had the policy of harmonizing education with the requirements or demands of the industrial community. The policy was implemented through several programs, one of which was the partnership program of vocational school teachers with industrial community. Hopefully, through the partnership program, teachers could transfer the competence to their students.

An effective and efficient implementation of vocational education is one that is able to provide real work experience. Prosser and Quigley state, among others, that vocational education is effectively and efficiently implemented if (1) the training environment is the working environment itself or a replica of the working environment; (2) the training jobs are carried on in the same way as in the occupation itself; (3) the instructor is himself master of the skills and knowledge he teaches; and (4) the training meets the market demands for labor whatever these may be in any given occupation. These abovementioned four principles would be more easily realized if vocational education has a collaboration with industrial community [3].

Kerzner in Osagie [4] states that partnership is the condition of a group of two or more individuals or companies working together to achieve a common objective. Petersen [5] defines partnership as, formally, an agreement where two or more people or groups work together toward mutual goals. The theoretical foundation in support of the program of the partnership is the social interdependence theory. According to Johnson and Johnson [6], there are two types of social interdependence: positive and negative. Positive interdependence exists when there is a positive correlation among individuals' goal attainments; individuals perceive that they can attain their goals if and only if the other individuals with whom they are cooperatively linked attain their goals. Positive interdependence results in promotive interaction. Negative interdependence exists when there is a negative correlation among individuals' goal achievements; individuals perceive that they can obtain their goals if and only if the other individuals with whom they are competitively linked fail to obtain their goals. Negative interdependence results in oppositional or contrient interaction [6].

Positive interdependence is posited to result in promotive interaction. Promotive interaction occurs as individuals encourage and facilitate each other's efforts to accomplish the group's goals. Promotive interaction is characterized by individuals (1) acting in trusting and trustworthy ways; (2) exchanging needed resources, such as, information and materials, and processing information more efficiently and effectively; (3) providing group mates with efficient and effective help and assistance; (4) being motivated to strive for mutual benefit; (5) advocating exerting effort to achieve mutual goals; (6) having a moderate level of arousal, characterized by low anxiety and stress; (7) influencing each other's efforts to achieve the group's goals; (8) providing group mates with feedback in order to improve their subsequent performance of assigned tasks and responsibilities; (9) challenging each other's reasoning and conclusions in order to promote higher quality decision making and greater creativity; and (10) taking the perspectives of others more accurately and thus being better able to explore different points of view.

The program of the partnership between vocational school teachers and industrial community was initiated in 2011 and, in the course of its implementation, the AMOVIE (Achievement Motivation Training, On-the-Job Training, Visual Exhibition, and Evaluation) model was applied in 2015. It was hoped that, through the AMOVIE model, the implementation of the partnership program of vocational school teachers and industrial community would become increasingly more effective. From a review of relevant research results, it is known that AMT (achievement motivation training) has an important role in arousing

the motivation for high achievement. A study by Khomsatun [7] finds that AMT and peer teaching as workshop actions are effective in improving the competence in learning management and the motivation for high achievement of the teachers. It is also found in similar research results that achievement motivation of employees is related significantly to their job performance [8].

In the partnership program of vocational school teachers and industrial community, on-the-job training was chosen as the pattern to use. According to Alipour [9], the results of a study show that on-the-job training strongly affects trainees to more creativity, achieving organizational objectives, and improved work quality. Training is a substantial organizational investment getting a satisfactory return on investment means linking the training function and activities to the company's overall business activity. The investment in people, both in developing and maintaining the appropriate skills, is vital part of the organization's strategy for the future. Like any investment, investment in training should produce an effective and measurable payback. Effective training enhances the knowledge, skills, attitudes, and behaviors of people and hence their performance. The improved performance of individuals leads directly to profit. Such a payback could be rapid and significant, yet it is rarely measured or presented in financial terms.

The partnership program was conducted through on-the-job training. There are three approaches to training, according to Rama and Bowen [10], namely, the traditional approach; the experiential approach; and the performance-based approach. In the traditional approach, the training staff designs the objectives, contents, teaching techniques, assignments, lesson plans, motivation, tests, and evaluation. In the experiential approach, the trainer incorporates experiences where the learner becomes active and influences the training process. In this model, the objectives and other elements of training are jointly determined by the trainers and trainees. Trainers primarily serve as facilitators, catalysts, or resource persons. In the performance-based approach to training, goal achievement is measured through attainment of a given level of proficiency instead of passing grades of the trainees. Emphasis is given to acquiring specific observable skills for a task. It is more suitable for vocational school teachers of the service field of expertise to use the approach employed in the performance-based teacher education (PBTE). In the PBTE model of training, there is a demand for teachers to always show quantity and quality in their work in accordance with determined work standards. It is more suitable for vocational school teachers of the technology field of expertise to use the experiential approach. With the use of such an approach, the creative teacher has a chance to make simulation media for certain work if the school still lacks such facilities as media for simulating some airplane machinery or a machine for CNC *(Computer Numerical Control), developing a PLC* (*programmable logic controller),* and others.

The term used to refer to the training for teachers who are already regular employees at certain schools is in-service training or upgrading. In-service training is a process of staff development for the purpose of improving the performance of an incumbent holding a position with assigned job responsibilities [11]. In-service training could be categorized into five types, namely, (1) induction or orientation training, (2) foundation training, (3) on-the-job training, (4) refresher or maintenance training, and (5) career development training. It is more suitable for the program of the partnership between vocational school teachers and industrial community to use two of the training types, namely, on-the-job training and refresher or maintenance training. On-the job training is ad hoc or regularly scheduled training, such as, fortnightly-run training under the training and visit (T&V) system of extension, and is provided by the superior officer or the subject-matter specialists for the subordinate field staff. Maintenance or refresher training is offered to update and maintain the specialized subject-matter knowledge of the incumbents. Maintenance or refresher training usually deals with new information and new methods, as well as review of older materials [12]. Such training models could be used in the work place without having to weave a partnership with other parties. Learman in Cantor [13] estimates significant increase in both short-term and long-term earning gains as well as overall social benefits from training through apprenticeship. The lifetime return of this investment is estimated as more than double the return of just a community-college two- year education.

Results of such a partnership had better be reported in writing and exhibited. The exhibition is necessary because it is more attractive, more informative, dan more actually visible in terms of results than a written report. The results of a program that are reported in writing and its success could only be known by the evaluator or rater who reads the report while the results of a program that are visually exhibited could be known and its success could be evaluated by many people. Situma (2012) [14] explains that exhibitions provide a forum for companies to display and demonstrate their products to potential buyers who have a special interest in buying those products. Exhibitions provide a natural and nearly perfect platform for the delivery of solutions to the buyers. Exhibitions could become an arena of promotion for teachers who are, according to Mulyatiningsih [15], teacherpreneurs in selling their expertise.

The objective of the research concerned here was to know the effectiveness of the AMOVIE model in the implementation of the program of the partnership between vocational school teachers and industrial community. The effectiveness was measured through the participants' performance during their OJT, the implementation of in-house training (IHT) to put to use at school the results of the OJT, and the final results of the implementation of the partnership program of vocational school teachers and industrial community. The program was to be declared effective when the results of the partnership program using the AMOVIE model were higher in score than those prior to using the AMOVIE model.

***Research Method***

The research activity was conducted in collaboration with the Directorate of HRD of 'Secondary or Middle Education'. The researcher was one of the designers and facilitators of the program of the partnership between vocational school teachers and industrial community held by Sub Directorate of HRD of vocational education from 2011 to 2015. Each time the partnership program was held, it took one year only so that in each following year different program participants were recruited in order that the holding of the program would be more evenly distributed to the vocational schools all over Indonesia.

The research used the quasi-experimental approach with the two-group posttest only design according to Neuman [16]. The experimental design could be described as follows:

| | | | |
|---|---|---|---|
| R | AMOVIE | O1, O2, O3 | 2015 |
| R | REGULAR | O1, O2, O3 | 2014 |

where
R = random assignment
O = evaluation of program result

The population (or N) of the research consisted of the participants of the program of partnership between vocational school teachers and industrial community in 2014 and 2015. The sample (or n) was taken by means of simple random sampling. The sampling frame is presented in Table 1.

*Table 1. Sampling Frame*

| Year | N | n | Group |
|---|---|---|---|
| 2015 | 120 | 90 | Treatment |
| 2014 | 116 | 90 | Control |
| Total | 236 | 180 | |

According to Krejcie and Morgan [17], if the population consists of 120 individuals, then, at the level of significance of 5%, a sample of 92 individuals are required. If the combined population of two groups is 236 in size, then it is sufficient to take a sample of 146/2 = 73 in size per group. With the sampling size theory according to Krejcie and Morgan as basis, the sample taken was already adequate in size and the simple random sampling technique used already resulted in the sample representing the population in characteristics.

The participants of the partnership program were vocational school teachers of 7 programme, namely, (1) Technology and Engineering; (2) Information and Communication Technology; (3) Agribusiness and Agrotechnology; (4) Maritime Science; (5) Business and Management. (6) Tourism and Health and Social Work, distributed into 13 provinces in Indonesia. The data were collected by using observation at the time of (1) monitoring the teachers' performance during the holding of their industrial OJT (on-the-job training); (2) the in-house training at school utilizing the OJT results;

*Table 2. Technique of Data Collection*

| No. | Subtance Evaluated | Observer | Rating Scale |
|---|---|---|---|
| 1 | Performance During OJT in industry | Mentor from industry | 5-10 |
| 2 | Post-OJT Performance at school | School Principal | 0-1 |
| 3 | Final Report and Visual Exhibition | Facilitator Team | 5-10 |

and (3) the visual exhibition after completing the running of the partnership program. The manner of data collection is briefly explained in Table 2.

The performance of the teachers participating in the partnership program during their OJT was observed and evaluated by mentors from industry. The score range was from 1 representing the category of being very poor through to 5 representing the category of being very good. The observation sheet was delivered to each observer by e-mail and collected at the time of monitoring the OJT activity. The grid for the performance evaluation instrument during the OJT is presented in Table 3.

*Table 3. Grid of the Participants' Performance Observation Sheet During the OJT*

| | | |
|---|---|---|
| Work Motivation | 1, 6 | 2 |
| Discipline | 3, 4 | 2 |
| Responsibility | 2 | 1 |
| Cooperation | 5 | 1 |
| Initiative | 7 | 1 |
| Competence | 8, 9, 10 | 3 |
| **Total** | | **10** |

After their OJT, the participants conducted in-house training at school by making use of the results of their OJT. These teachers' performance after returning to their respective schools was observed and evaluated by the principal. The observation sheet used the Guttman scale with items to be answered with either YES or NO. The grid for the instrument used to evaluate the performance of the teachers participating in the program after their OJT is presented in Table 4.

*Table 4. Grid of the Participants' Post-OJT Performance Observation Sheet*

| Subtance Evaluated | Item No. | Total |
|---|---|---|
| Follow-Up of OJT Results | 1, 2,10 | 3 |
| Learning Quality Development | 3, 4, 5, 9 | 4 |
| Work Ethos Improvement | 6, 7, 8 | 3 |
| **Total** | | **10** |

The effectiveness of the AMOVIE model was measured based on the degree of goal attainment observed at the time of the visual exhibition. The evaluation of the degree of goal attainment was done by the program facilitators. There were four components evaluated, namely, the report of the program results, the poster media, the presentation, and the product/the outcome. The grid for the visual exhibition evaluation instrument is presented in Table 5.

*Table 5. Grid of the Visual Exhibition Evaluation Instrument*

| Subtance Evaluated | Item No. | Total |
|---|---|---|
| REPORT | | |
| Material Newness | 1, 2 | 2 |
| OJT Duration | 3 | 1 |
| Goal Attainment | 4, 5, 6, 7 | 4 |
| Administrative Requirements | 8, 9, 10 | 3 |
| POSTER | 11, 12, 13 | 3 |
| PRESENTATION | 14, 15, 16 | 3 |
| PRODUCT | 17-20 | 4 |
| **Total** | | **20** |

The indicators of the goal attainment of the program were measured from the quantity and quality of the product/the outcome exhibited. The outcome types considerably displayed included new learning modules/jobsheets/materials from industry, learning media, sellable innovative works, and expertise-supporting innovative works.

The data collected were analyzed descriptively quantitatively. The effectiveness of the AMOVIE model in the execution of the partnership program was known from the difference in mean score for program results between the treatment (or experimental) group and the control group. The testing of difference used the independent sample t-test.

**Results and Discussion**

***a. AMOVIE Model***

In 2015, the program of the partnership between vocational school teachers and industrial community was conducted by using what was named AMOVIE, with the name being (as aforesaid) the abbreviation of Achievement Motivation Training (AMT), On-the-Job Training (OJT), Visual Exhibition, and Evaluation [15]. AMOVIE was a model for guiding the execution of the partnership program of vocational school teachers and industrial community. The steps in AMOVIE are illustrated in Figure 2.

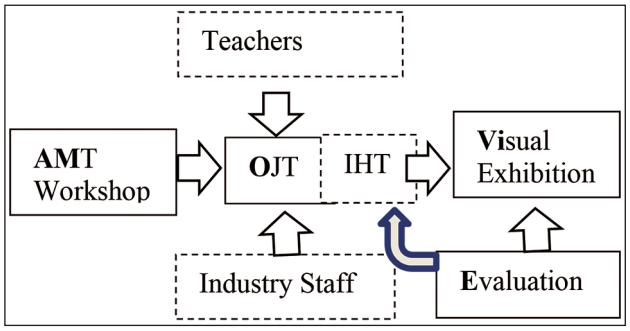


*Figure 1. AMOVIE Model*

The steps in using the AMOVIE model were as follows.

1. Before conducting the partnership program with industry, the vocational school teachers participating in the program were given preparation in workshop and AMT (achievement motivation training) activities. The purpose of the activities was to motivate them to have dreams of high achievements and to be willing to produce innovative works for learning and develop business in education having the potential of additional income. AMT is considerably used in government institutions to improve employees' motivation. McClelland in Smith [18] demonstrated that achievement motivation training programs were successful with businessmen across the world. At this time AMT was introduced to the public school setting, demonstrating gains made by students in academic subjects, achievement thinking, internal control, and goal setting ability. AMT programs have been successful when individuals incorporate thoughts and achievement strategies of high achieving individuals.

2. On-the-Job Training

The implementation of the partnership used the pattern of on-the-job training (OJT) in industry and in-house training (IHT) at schools. During the execution of the OJT/IHT, the facilitator team monitored and evaluated the activities. With the use of the OJT model, the teachers could join apprenticeship programs in industry at the times they did not have any teaching activities at school. Jagero, Mlingi, and Komba [19] state that training is therefore necessary to enhance the knowledge, skills, and attitude of employees. It would also make it easier for employees to acquire further knowledge based on the foundation gained from the training and further effect changes in other coworkers. It was found that those employees who have taken trainings were more capable in performing different tasks and vice versa.

3. Visual/Virtual Exhibition

Results of the partnership between vocational school teachers and industrial community were reported, presented in forums, and displayed. To give participants motivation to attain achievement, the exhibition of OJT results was designed as a competitive event with the best participants to be selected from among the group representing each programme of expertise. The substance evaluated in the visual exhibition included the report of activities, the presentation, the posters, and the product display. Mehzoud *et al*. [20] suggest that a research exhibition could communicate the research through predominantly non-verbal means, ranging from maps and diagrams, illustrations and photographs, to slides and films. An exhibition could be employed to help communicate the research through thematic ordering, juxtaposition, and platform recognition.

*Table 6. Activities Done by Vocational Schools in the Partnership with Industry*

| Partnership Activity | % (n=180) |
|---|---|
| Effective Management of teaching industry | 18.3 |
| Laboratory/Workshop Resource Sharing | 51.7 |
| Exchange of Experts | 16.7 |
| Holding Education and Training Sessions Collaboratively | 56.7 |
| Curriculum Design | 48.3 |
| Dissemination of New Technology | 46.7 |
| Recruitment of Workforce | 81.7 |
| Providing Places for Students' apprentichecip | 98.3 |
| Providing Places for Teachers' On the job training | 51.7 |

4. Evaluation

The evaluation was conducted at the time of the OJT, of the IHT putting to use at school the results of the OJT, and of the visual exhibition of the program results. The results of the evaluation were to be used for quality improvement in the execution of partnership programs at times to come.

***b. Partnership Activities of vocational school teachers and industrial community***

One of the requirements for effective vocational education, according to Prosser and Quigley [3], is that the training environment is the working environment itself or a replica of the working environment. To fulfill the requirement, it was suggested that vocational education have a partner from industrial community. The types of activities in the partnership with industrial community done by the 180 schools that were the research respondents could be known from Table 6.

The data in Table 6 indicate that the most frequent activities done in the partnership with industry were the provision of the place for the industrial work practice of students as apprentices and the recruitment of workforce from industry. The partnership activities that were the least frequently done were the exchange of experts and the effective management of teaching industry.

***c. Teachers' Performance During OJT***

The effectiveness of the AMOVIE model in the execution of the vocational school teachers and industrial community programme was measured from the difference in performance during OJT between the treatment group (whose members were the program participants in 2015), who

*Table 7. OJT Performance Mean Score*

| No. | Substance Evaluated | '14 | '15 |
|---|---|---|---|
| 1. | Participating in activities with sincerity | 9,5 | 9,6 |
| 2. | Completing tasks with full responsibility | 9.2 | 9.4 |
| 3. | Obeying the rules of conduct/the work procedures in effect | 9.3 | 9.3 |
| 4. | Keeping promises and keeping to the time already agreed on | 8.8 | 8.9 |
| 5. | Able to collaborate with both fellow OJT participants and industry employees | 9.2 | 9.4 |
| 6. | Learning new knowledge or skills with full spirit/enthusiasm | 8.9 | 8.8 |
| 7. | Possessing considerable initiative to make use of learning opportunities | 8.4 | 8.7 |
| 8. | Deft/Skillful in working/training | 9.0 | 9.1 |
| 9. | Able to work according to the correct procedure | 9.1 | 9.1 |
| 10. | Results of work meeting industry quality standards | 8.9 | 9.1 |
| | **Total Mean** | **9.0** | **9.2** |

*Table 8. Difference in OJT Performance*

| Variable Measured | t | df | sig. |
|---|---|---|---|
| Performance During OJT | -1.092 | 178 | .276 |
| | -1.092 | 176.022 | .276 |

*Table 9. Teachers' Post-OJT Performance at School*

| No. | Substance Evaluated | 2014 | 2015 |
|---|---|---|---|
| 1. | Giving other teachers information of the OJT results | 90.0 | 97.8 |
| 2. | Applying the new IPTEK from DUDI | 82.2 | 100.0 |
| 3. | Improving the quality of the learning process | 87.8 | 100.0 |
| 4. | Constructing new teaching materials matching materials learned in DUDI | 88.9 | 96.7 |
| 5. | Developing innovative learning media | 90.0 | 98.9 |
| 6. | Teaching and working with spirit | 91.1 | 100.0 |
| 7. | Improving the curriculum and syllabus | 90.0 | 90.0 |
| 8. | Completing learning devices | 84.4 | 98.9 |
| 9. | Developing production/service units | 56.7 | 63.3 |
| 10. | Holding IHT workshops | 83.3 | 88.9 |

already used the AMOVIE model, and the control group (whose members were the program participants in 2014), who did not use the AMOVIE model yet. The evaluation used 10 performance observation items with a score range from 5 to10. The mean scores for the participants' performance during their OJT are presented in Table 7.

The respective mean scores of the treatment group and the control group were nearly the same. It was caused by the participants' high commitment in OJT implementation. The lowest mean score was of the control group for the item of "possessing considerable initiative to make use of learning opportunities", namely, 8.4. A mean score >8 is categorized as good. On-the-job training programs really positively influence employee performance.It is recommended that governments should invest more in practical education through Vocational Educational Training Authority schools (VETA) [19]. The hypothesis that there was difference in performance between the treatment group and the control group during their OJT was tested by using the independent sample t-test. Results of the t-test analysis are presented in Table 8.

Results of the t-test analysis indicated that sig. (α) was .276>.05 so that it could be concluded that there was no difference in performance during OJT between the treatment group and the control group. The two compared groups alike showed good performance (with scores>8).

***d. Teachers' Post-OJT Performance***

After completing their OJT in industry, the teachers participating in the program underwent in-house training (IHT) and put to use their OJT results for improvement in the performance of the learning. The teachers' performance after returning to VOCATIONAL SCHOOL was observed and evaluated by the principal.

There were 10 points to be observed and responded to by filling in the option YES (scored 1) when the behavior to observe appeared or the option NO (scored 0) when the behavior to observe did not appear. The results of the analysis of data concerning the teachers' post-OJT performance in percentage (%) of n=90 per group are reported in Table 9.

The data in Table 9 indicate that the treatment group was higher in performance mean score than the control group. The lowest frequency of occurrence in score was for the item of "developing production/service units". Their reasons for not entering the production/service units were that they already had considerable teaching loads, the time that they had for such units was limited, and there

were already specific staff whose job was managing the production units. Results of the hypothesis testing concerning the difference in post-OJT performance are presented in Table 10.

*Table 10. Difference in Post-OJT Performance*

| Variable Measured | t | df | sig. |
|---|---|---|---|
| Post-OJT Performance | -6.700 | 178 | .000 |
| | -6.700 | 157.672 | .000 |

The results of data analysis in Table 10 indicate that sig (α) was .00<.05 so that it could be concluded that there was difference in teachers' post-OJT performance between the treatment group, who used the AMOVIE model, and the control group, who did not use the AMOVIE model. Van der Klink [21] states that past studies indicated that the OJT programs were only partially successful in realising training goals and that self-efficacy, prior experience with tasks, and managerial support and workload were the most powerful predictors for training effectiveness and concludes that the evidence suggests that OJT is not entirely an effective training method although more research is needed in this area. In the research concerned here, the partnership program through OJT was initiated with AMT so that there was a chance for improvement in self-efficacy, which indirectly exerted influence on the post-OJT performance.

***e. Teachers' Performance During OJT***

One of the indicators of the effectiveness of a program is the attainment of any goal of the program itself. The evaluation of the degree of the

*Table 11. Mean Scores for Program Results*

| Substance Evaluated | 2014 | 2015 |
|---|---|---|
| The selection of activity materials meets the need. | 7.7 | 8.1 |
| The OJTmaterials are new materials for teacher. | 7.4 | 7.9 |
| The targeted 100-hour execution of the OJT schedule is achieved. | 7.6 | 8.1 |
| IHT reaches a sufficiently wide target audience. | 7.3 | 7.7 |
| The results are consisten with the plans of the activities. | 7.4 | 7.9 |
| The results have the potential for improving learning quality. | 7.6 | 8.2 |
| The OJT results are developed for entrepreneurship. | 7.2 | 7.8 |
| The contents of the report are systematically arranged according to the guidence. | 7.6 | 8.0 |
| The writing system is prim. | 7.3 | 7.9 |
| The attachment of activities is complete. | 7.6 | 8.1 |
| POSTER | | |
| The poster contents could represent all activities. | 7.0 | 7.6 |
| The poster is creative in displaying attractive pictures | 7.0 | 7.5 |
| The contents of the messages are clear and easily understood. | 6.9 | 7.5 |
| PRESENTATION | | |
| The media of presentation are creative and attractive | 7.4 | 7.8 |
| The performance at presentation time interests the audience. | 7.4 | 7.7 |
| The time for presentation is used according to schedule. | 7.5 | 7.7 |
| PRODUCT | | |
| Modules/jobsheets/materials for learning | 6.6 | 6.9 |
| Instructional media | 6.3 | 6.8 |
| sellable innovative works | 5.7 | 7.1 |
| expertise -supporting innovative works | 5.6 | 6.8 |
| Total Mean | 7.1 | 7.7 |

program goal attainment was conducted at the time of the visual exhibition. There were 4 components evaluated, namely, the quality of the activity report, the posters, the presentation, and the product. The evaluation used the rating scale ranging from 5 to 10. The mean scores resulting from the visual exhibition are presented in Table 11.

Results of data analysis in Table 11 indicate that there was difference in mean score between the program results before using the AMOVIE model and those after using the AMOVIE model. The difference that was sufficiently striking was in the case of product as component of the substance evaluated, and particularly in the case of the items concerning the production of sellable innovative works and expertise-supporting innovative works, with respective mean score differences of 1.4 dan 1.2. The hypothesis testing concerning difference in visual exhibition results between the treatment group and the control group is reported in Table 12 as follows.

*Table 12. Difference in Program Results*

| | t | df | sig. |
|---|---|---|---|
| Exhibition total | -5.996 | 178 | .000 |
| | -5.996 | 177.981 | .000 |
| Report | -5.068 | 178 | .000 |
| | -5.068 | 171.081 | .000 |
| Poster | -3.075 | 178 | .002 |
| | -3.075 | 177.980 | .002 |
| Presentation | -2.332 | 178 | .021 |
| | -2.332 | 177.306 | .021 |
| Product | -5.745 | 178 | .000 |
| | -5.745 | 177.598 | .000 |

The results of data analysis in Table 12 show that all the components measured at the time of the visual exhibition demonstrate a significant difference (sig.<.05). It indicates that the AMOVIE model was more effective in the attainment of the program goal. An example of a visual exhibition document of one of the program participants from the field of expertise of Pharmacy is seen in Figure 2.


*Figure 2. Documentation of a Visual Exhibition in the Partnership Program of vocational school teachers and industrial community*

After using AMOVIE, the vocational school teachers felt challenged to show their best results. The products exhibited were, among others, (1) laboratory/workshop practice equipment; (2) electronic instrutional media; (3) lesson modules/ lesson books; and (4) products from the teaching industry of the school. The visual exhibition activity at the end of the program execution was in line with the results of certain research by Dumitrescutt *et al*. [22] though the activity done was different. They state that the crossover between virtual and physical interactions in smart virtual exhibitions seems particularly attractive because it puts the focus on the physical heritage and, at the same time, on digital capabilities specifically created to fit the personalized user vision and experience. There are presented concrete examples of virtual exhibitions, which put the theory into practice, by combining exhibition design with digital objects, from multimedia content to virtual objects, using a curatorial narrative in order to offer experience and immersion to visitors.

Motivation has an important role in the attainment of goals in both learning and working. To get high achievement at work, it is necessary to make efforts to attain predetermined goals. To improve the motivation to get high achievement, the partnership program of vocational school teachers and industrial community was initiated with AMT. It is in line with the finding by Kolodziej [23] expressed in the statement that the correlation between academic achievement and motivation shows that the need for achievement is a valid factor of students' commitment and positively correlates with

academic performance. Alipour [9] has made use of motivation before, during, and after a training process. Motivational planning and management indicate the recognition of the ways that a trainee can be motivated to learn the system, and to have a high motivation to continue to learn the system after training. The objectives of a motivational planning approach include developing the confidence of success, managing reinforcement, connecting the instruction to important needs and motives, and arousing and maintaining curiosity and attention. Trainees are asked to bring their problems to work on during training. These approaches may be integrated. For example, application training could be utilized early in training to demonstrate the usefulness of the software for solving trainees' problems.

## Conclusion

The AMOVIE model in the implementation of the partnership program of vocational school teachers and industrial community was to be declared effective on the basis of two conditions, namely, (1) the goals of the program were attained; (2) the mean score of the treatment group using the AMOVIE model was better than that of the control group not using the AMOVIE model.

After the data were analyzed, it could be concluded that the AMOVIE model proves to be effective when used in the implementation of the program of partnership between vocational school teachers and industrial community because (a) the mean score for performance during OJT of the treatment group (which is 9.2) has been slightly better than that of the control group (which is 9.0) though the analysis of the independent sample t-test results in $t_{obtained}$ = 1.092 with sig. = 0.276, indicating that there is no difference in performance during OJT between the treatment group and the control group; (b) there is difference in post-OJT performance between the treatment group and the control group as indicated by $t_{obtained}$ = -6.7 with sig. = 0.00; and (c) the mean score for the program results of the treatment group (which is 7.7) is better than that of the control group (which is 7.1) and the analysis of the independen sample t-test results in $t_{obtained}$ = 5.996 with sig. = 0.00, indicating that there is difference in program results between the treatment group and the control group.

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# The necessity of applying marketing strategies in tourism – the case of Slovenia and Tunisia

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**Abstract**

It is known that tourism represents an interaction between the tourist offer on one side and the tourist demand on the other side. The results of this interaction contribute towards the increase of the national gross domestic product and an increase of the rate of employment. It can be stated that significant attention needs to be allocated in tourism and its development and distinction of the destination has to be made in order for it (the destination) to be attractive for tourists (domestic and foreign as well i.e.). This can be done if and only if the policymakers in tourism create a marketing strategy for development of different types of tourist products and promotion of those products on the targeted markets. Therefore, based on a comparative analysis of the tourism strategies of Slovenia and Tunisia, this paper presents prospective guidelines for creating and implementing these strategies in Republic of Macedonia. The experiences of these countries can serve as a solid basis for developing strategies in tourism at different levels, which will contribute to its successful development in Republic of Macedonia.

**Key words:** marketing, tourism, marketing strategies

JEL classification: M31, M39

## 1. Introduction

Tourism as an industry is an interaction of supply and demand that is formed as a result of people's need to find themselves as tourists on one hand, and on the other hand, they also can be actors who are organizing the supply of the tourism product for satisfying the needs of the tourists. The results of an interaction like this contribute for up surging of the meaning of the tourism as an industry and incorporating it as significant element in creation of the GDP, national income and employment.

Besides the meaning and the role of the tourism as an industry, in some way it also mediates the development of other non-industrial branches as: trade, business, banking industry, public health, education, utilities and crafts as well.

With the occurrence of the marketing concept in the mid-20$^{th}$ century, the preferences and consumer behavior are of great importance for the marketers. The application of the marketing in services requires acceptance of the basic principles of the marketing in general, rather a differentiated approach because of the individual characteristics of the tertiary industry. Therefore, the concept of the tourist market means using the general principles of marketing, but with respect to any specifics that are presented with the interaction of the components of the tourist market. With the appearance of the Internet and the social media, the consumers are becoming more aware of the products and services they are using and by utilization of the above mentioned channels; they are gathering information about what they need.

## 2. Theoretical frame regarding the marketing strategy in tourism

Marketing strategies and strategic planning, at its base, represent a process that involves taking steps which are organized in order to form and lead the organization and what it stands for [1]. There are so many theories dealing with the matter of marketing strategies. Some authors [2] suggest that the best and the most efficient way to create a strategy and a strategic plan is to first identify the problem i.e. the approach has to be based on the problem and finding a way to resolve it. However, other authors [3] in the focus of creating the strategies and plans put the intention and purpose of the business factor in tourism as a basis for the formulation of the strategy. But there are also au-

thors [4] who believe that the theory of the matrix is the most appropriate in the creation of strategies and strategic plans. From all this elaborated above, it can be considered that the most appropriate model when developing marketing strategic is the one that includes the aims and intentions of the business included in tourism. Still, taking into account that the development of marketing strategy in tourism is an extensive process, the internal and external factors of business environment, resources, trained personnel, competition and etc. have to be taken in consideration [4].

In their base form, the strategies include creation of a strategic plan that is an essential tool for the implementation of the plan of companies including the one in tourism. Thus, strategic plans can be used as mechanisms by which companies will answer on the more and more challenging working conditions on the market. Therefore, it can be stated that the strategic plan is closely related to the direction in which the company should go in the future, in line with its ambitions, resources and how it interacts with the world in which it operates [2]. The role of the strategic plan of the companies in tourism varies depending on how the market works, but in most of them it can be said that they have a single purpose and that is to help the company for better utilizing the given resources in order to improve its market position. Even though it is like that, still, there are few steps that are common to all companies in the creation of marketing strategies. These steps include corporate, operational and business aspects while formulating the strategies [3]. These considerations, in some point of time are helping the business in tourism to gain competitive advantage over the competition.

The process of strategic planning contains a need to create strategic alternatives. But the growing demand for services in tourism in the contemporary working conditions can be content only with creating modern marketing strategies. Strategy is a tool that allows companies to implement all plans and to make effective decisions that will help in achieving their organizational goals.

In order for this theoretical framework to be successful in practice, there must be an evaluation and control of the process of creating marketing strategies in tourism. Some authors [1] go even a step further and propose concrete steps for evaluation and control of the strategy:

- Defining the parameters that can be measured
- Defining some values of that parameters
- Process of measuring
- Comparison between the procured results with previously set standards
- Implementation strict steps for application

Taking this into consideration, for creating a prosperous strategy, the process has to be permanent i.e. it must gain constant feedbacks of the strategy's efficiency as well as every segment that must be improved in future and all that with one goal: satisfying the more demanding need of the consumers.

The absence of a comprehensive marketing strategy in tourism is, actually, the basis of the negative trends in tourism development. There is a need to create a generic framework that will enclose all the parameters that are essential for creating a complete marketing strategy in tourism. Although in the past it was believed that as the world becomes increasingly globalized, so the products and services would become more prevalent [2].

The market research in a way represents a collection of data with a unique task to be used in order to achieve the marketing plan so that they become more and more efficient.

The tourist industry has a constant need from these types of research and data because of various reasons [5]:

- Identifying of the possibilities to develop tourist products
- Setting up prices which correlate to the ones of the competition
- Ensuring that the distribution channels work effectively
- Selecting the best possible combination of promotional techniques and tools
- Making decisions to invest
- Choosing location to open new hotels and restaurants

When a research is done in an area which has essential significance to the economic development of a country, it is of great importance to be able to compare the experiences from other similar countries and to see how they have dealt with the growth and development of tourism. In this paper, the experience from the Slovenian and Tunisian example is taken into consideration.

### 3. Experience from creation of marketing strategy in tourism - Slovenia

According to the assumptions from the WTO [6], the tourism industry in Slovenia participates with around 12.1% of the GDP of the country. And, at the same time, the tourism is also an important export activity, contributing with around 8% from the total export and around 40% of the total export of services and payments. In the past decade, tourism in Slovenia shows progressive rate of growth, both when it comes to increase of the total number of tourists and overnights, as well as when it comes to the spending in tourism [7].

Based on previous research, the people responsible for the tourism in Slovenia have identified several obstacles in the development of the competitiveness of the Slovenian tourism [7]:

1. Financial assets to market and develop tourism – limited financial assets decrease the possibility to develop tourism, as well as the possibility to develop strategies for the tourism in general
2. Availability of the destination – small amount of direct flights from the main countries which generate tourists, but also the outdated road and railroad infrastructure and so on
3. Promotion – the inconsistent usage of the national brand "I FEEL SLOVENIA" in terms of promotional activities on the foreign markets and the low level of recognition as a tourist country
4. Tourist offer – lack of competitiveness of the tourist products, added value to the price of the tourist product as well the lack of integration of the tourist offer
5. Human resources in tourism – the lack of qualified and quality workforce
6. Legislation – the existing legislation is inconsistent and not in correlation with the needs of the tourist sector.

Source: Slovenian tourist board. Marketing plan for Slovenian tourism 2007/2011. 2007 [7].

These obstacles can be overcome if the officials follow the policies for tourism development. They include cooperation for planning, shaping and marketing of the tourism in Slovenia on all levels, starting with the local and all the way to the national level. What is also important is to manage to promote Slovenia as a tourist destination in general.

The tourism marketing plan for Slovenia from 2007 includes the tourist offer which has been previously researched, valorized and consists of natural and unique specifics, but in accordance to the trends of the world's tourism [7].

The aim of this strategy is to focus on a tourist offer on smaller segments of the market. That means development of a detailed plan for successful segmentation of the market, research of what that market needs and wants as well as to create a tourist offer which will satisfy the needs and wants of those markets.

It can be stated that the strategic marketing concept is consisted of diversification strategy, which in phase one includes development of new products and promotion of those products on new tourist markets. The diversification of these products will be done thru expansion and improvement of the existing ones and offered on the tourist markets. This concept also includes a strategy for differentiation, meaning that only by differentiation of the tourist offer with distinctive and familiar attributes which are unique for Slovenia. The main goal of this strategy is to create a powerful brand association with the help of these unique specifics for the Slovenian tourism.

When it comes to the present system of the tourism in Slovenia, it can be stated that there are seven different tourist products which are complete, and two other which are in the development process. The completed tourist products include [7]:

1. Active holiday
2. Cities and culture
3. Nature, eco-tourism and rural tourism
4. Gastronomy tourism
5. Health tourism
6. Business tourism and
7. Entertainment and gambling.

Additionally, the products in the development phase are [7]:

1. Offers for more demanding tourists
2. Offers for young people.

Apart from these basic products which are offered to individuals, combined tourist products can

be created in tourism. This means that they represent a combination of two or more individual products. The following can be mentioned as such [7]:

- Regional tourist product
- Combined tourist product
- Partial tourist product.

In general, it is about three different development zones, for which the strategy has the aim to incorporate and to create synergy in between [7]:

- Increase of the competitiveness
- Creation of positive business environment
- Efficient and innovative marketing.

These development zones are crucial part of the investments in quality and innovation, the development of strategic partnerships with outer parties in order to eliminate the obstacles for effective tourism development. It can be said that the aims of the strategy are [7]:

- Creation of competitive advantage thru innovation, value added, safety, security and so on.
- Increase of the quality of life of the local population
- Tourism development via partnerships for development, public-private partnerships, improvement of the image of tourism and so on.

In the years to come, the tourism in Slovenia will be in the focus of the economic development of the country in general. This will contribute towards creation of significant contribution towards the increase of the GDP, increase of the employment, regional development and so on.

## 4. Experience in the creation of marketing strategies – Tunisia

Tunisia is a small country located in North Africa. According to some, Tunisia is a strategically irrelevant state that has no natural or oil resources [8]. Nevertheless, Tunisia runs on tourism, which is crucial for the economy [9]. Thus, in order to approach the development of the economy, it is necessary first to start developing a new marketing strategy that will contribute to the development of tourism in the post-revolutionary period. Tourism in Tunisia has several advantages in terms of attracting tourists: beautiful beaches, a variety of archaeological sites, excellent climate throughout the entire year and most importantly it is close to Europe.

Tourism is a sector of strategic importance for Tunisia, as it participates with about seven percent in the gross domestic product of Tunisia and generates about 400,000 jobs [8]. Therefore, having into consideration the close link between tourism and the other sectors of economy (such as trade, crafts and transport), the reduction in the number of tourists will negatively affect revenues from these and other sectors of the economy, which represents an indirect threat to those people who depend on tourism.

The number of tourists who visited Tunisia in 2011 was not over three million. This compared with over seven million tourists in the pre-revolutionary period is a very small number. But it is important to point out that tourism in Tunisia in 2012 showed high rates of growth, despite all that has happened in this country. Nevertheless, regardless of this fact, the tourism industry, from a business perspective, is still in the stage of recovery and in any case is not in favor of tourism stakeholders [9]. Even though it was expected for this trend of progressive growth to continue, nevertheless, the situation is different as in the beginning of 2013 violence once again broke out, contributing greatly to a reduced number of tourists vising Tunisia.

Perhaps, it is too early to assess how these developments will affect tourism in Tunisia. However, it is clear that indicators point to an increased caution among potential tourists, travel agencies and tour operators that offer arrangements for Tunisia. There are even cancellations of already booked travel arrangements. This greatly affects the overall situation of the tourism industry in Tunisia.

The tourism sector in Tunisia is experiencing a decline also as a result of its excessive dependence on resorts that provide services with a medium level of quality. This business model brings low profits, and carries a high risk of volatile economic conditions [8]. Data from the World Tourism Organization show that in average tourists spend $385 per capita, which is the smallest amount from among the other countries along the Mediterranean. In comparison, the average per capita consumption of tourists who visit Morocco is $725,

while in Turkey they spend $770, in Egypt $890 and $1,000 in Greece [6].

The recovery of tourism in Tunisia mostly depends on the increase of the stability and security of the country. But, in order for the tourism sector to develop and ensure economic growth and development that will contribute to the creation of new jobs (especially among the young population) considerable changes must be made in the overall strategy of the country, especially in two directions [9].

1. First, Tunisia must take into account the demographic changes that are taking place in Europe and the changes in the needs and demands of tourists for new forms of tourism (especially cultural, environmental, adventure and research tourism). Estimates of the World Tourism Organization WTO are that about 40% of world tourism is in fact tourism associated with cultural activities. These types of activities are more profitable and less susceptible to seasonal changes.
2. Second, Tunisia must create a new market in order to diversify its revenues from tourism. This will contribute towards reducing or perhaps eliminating the excessive dependence it has on tourists from Europe, which currently represent 80% of the total number of tourists in Tunisia. Markets in Asia and South America are on the rise and are becoming ever more important sources as the standard of living is constantly improving and air traffic is in constant development.

Experts argue that authorities have failed to create a marketing strategy that will reflect the actual situation in the tourism sector. Existing plans do reflect the needs and the demand of foreign tourists, but are not in line with the post-revolutionary period. They have created a strategy that has failed to take advantage and exploit these events, but has rather concentrated on mass tourism with a focus on making use of the potentials of the seashore. It is important to note that this strategy does not correspond to the needs of the tourists, especially the tourists from Europe [9].

Tunisia has all the fundamental and basic features for development of diversified tourism and tourism with a high level of quality. Also, the use of these advantages is in the hands of the state and the institutions, which must develop a strategy that will contain the most important values that can be offered to the market and which will be oriented towards satisfying the needs of "new" tourists from emerging markets. Nonetheless, the political instability has led to a distortion of the image (which is an important component in the process of making a decision to travel) for Tunisia as a tourist destination. [10].

Those competent must promote this destination by creating an aggressive marketing campaign that will contribute towards restoring confidence among potential tourists and will help restore a positive image. Also, they will have a difficult task in finding new markets where to sell the tourism product, and in doing this they will contribute to the development of the tourism industry and the economy as a whole.

## 5. Conclusion

The comparative analysis in this paper could be used for future planning of the activities in the tourism industry in Macedonia, as well as to help in the direction of which activities and measures should be taken and how those activities should be implemented. When it comes to planning the strategy in tourism, a lot of factors have to be taken into consideration. Amongst those factors are the economic, political, social, technological factors as well as the influence of the media and so on. The influence of these factors can lead towards [11].

- Growth of tourism in the countries which previously weren't generating international tourist travels
- Growth of tourism for specific groups of the society
- Development of new tourist products
- New and innovative ways of buying the tourist product.

The research contributes towards better understanding of the tourist products and that the development of new product will lead primarily to:

- Change the consumer behavior
- Improved availability of the tourist products and
- Eminent technological innovations.

It can be said that the continual growth of pressure in the modern way of living will lead to make people seek holiday to release from the stress. Thus, it seems that tourists will prefer more to travel to destinations which are different and unique, opposed to what they are used to. On the other side, because of the constant development of the technology, the promotion of the destinations has been changed as well as the distribution of the tourist products. Because of that, it is recommended that the future development of tourism should be based on these fundaments.

When it comes to framing the strategy for tourism, it can be concluded that there is a need to get the national tourist organization involved in the development of the tourism in general. The organization will be in charge of implementation of the strategy, as well as for the promotion and support of tourism on a national basis. This can and should be done via promotion and improvement of the processes in tourism, preparation and implementation of a program to promote and support tourism as well as to prepare promotional material and promote the tourist values of the destination. Also, it is of crucial significance to prepare and conduct research and analyze the needs and wants of the modern tourist. In this way, the marketing activities can be focused towards the markets which have the highest potential of growth.

In order to improve the image of tourism in Macedonia, there is a need to first make attempts to analyze the similar tourist products and tourist offers of countries which have more-less the similar geography and potential for development. It is of great importance to follow their development throughout the different phases of the process of development. That is because, when these products are properly introduced, the possibility for synchronization of the tourist offer is much higher and the development of different tourist products is much higher as well.

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# Performance auditing of the coordination of pre-disaster management in BiH

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**Abstract**

Hazards, risks, natural and other disasters are an integral part of life. It is not possible to eliminate them, but should be constantly monitored, evaluated and better managed. The occurrence and negative impacts of disasters has significantly increased in last decade in Bosnia and Herzegovina (BiH). This is the reason that BiH constantly needs to improve its protection and rescue (P&R) management in order to meet the needs of citizens of BiH. As main problems in P&R system in BiH are lack of equipment, insufficient number of trained personnel and financial resources, and non-efficient coordination between P&R institutions at different administrative levels of governance in BiH.

Today, countries are doing different analysis/measurement in order to assess efficiency of different systems within government. Performance measurement represents a tool that governments are using to assess efficiency, economy and effectiveness of certain governmental systems. Significant number of countries are using International Standards of Supreme Audit Institutions (ISSAIs) for performance measurement of their governmental agencies.

Thus, researchers have used the ISSAI 5510 – The audit of disaster risk reduction in combination with statistical non-parametric tests (Kruskal-Wallis H and Mann-Whitney U Tests) to assess the adequacy of coordination within P&R management in BiH. The results of the data analysis revealed that there was a statistically significant difference of coordination mechanism between different administrative levels of P&R system in BiH.

**Key words**: Hazards, risk, pre-disaster management, protection and rescue, BiH.

## 1. Introduction

Protection and rescue (P&R) management is perhaps one of the most complex functions of governments and requires participation from a broad spectrum of stakeholders including governmental institutions (state, entity, district, town/municipality, armed forces, police, etc.), non-governmental organizations, economy/private sector, scientific institutions and individuals or volunteers. All of those institutions and individuals are not functionally integrated into the system of civil P&R from natural and other disasters in BiH. The numerous challenges in this area lies in the set of functions aimed at efficient, economic and effective using of resources to achieve an adequate implementation of four disciplines of P&R management known as mitigation/prevention, preparedness, response, and recovery.

P&R system is a function of security system [1] and represents sub-system of internal security system with all required organizational and functional elements [2]. It represents ability of state to establish adequate legal framework which will clearly define responsibilities of different administrative levels of government as well as set up effective organization and structure that will meet the legal obligations and tasks.

In that sense and in accordance with ISSAI standards, P&R institutions assisted by non-governmental organizations, and private entities at their administrative levels of government need to explore the hazards/risks that might lead to disasters; to understand national strategy and action plans; responsibilities; framework and organization of the authorities involved in P&R system; coordination mechanism; early warning systems and disaster management tools; funds; training and exercises as well activities for making urban areas more resilient to disasters [3]. All above men-

tioned "wheels" within this paragraph relate to each other and when one "wheel" is out, P&R institutions miss a crucial element to achieve a pre-disaster capability. In this article, the authors researched the coordination mechanism.

## 2. Legal and Institutional Framework of the P&R System in BiH

BiH as the country located in the center of the Balkan Peninsula in the South Eastern Europe consists of the state government (a first tier of government) and two entities Federation of BiH (F BiH) and the Republic of Srpska (RS)) and one district – Brcko district, (a second tier of government). F BiH is divided into cantons (a third tier of government) and the cantons into municipalities (fourth tier in F BiH) while municipalities in RS are directly subordinated to the entity government. Based on this country structure, P&R system in BiH is mainly regulated by laws at first and second tiers of government. Framework law on P&R of people and property from natural or other disasters in BiH („Official gazette of BiH", no. 58/08) [4] has clearly determined jurisdiction of authorities and institutions of BiH in the field of domestic and international cooperation as well as mutual cooperation and coordination with P&R institutions at lower administrative levels of government.

The second tier of government have jurisdiction in conducting, planning, organizing, and financing the system of P&R of people and property in the case of natural and other disasters in the Entities and the Brcko District of BiH and those activities are regulated by their legislation (Law of P&R of people, material goods against natural and other disasters in F BiH, "Official Gazette of F BiH, no. 39/03, 22/06 and 43/10; the Law on P&R in emergency situations "Official Gazette of RS, no.46/17, and 121/12 as well as Law on P&R people and material goods from natural and other disasters in 2016 (Official Gazette of Brcko District of BiH", no. 001-29-16) [5] which have to be harmonized with Framework Law.

Additionally, there are other laws related to this area as well as many other strategies, policies, and acts that affect P&R system at every administrative level of governance in BiH but we heavily rely on most important ones.

P&R system in BiH is decentralized and organized from tactical up to the strategic level in an organizational setting as shown on Figure 1. Ministry of Security (MoS) of BiH (its Sector for P&R) and Coordination body of the BiH Council of Ministers are directly responsible for dealing with P&R issues at strategic level. There are other ministries, agencies and directorates at state level which provide assistance to civil authorities prior, during, and after disasters. Civil protection directorates in the entities and Brcko district comprises operational level of P&R management while cantons, cities, and municipalities represent tactical level of the P&R activities.

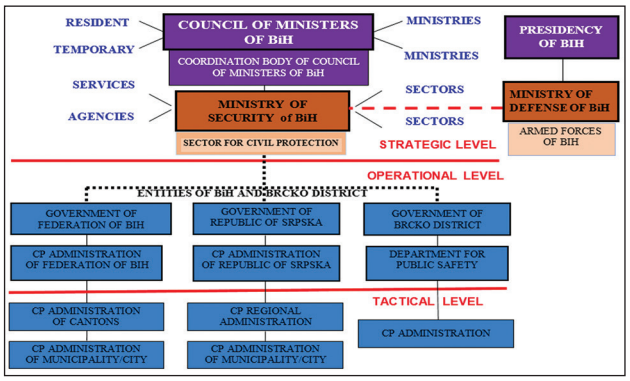


*Figure 1. Organization of P&R system in BiH*
*(Adopted from http://ipacivilprotection.eu)*

Also, there are many other institutions and agencies at every administrative level in BiH that directly or indirectly support P&R system in BiH (e.g. Federal Hydro meteorological Institute, The Republic Hydro meteorological Service of Republic Srpska, Sava River Watershed Agency, Agency for Adriatic Sea Watershed, etc.).

Local government and local community authorities such as civil protection authorities, fire, public health, emergency medical services, local police, public workers, members of mountain rescue services in BiH, and others are often the first to detect/respond a threat or hazard, or to deliver message or news to appropriate authorities to react and respond to hazard or emergency situation. Beside local government, individuals and voluntary organizations play an important role because of their intimate links with the communities they serve.

According to the Framework law the institutions and bodies of BiH, and the bodies and institutions of the Entities and the Brcko district of

Bosnia and Herzegovina (BD of BiH), within their competencies in the field of P&R, shall conduct P&R based on the "subsidiarity principle". It includes the decision making and decision implementation at the lowest possible level with the coordination from the highest required level.

Finally, the military support to civilian authorities in case of natural and other disasters in BiH has become a well-known phenomenon (heavy snow in 2012, aerial firefighting 2011-2017, floods in 2014, etc.). Armed force's support is officially recognized by article 4. of Law on defense of BiH (Official Gazette of BiH, no. 88/05) [6] as assistance to civil authorities in responding to natural and other disasters.

## 3. Performance management and performance audit

Today, countries are doing different analysis/measurement in order to assess efficiency of different systems within government. Performance measurement has significant role in evaluation work of government and non-profit sector in last decade. Poister [7] says that "managing programs or agencies without performance measures has been likened to flying blind, with no instruments to indicate where the enterprise is heading".

Berman [8] stated that performance is about keeping public and non-profit organizations up-to-date, vibrant, and relevant to the society...and people want public and non-profit organizations to be effective and not wasteful. Therefore, "public administrations must, among other things ensure transparency and a growing stakeholders' involvement" [9]. A performance measurement system may include measures of resources, workload, outputs, efficiency and productivity, quality, client satisfaction, and cost-effectiveness [7]. Additionally Bergman [8] claims that performance is not only about doing the right thing, it is also about doing the practical thing. Performance management can help refocus priorities, and assist programs to achieve their aims in more efficient ways.

The P&R system is an area where performance measurement must be monitored continuously. The reason for continuous monitoring of performance measurement is because a thousands of people who are affected by natural and other disasters owe their life and their property to economic, effective and efficient P&R system.

The establishment of an efficient, and effective pre-disaster management with already above mentioned "wheels" is the first step for P&R. To be able to talk about the success of pre-disaster management it is necessary to adequately use the performance measurement methods. Performance measurement is a complex, demanding, expensive and it is carried out periodically as necessary on request of the relevant authorities. There is a significant number of countries that are using Performance auditing as young discipline from the accounting and auditing area. In literature, for performance auditing, many authors used terms as performance evaluation, comprehensive auditing, auditing of 3E (Economy, Efficiency and Effectiveness), or auditing of 5E (Economy, Efficiency and Effectiveness, Ethics, and Environment) [10] or auditing of 6E (Economy, Efficiency and Effectiveness, Equity, Environment and Ethics [11]. Performance auditing key feature is characterized by advanced multi-dimensional access to the outputs of institutions versus the classical one-dimensional control view of the economic use of the resources of those institutions.

Lately, the demands for public accountability of managers in public institutions is intensified so the interest for the performance audit increased. Performance audit examines the practice of management responsibilities, application of legislative in the institution, focusing on the weaknesses and failures in the management of the institution as well as promoting the overall organizational learning [12].

Significant number of countries are using International Standards of Supreme Audit Institutions (ISSAIs) for performance measurement of their governmental agencies. The International Standards of Supreme Audit Institutions (ISSAIs) developed by International Organization of Supreme Audit Institutions (INTOSAI) with the aim to promote independent and effective auditing and support the members of INTOSAI in the improvement of their own professional approaches in accordance with their mandates and with national laws and regulations.

INTOSTAI defines performance auditing in ISSAI 3000 – 3100 Performance Audit Guidelines "as an independent, objective and reliable examina-

tion of whether government undertakings, systems, operations, programs, activities or organizations are operating in accordance with the principles of economy, efficiency and effectiveness and whether there is room for improvement". Performance auditing "is based on decisions made or goals established by the legislature, and it may be carried out throughout the whole public sector" [13].

INTOSAI has developed and approved International Standard of Supreme Audit Institutions (ISSAI) 5510 – The audit of disaster risk reduction, in 2013. „The purpose of ISSAI 5510 is to assist Supreme Audit Institutions (SAIs) in the audit of disaster risk reduction by governments. It can be used both by SAIs and by governments and communities seeking to improve mechanisms, procedures and institutions so as to reduce the risk of exposure of populations and assets to the consequences of disasters"[3].

Since the global goal of United Nations claimed in the Sendai framework for Disaster Risk Reduction 2015-2030 is to reduce the risks of disasters and their impact on people, property and the environment within and across sectors by States at local, national, regional and global levels [14], ISSAI 5510 is a great supportive tool for assessing such a system.

According to INTOSAI, the 5500 series of ISSAIs on disaster-related aid focuses on natural disasters, although the guidance and good practice cited can in most cases equally be applied to man-made disasters. ISSAI 5510 does not cover auditing disaster-related aid provided for emergency response and relief, rehabilitation and reconstruction (the post-disaster phase). The 5500 series of ISSAIs is not compulsory for SAIs and should not be used as standalone audit guidance. ISSAI 5510 should be used to supplement the level 3 (Fundamental Auditing Principles) and level 4 (Auditing Guidelines) ISSAIs, which are published by INTOSAI and available on the website of the Professional Standards Committee [15].

Since, ISSAI 5510 is adopted by INTOSAI in 2013, it is important to state that the Coordinating Committee of Supreme Audit Institutions in BiH, on the 72nd session in 2014 adopted a Decision on amendments to the Decision on takeover of ISSAI framework in BiH. An article 4 of this decision has recognized ISSAI 5500 - Introduction to guidance for audit work on disaster-related aid, ISSAI 5510 - The audit of disaster risk reduction, and ISSAI 5520 - The audit of disaster-related aid. By this decision, audit authorities has showed that they understood standards' importance, recognized its place and had planned its adoption but the standard has not been adopted so far [16].

In October 2016 the Audit office of the institutions of BiH, performed auditing of institutions of BiH related to conducting P&R operations during natural or other accidents [17]. As already stated, the ISSAI 5510 is not adopted by authorized institutions of BiH [18] so the report of this performance audit didn't mention this standard even though INTOSAI suggests that using of this standard is acceptable and recommended in audit of disaster risk reduction or in other words for audit of pre-disaster management.

Finally, standard says that „SAIs should use the questions and criteria which are relevant and appropriate to their audits on disaster risk reduction [3]. Accordingly, it is important to state that the International Standards of Supreme Audit Institutions developed eight sets of questions within ISSAI 5510. The first seven sections of the audit programme refer to prevention and mitigation activities of disaster risk reduction, which are best considered at national and international level while the final section refer to activities aimed at making cities resilient and reducing urban risk, which are better examined at local/city level.

## 4. The adequacy of coordination within P&R Management in BiH

In recent years, BiH has mainly faced natural disasters such as floods, extreme temperatures, fires, landslides, and storms that have culminated in loss of life, serious damage of material goods as well as displacement of population within BiH. When it comes to technical and technological accidents, BiH has faced overflow dams, explosion of gases and hazardous substances, contamination of air, water and land, and mining accidents. The complexity of the effects caused from different threats/hazards on the community force governments or responsible institutions to have in place measures to minimize the impacts of possible hazards/disasters and be ready for immediate re-

sponse to natural and other disasters. It includes set of arrangements that encompasses a range of regulations, personnel, procedures, resources, technological support and funds designed to support efficient pre-disaster management in BiH. But, in recent years, citizens of BiH could see that P&R system does not work properly.

Huseinbasic [2] believes that BiH is more intensively exposed to risks of natural disasters in the postwar period. The reasons for the increasing exposure to natural and other disasters are expressed as „the outdated industrial capacities and equipment used for operations, sensitive community infrastructure, lack of instruments for meteorological, seismological, and hydrological measurements, lack of surveillance and communication systems for timely detection and tracking of changes and phenomena in nature, and adequate sharing of those information. In addition to these deficiencies, aggravating circumstances are lack of planning, designing and programming of specific and all other areas".

Similarly, The United Nations Office for Disaster Risk Reduction (UNISDR) claims that the hesitancy of institutions to effectively implement the system of P&R were partly the result of "the dramatic consequences of the long conflict in BiH that are still being felt by the people of this war-torn state. The widespread presence of unexploded ordnance, minefields, and the hundreds of areas contaminated by depleted uranium represent significant obstacles to growth and huge challenges to effective Civil Protection. Given the nature of the challenges that face this country, the development of effective Civil Protection structures is one of the founding cornerstones upon which modern society is being built" [19].

The elaborated problem and necessity for development of P&R system is also recognized by the European Commission (EC) report on BiH in the area of civil protection emphasizing that attention given to the disasters and management of P&R system needs to have a priority particularly related to the recent severe floods [20]. The overall financial amount of the economic effects of floods in May 2014 in BiH (destruction or serious damage to property, infrastructure and goods, as well as the consequences of the destruction of industrial capacity and production) reached 2.041 billion EUR [21]. According to BiH meteorological experts the recorded flood statistics in 2014 exceed the historical measurements in terms of meteorology and hydrology in BiH.

As seen in the World Bank report above, the economic effects of the flood are very high. Recent flood demands an answer about current state of P&R system in BiH and its readiness to cope with such situations. Consequences of 2014 floods have to be a serious reason to conduct an analysis about the system. It is a necessary to look at all reasons for the failure of the P&R system in BiH. The problems have been detected in both institutional and organizational sphere. The ineffective actions of P&R system in BiH caused disappointment of BiH citizens. Failures in disaster preparedness, prevention, response, and recovery phases as well as the lack of coordination of actions among P&R institutions at different levels have been criticized for inefficiency.

Inefficiency of system is also recognized by the Center for Civilian Initiative (CCI) in their analysis of 2014 floods in BiH. An analysis showed that the current system of P&R can't adequately meet the needs of the citizens of BiH and in case of natural and other disasters neither provides security to the lives of population, nor for their material goods [22].

Moreover, Assistant Minister for civil protection from Ministry of Security of BiH after 2014 floods claimed that „...BiH facing problem related to the policy and country organization. P&R managers cannot give orders between each other's regardless the level of governance. Currently, BiH does not have a P&R system, because the system involves the management, coordination and exchange of information. The consequences of floods would have been reduced if the institutions had had exchange of disaster information..." [23]. Also, a report of Audit office of BiH institutions [17] found the lack of functionality in the work of coordination body at state level especially during floods in 2014.

Three years after a massive flood, the relevant risk assessments indicate that nearly 500,000 people still live in areas exposed to significant risks of floods and landslides [24]. Looking at these examples above, it may be concluded that even though certain progress has been made since 2014, BiH is mostly in a reactive mode waiting for something to happen, hedging minimal political or

financial investments, relying heavily on international support and hoping that disasters might not occur. Consequently, current state of P&R system demonstrates a need for systematic changes reified through new measures and solutions.

## 5. Research findings and discussion

Focus of this article is therefore on assessing whether the Coordination mechanism is adequately established between P&R authorities at different administrative levels of government in BiH. For the purpose of answering such a research question we have articulated starting assumption which states that "There is a difference of Coordination mechanism between P&R authorities at different administrative levels of government in BiH".

For the sake of establishing proper analytical framework ISSAI 5510 recommended 7 questions for assessment of the adequacy of coordination [3] and allowed researcher/auditor to add own questions during the audit process. Researchers decided to use 6 of 7 questions from ISSAI 5510 and added 3 specific questions. Accordingly, the researchers agreed with using survey with set of 9 statements to assess adequacy of coordination of P&R system in BiH. Survey questions were formatted in the Likert scale (1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree). The institutions/authorities for civil protection at state, entity, district, cantonal and municipal/city level were selected for participation in the survey. Table 1 shows that 145 respondents answered the survey's statements shown below. The hypothesis is tested by using respondents' answers on statement 1 while other statements, written in paragraph below, were used for descriptive statistics.

1. An established coordination mechanism between different levels of P&R system in BiH is not efficient and effective.
2. All relevant representatives of different levels of governance have been identified and included in the coordination mechanism (national/entity/regional-cantonal/local level and the main contact point for external bodies).
3. The expected level of coordination between the agencies concerned is achieved during the occurrence of recent disasters.
4. There is a monitoring mechanism to provide information to help ensure cooperation, as appropriate, with different bodies at the entity, national and international levels,
5. The existing coordination foster collaboration in order to avoid the duplication and overlap of activities in the field, to make the most efficient use of resources and to raise awareness of the risk of disaster.
6. Different forms of cooperation for disaster risk reduction activities, such as technical assistance, consultancy, equipment and supplies, etc. are specified in accordance with the nature, role and work of different participants in this field.
7. The Emergency Operations Centre (EOC) is established at your level of governance.
8. There is an existing communication system within EOC at your level that effectively may provide timely information to upper/lower level of government with regard to hazard/disaster risk reduction.
9. The forms and procedures about exchange information and reporting between EOCs are defined.

Based on P&R professionals' responses researchers evaluated differences between administrative levels of government by using Kruskal-Wallis H and Mann-Whitney U tests as follows.

*Table 1. Descriptive statistics*

| Admin. level | N | Mean | Std. Dev. | Std. Error |
|---|---|---|---|---|
| BiH | 12 | 4,25 | 0,866 | 0,250 |
| FBiH | 10 | 3,40 | 1,174 | 0,371 |
| RS | 6 | 3,00 | 1,095 | 0,447 |
| BD | 4 | 1,25 | 0,500 | 0,250 |
| Cantons | 41 | 3,85 | 0,910 | 0,142 |
| Municip. | 72 | 3,64 | 1,214 | 0,143 |
| Total | 145 | 3,64 | 1,171 | 0,097 |

*Table 2. Kruskal Wallis H test*

| | Risk assessments |
|---|---|
| Chi-Square | 17,043 |
| Df | 5 |
| Asymp. Sig. | 0,004 |

*a. Kruskal Wallis H Test*
*b. Grouping Variable: Level of Governance*

*Table 3. Mann-Whitney U test*

| Admin. level | | Mann-Whitney U | Asymp. Sig. (2-tailed) |
|---|---|---|---|
| BiH | FBiH | 34,500 | 0,078 |
| | RS | 13,500 | 0,027 |
| | BD | 0,000 | 0,003 |
| | Cantons | 187,500 | 0,184 |
| | Municip. | 312,000 | 0,110 |
| FBiH | BiH | 34,500 | 0,078 |
| | RS | 22,500 | 0,388 |
| | BD | 3,000 | 0,013 |
| | Cantons | 160,000 | 0,253 |
| | Municip. | 311,500 | 0,473 |
| RS | BiH | 13,500 | 0,027 |
| | FBiH | 22,500 | 0,388 |
| | BD | 2,500 | 0,034 |
| | Cantons | 64,500 | 0,045 |
| | Municip. | 140,500 | 0,141 |
| BD | BiH | 0,000 | 0,003 |
| | FBiH | 3,000 | 0,013 |
| | RS | 2,500 | 0,034 |
| | Cantons | 3,500 | 0,001 |
| | Municip. | 18,500 | 0,002 |
| Cantons | BiH | 187,500 | 0,184 |
| | FBiH | 160,000 | 0,253 |
| | RS | 64,500 | 0,045 |
| | BD | 3,500 | 0,001 |
| | Municip. | 1382,000 | 0,554 |
| Municip. | BiH | 312,000 | 0,110 |
| | F BiH | 311,500 | 0,473 |
| | RS | 140,500 | 0,141 |
| | BD | 18,500 | 0,002 |
| | Cantons | 1382,000 | 0,554 |

A Kruskal-Wallis H test showed that there was a statistically significant difference about efficiency and effectiveness of established coordination mechanism between different levels of P&R system in BiH on different level of governance, $\chi^2(5) = 17.043$, $p = 0.004$, with a mean rank score of 4,25 for BiH, 3,40 for FBiH, 3,00 for RS, 1,25 for BD, 3,85 for cantons and 3,64 for municipalities.

The researchers used Man Whitney U test to determine paired levels of government where difference in coordination mechanism exists. According to Man Whitney U test there are significant differences in attitudes of the Brcko District and all other levels of government, but also in relations between the cantons and RS and between RS and BiH. Thus, even 7 of 14 individual combinations of paired levels confirmed the hypothesis. This shows that the differences in coordination mechanism are existing among different administrative levels in BiH.

Satisfaction with the coordination mechanism between levels of governance is evaluated with the average score (excluding Brcko District, which has a low score of 1.75). Almost 64% of responders are of the opinion that the expected level of coordination between the agencies is not at appropriate level while 21% stayed neutral and only 15% believe that coordination mechanism is efficient and effective. This research results confirmed that the coordination mechanism is not as efficient and effective as it should be. Inefficiency of coordination mechanism between P&R institutions is partly caused by human factors, and partly because of inadequate communication equipment and decision supporting systems. It is clear that all levels of government have established some form of operational center but also that different forms of cooperation for disaster risk reduction activities, such as technical assistance, consultancy, equipment and supplies, etc. are not clearly specified in accordance with the nature, role and work of different participants in this field. However, responders have the opinion that there is an existing communication system within EOC that effectively may provide timely information to upper/lower level of government with regard to disaster risk reduction. Also, all levels of management (except Brcko District) agree with the fact that the forms and procedures about exchange information between EOCs are defined.

The researchers pointed out that certain high marks are expressing concern because of the apparent dose of unjustified self-confidence. This particularly applies to the attitude of respondents that they have adequate communication systems. Moreover, the responders evaluated that the existing coordination mechanism doesn't foster collaboration in order to avoid the duplication and overlap of activities as well as to make the most efficient use of resources and to raise awareness of the risk of disaster.

Assumption of proper coordination between the various agencies that are part of the P&R system in BiH requires a clear division of jurisdiction be-

cause continuous multi-agency cooperation offers an effective way to conduct and coordinate different resources to disaster risk reduction. Canton [25] stated „no area is more fraught with controversy than issues arising over jurisdiction. During crisis and disaster, some overlapping responsibilities and authorities represent a significant potential for conflict". So, the application of subsidiarity principle at different administrative levels in BiH sometimes are leading to overlapping jurisdictions and sometimes weight to dissatisfaction of some P&R managers. The Guardian writes that BiH is "home to what is most probably the world's most complicated system of government" [26].

Due to complicated governmental structure existing problems within P&R management in BiH cannot be only solved by P&R managers. Some people believe that „many of these jurisdictional issues have a political dimension and are related to public policy and must be decided by the political leadership of the jurisdiction." [25].

There is no civil protection headquarter as a body that manages hazards/disaster at the state level, but there is a coordinating body for civil protection, which has the role to coordinate the activities of civil protection [27]. Coordination body (CB) is established in accordance with article 16 of the Framework Law on the P&R of people and property in the event of natural or other disasters in BiH. This expert operational body of the Council of Ministers of BiH (Article 17 of Framework Law) occupies 21 members; 10 members of Council of Ministers of BiH; 10 members from entities (5 FBiH and 5 RS of BiH) and 2 members from Brcko district. The Coordination body has the primary coordination role at the national level and coordinates the activities of P&R at the entire territory of BiH, while the lower administrative levels are responsible for the management on site. It has a legal authority to declare status of emergency or extraordinary conditions at BiH level [1]. CB makes decisions by principle of obligatory presence of at least half of entity members and without their presence decision is not possible to be taken. Marenin [28] claims "whether there is a crisis or one is to be declared is a political decision, not a legal one, which is affected not only by the objective causes and conditions of an event but by calculations of material and symbolic benefits".

There was an apparent inefficiency of this body in recent years due to lack of quorum of nominated members and replacement of nominated members. Due to the inefficient role of the CB it is needed to analyze for a possible reducing the number of members of CB taking into account the national structure and representation of different administrative levels within this body. It will be more efficient to organize CB's activities with smaller group of members in order to ensure fully functioning of this professional body of Council of Ministers of BiH. Also, 75% of respondents answered that the forms and procedures about exchange information and reporting between EOCs are defined. But, in practice many P&R professionals complain about coordination.

The Operations Center 112 as organizational structure of Ministry of Security of BiH is collecting, processing and distributing data about hazards and disasters to the CB and relevant authorities and legal entities at state level. It has to be connected with operational centers of other institutions and bodies of BiH, as well as the EOCs of the Entities and Brcko District (Article 18 of Framework Law) [4].

The headquarters of civil protection are established to manage P&R actions on the territory of the Entities and Brcko District of BiH. They are established as the operational expert bodies. The Federation of BiH has formed headquarters at the level of Federation, cantons, and municipalities while in another entity Republic of Srpska these headquarters are formed at the entity and city/municipal level. Brcko District also has a civil protection headquarter which is responsible to deal with hazards/disasters at Brcko District level as well as headquarters in local communities and legal entities as required. Also, depending on the assessment a civil protection headquarters can be formed by legal entities and local communities. Moreover, entities and Brcko District are responsible for the establishment and running the system of early detection, monitoring and reporting on the hazards of natural and other disasters through their EOCs. But, Center for Security Studies - BiH [27] in their analysis of P&R system in BiH states that the current status of equipment of operations and communication centers is such that hardly provides functionality. Significant investments in equipment are not recorded in the last 7 years.

Obviously, the practical use of the established coordination mechanism is not at an adequate level. Coordination mechanism is established but is not practically implemented. Coordination inefficiency is a clear message for P&R institutions to sit at the same table in order to establish the procedures that fits to state and entity level. The solution may be the organization similar to some countries where the system is efficient and effective. In that sense UNISDR and World Bank [19] stated that „the Civil Protection sector of Italy, the structure of which is based on a distributed network of autonomous regional centers coordinated by a central node, could be a potential and interesting model and some aspects could be adapted to fit the requirements of BiH".

Besides standards and procedures for exchange of hazard/disaster information between P&R institutions the authorities have to think about establishment of modern communication system for EOCs at different administrative levels of government that will meet the needs of modern P&R system that effectively may provide timely information to upper/lower level of government with regard to hazard/disaster risk reduction.

## 6. Conclusion

Assumption of efficient, economic, and effective coordination between the various P&R institutions at different administrative levels of government requires a clear division of jurisdiction. Research has shown that coordination mechanism is established but is not practically implemented in BiH. Since most of P&R professionals in this research complain of coordination something needs to be changed. It is a clear message for P&R institutions to sit together at the same table in order to establish procedures and technological solutions that fits to everyone which will ultimately yield BiH having improved coordination within the BiH P&R system.

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Authentic papers contain these parts: introduction, goal, methods, results, discussion and conclusion. Introduction is brief and clear review of problem. Methods are shown so that interested a reader is able to repeat described research. Known methods don't need to be identified, it is cited (referenced). Results need to be shown clearly and legically, and their significance proven by statistical analysis. In discussion, results are interpreted and compared to existing, previously published findings in the same field. Conclusions have to give an answer to author's goal.

**REFERENCES**

Quoting references must be in a scale in which they are really used. Quoting most recent literature is recommended. Only published articels (or articles accepted for publishing) can be used as references. Not-published observations and personal notifications need to be in text in brackets. Showing references is as how they appear in text. References cited in tables or pictures are also numbered according to quoting order. Citing paper with six or less authors must have cited names of all authors; if seven or more authors' wrote the paper, the name of the first three authors are cited with a note "et all". If the author is unknown, at the beginning of papers reference, the article is named as "unknown". Titles of the publications are abbreviated in accordance to Index Medicus, but if not listed in the index, whole title of the journal has to be written.

Footnote-comments, explanations, etc., cannot be used in the paper.

**STATISTICIAL ANALYSIS**

Tests used for statistical analysis need to be shown in text and in tables or pictures containing statistical analysis.

**TABLES AND PICTURES**

Tables have to be numbered and shown by their order, so they can be understood without having to read the paper. Every column needs to have title, every measuring unit (SI) has to be clearly marked, preferably in footnotes below the table, in Arabian numbers or symbols. Pictures also have to be numbered as they appear in text. Drawings need to be enclosed on a white paper or tracing paper, while black and white photo have to be printed on a radiant paper. Legends next to pictures and photos have to be written on a separate A4 format paper. All illustrations (pictures, drawings, diagrams) have to be original and on their backs contain illustration number, first author last name, abbreviated title of the paper and picture top. It is appreciated if author marks the place for table or picture. Preferable the pictures format is TIF, quality 300 DPI.

**USE OF ABBREAVIATIONS**

Use of abbreviations has to be reduced to minimum. Conventional units can be used without their definitions.