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Geographic Information System(GIS) and Roadeng Usage to Determine the Environmentally Sensitive Forest Road Route in Mountainous Terrain

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Abstract

Road between two known points and placing the various economic and environmental factors that require consideration is a highly complex engineering problems. Engineers, soil conservation and water resources, taking into account the total road construction, maintenance and handling cost is the lowest of the route is difficult to determine. Forest road construction and maintenance costs of raw wood is a significant proportion of the total cost of production. Of forest road network planning, forest villages transportation, production work, social needs, providing transportation to the recreation area, depending on the functional use of forests that are made according to the purpose. In this study, by using GIS and Roadeng Technology planning forest road network planning was make zero line, curve, longitudinal profiles, cross sections, such as the amount of excavation and filling all the planning criteria are determined. Roadeng of software for planning of forest roads; surveillance, compliance of the terrain and the location of the module were investigated. Look at the slope of the land and river maps with GIS software has been created.Roadeng numerical software made its way forest we have done with classical methods and technical processes are automatically offers more detailed and more quickly practitioners do on computers.

Keywords: *Forest road network, forest road planning, Roadeng, GIS, Environmentally Sensitive*

Introduction

Forest roads play an important role in forest management, transportation of wood raw material protection and afforestation activities in mountainous areas. Incorporating the consideration of technical and environmental issues into manual road planning is a difficult job. Manual road planning in mountainous forests, considering technical and environmental issues, is a difficult job. More recently, simultaneous information management with respect to the important factors in road planning and rapid assessment of the roads has been possible by using GIS capabilities Naghdi, et al., (2009); Pentek, et al., (2005); Gumus, et al., (2007).

Previous studies developed forest road networks via manual methods, while in the last few years computer software and hardware have been used extensively and effectively for solving complex problems in forest areas, especially in developed countries (Akay 2003; Rogers 2005; Demir 2007). Today, concepts such as digital map, GIS and land information systems have gained importance in the design of road networks (Akay, 2003; Aruga, 2005; Gümüş, 2008; Çalışkan, 2013). In Turkey, forest roads are divided into three main categories such as primary forest roads, secondary forest roads (Type A and Type B secondary forest roads) and tractor roads. The geometric standards of all types of forest roads are given in Table 1. Each category of forest roads is determined depending on the objective of construction, traffic density, the amount of the load to be transported, tonnages of trucks in accordance with the Communique No. 292 by General Directorate of Forests. As well, the processof forest road planning is conducted according to this communique.

Table 1.Geometrical standards of all types forest roads (GDF, 2008).

Table 1.Geometrical standards of all types forest roads (GDF, 2008).

Road features	Unit	Main forest roads	Secondary forest roads				Tractor roads
			A - Type	B – Type			
				HBT	NBT	EBT	
Platform width	m	7	6	5	4	3	3.5
Number of road line	Number	2	1	1	1	1	1
Roadway width	m	3	3	3	3	3	3
Maximum longitudinal slope	%	8	10	9	12	12	20
Minimum vertical curve diameter	m	50	35	20	12	8	8
Shoulder width	m	0.50	0.50	0.50	0.50	0.50	
Ditch width	m	1.00	1.00	1.00	1.00	0.50	
Superstructure width	m	6	5	4	3	3	
Bridge width	m	7+(2 x 0.6)	6+(2 x 0.6)	5+(2 x 0.6)		4+(2 x 0.6)	

HBT: High standard B type forest road, NBT: Normal B type forest road, EBT: Extreme B type forest road

The aim of this study, by using GIS and Roadeng Technology planning forest road network planning was make zero line, curve, longitudinal profiles, cross sections, such as the amount of excavation and filling all the planning criteria are determined.

Material and Method

Research Area

The study area, Turkey, Artvin Regional Directorate of Forestry, Forest Management Directorate of Artvin Merkez, Artvin Central Planning Unit, covers an area of 5113.1 hectares. According to the current total area of 4279.21 ha of forest management plan data research with 5224.71 ha of forests, 945.5 hectares were deforested areas while. The total length of forest roads in the study area 93 km. 1 km. forest roads are planned. forest roads forest roads in the study area is B-type standards.

Method

During the field work, with the help of GPS and topographic maps of the study area were visited existing forest roads. GPS track log opened in all available ways of coordinate values (x, y, z values included) and is stored in the GPS memory length measurement. Meanwhile, the road planning in the current path of those who need art structure, superstructure, major repairs, ditches, road expansion and lase-curve expansion of all jobs in the beginning and ending point of land to be like (at the point of application of art works) made the point recording with GPS amount of work, and to do coordinated work place have been determined.Still in need during office work as well as working with numerical pad with ready computer in the car in the field are monitored all the time, the land must be planned simultaneously new ways and places have been identified on topographic maps.

Digital Terrain Model (SAM) was created. After terrain model created is defined horizontal route of forest road. At this stage, implemented in Turkey "Forest Roads Planning Construction and Maintenance" No. 292 from normal B-Type Secondary notification of specified types of forest road geometric standards of forest roads are used. In that field, lakes, streams and rivers in digitized geographic information systems was made available to the database queries made into layers.

In the planning stages of forest roads Location module is used. After determining the route will pass on the road map, cross sections related to road, profile-all excavation work, such as determination of the amount of padding made, respectively, and has been demonstrated literally a forest road project.

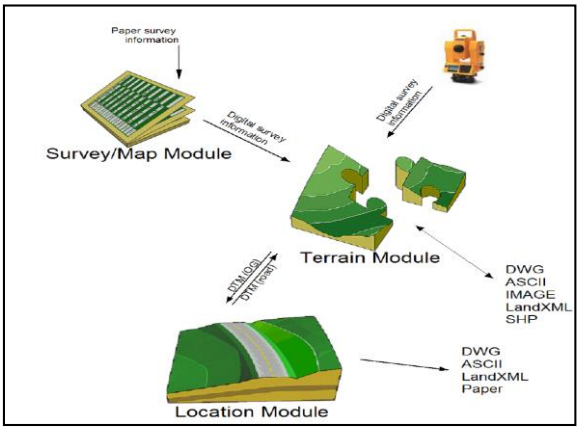

Figure 1. Roadeng Software Module

Result and Discussion

In computer, digital creation of a terrain model, the area is better known to and forest road projects in important tilt-bond slope due to issues such as and bond analysis was conducted for the most important element slope which increases the cost of construction of forest roads. In case of increase or decrease of the slope excavation and filling than changes in the volume and reduce the cost of this increase. The total length of the route to be planned is 1000 m, the slope of the road route has varied between 2-10%. The planned path is B-type forest road. The width of the road, shoulder width of 4 m and 0.5 m is planned to be on both sides. Scrape Slopes Planned ways, depending on the slope of 1: 1 to 3: 1, filling slopes 2:3.

Path of the trench width of 1 m, has been identified as a trench depth of 0.30 m. Forest road planned in the beginning and is set to pass the cardinal points that way after the first endpoints are marked. Considering the general slope of the land, as chosen point of stowage length and slope of the road is planned as a road.

Determining if the road route points, after drawing the route, one and curves per every 20 m, curve, middle and curves cross sections are taken from the last point created longitudinal section taking into account the total length of the path and the path of the black and red jeans were drawn.

All of these drawings will occur along the route of the road as a result of the cut and fill quantities prepared in computer tables have been created. After the work is completed as drawing path planning, the cost will be determined by the selection and soil and ground properties in the area of road construction machinery. Cost is the main factor in the creation of form-filling excavations statements prepared in computer environment. Zero line in the drawing for which calculations are made according to the contour lines, create a triangle pattern on our land has started to curve fitting process. Terrain module using the digital terrain model for this land was created.

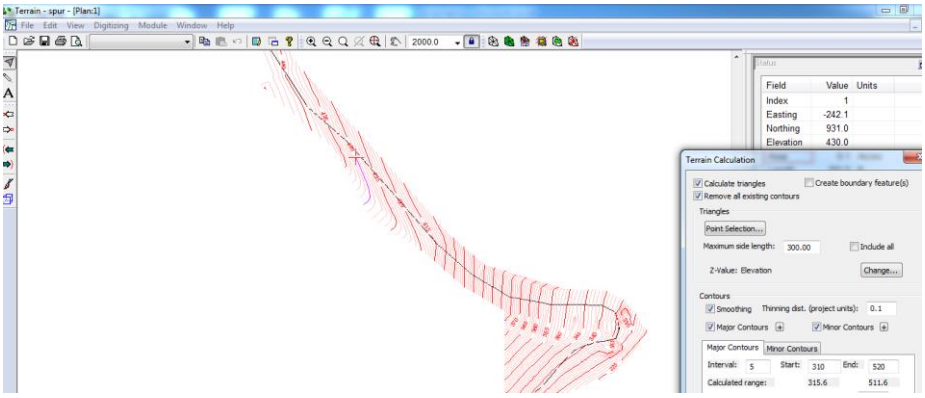

Figure 2. Terrain Module

Location modülü; zero line, curves, generated cross sections and material removal profiles.

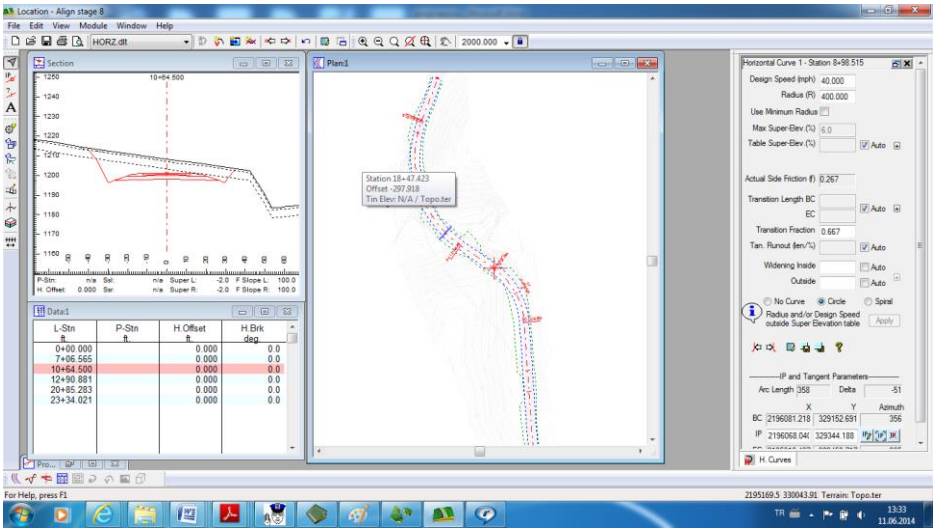

Figure 3. Create curves

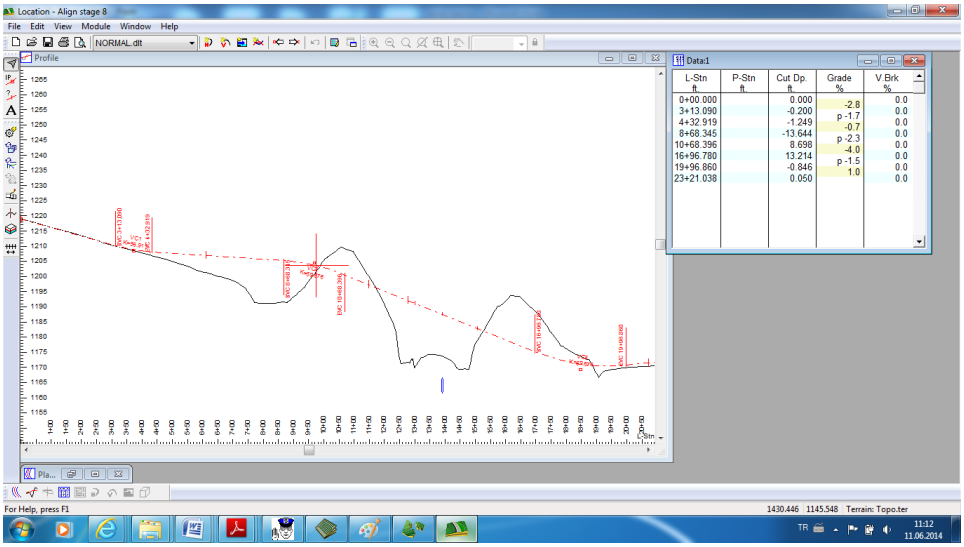

Figure 4. Creating Longitudinal Profile

Establishment of the road taken to the platform sections perpendicular to the axis path after determining the horizontal axis. Cross-section, depending on the terrain conditions along the horizontal axis certain intervals (usually 20 m) and must be taken when necessary. Cross sections are taken typically 10 m in length, including the left and right from the horizontal axis.

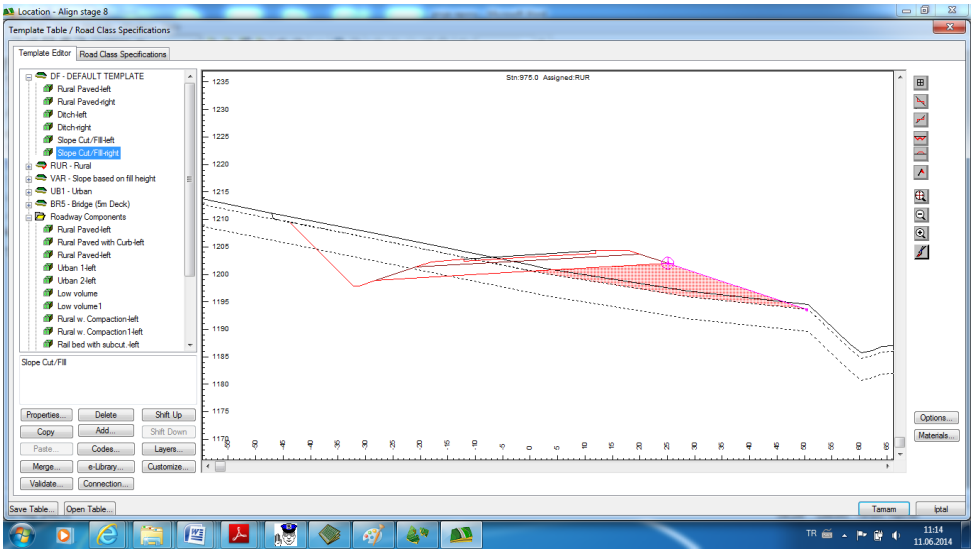

Figure 5. Creating Cross-section

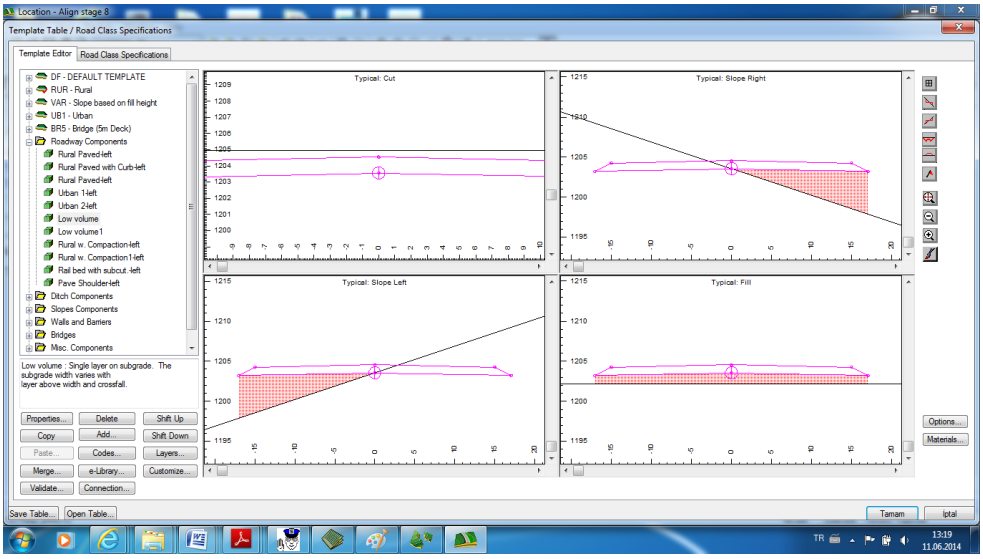

Figure 6. Create different cross sections

To make the area and volume, cubic editor is used. Then material removal profile being formed.

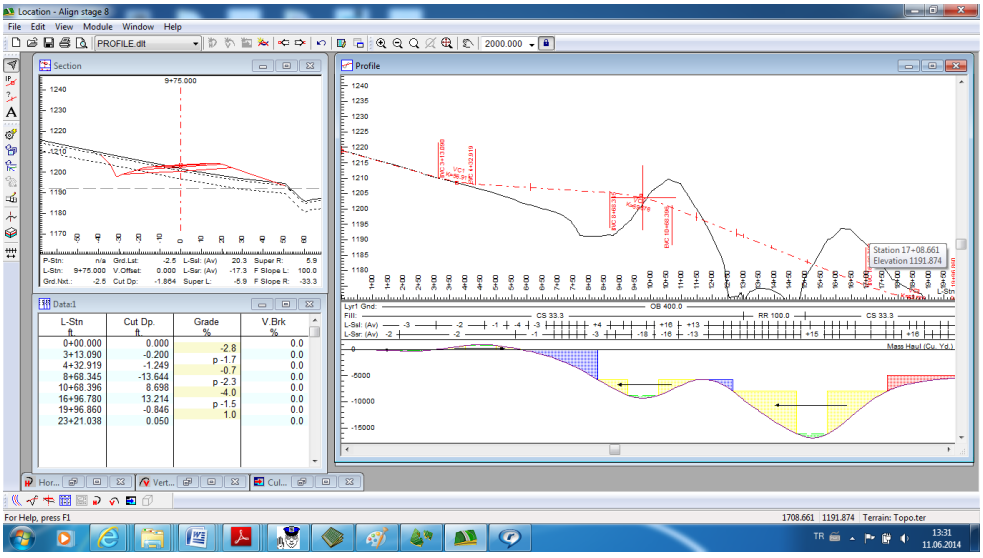

Figure 7. The same screen display different profiles

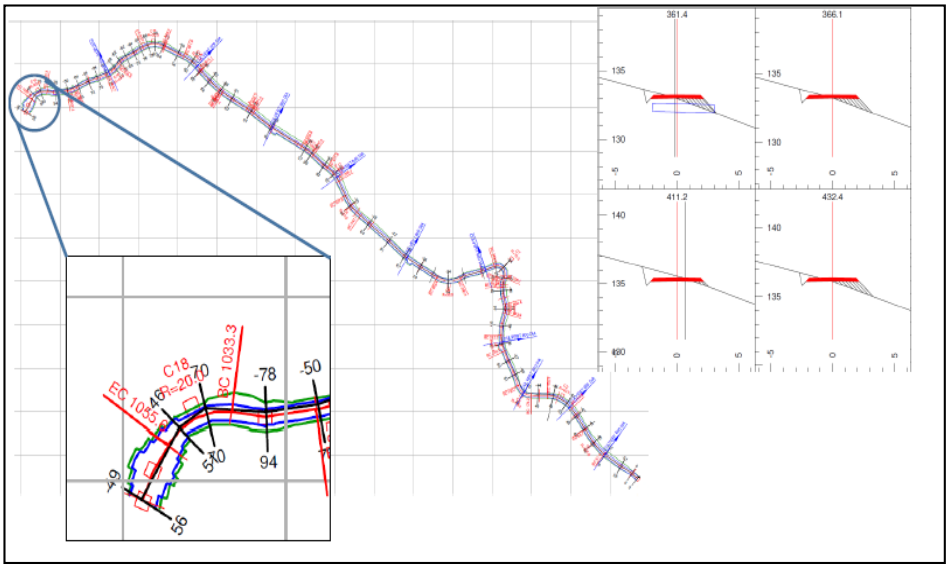

Figure 8. The planned route of the road and some properties

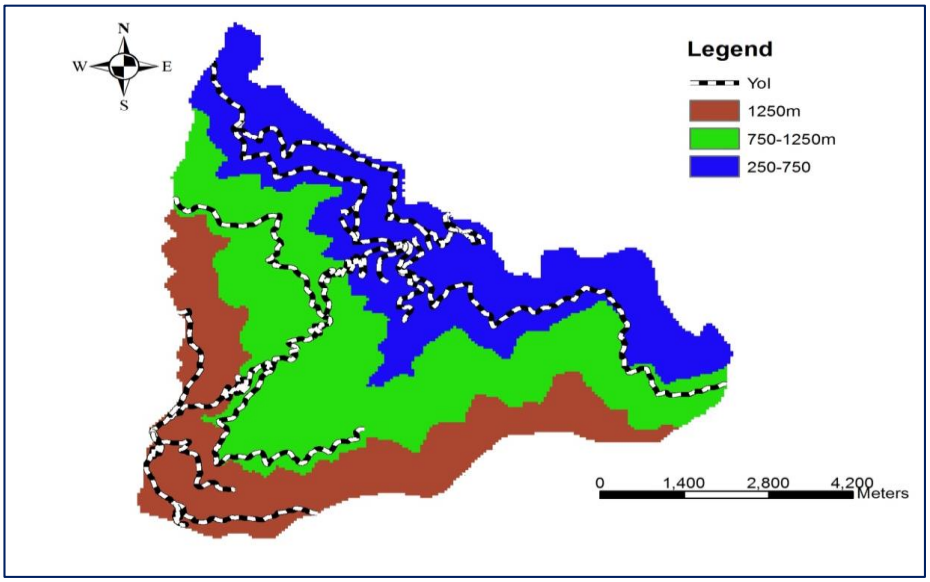

Figure 9. Height map of planning unit

Conclusions

The people living in today's world and people have to deal with a specific area of computer-aided software packages. In this study, the conventional method of forest roads made so far describes how to do the different computer-aided software. Other conventional methods of faster and more easily made and future requirements of the project is seen to be done with

this program. No matter how excellent if done road construction work done on computer must be supported by field studies. Before you start planning the start and end of the road on the basis of land, road type and road space according to use functions, soil types, it is necessary to identify the place as you have to avoid the area we can be rocky and marshy areas. After all this field work and road later after determining exactly which route should pass the office work.

The forest road planning, construction and maintenance of the forest is properly done can be very damaging. route will pass the road when planning work is very important. During the construction work, the experience of using the machine type and operator plays a major role. All in a way that conditions in the study without taking into consideration the trees and saplings to large losses given to forest land. This situation is of great importance for the national economy and the natural environment.

In this study, B-type forest road planning is made. The total length of the path between the start and end points 1000 m and the width of the road is determined to be 4 m. The amount of excavations along the route of the planned road 1472 m3 and 732 m3 of fill amount was found. 6% average gradient of the road, the average slope of the land is 55%. curves along the road route has been used a total of 8. radius of curve 20 - varied from 70 m. All stages in the planning of forest roads have been converted into project deliverables prepared by computer.

Thanks to dynamic modeling of the structure of the data processing software Roadeng at any stage of the project, even if the project completed, the changes made are reflected simultaneously in all phases of the project. Thus, desk and minimizing the time allocated for field work are provided. Moreover, thanks to restrictions and criteria set out in the database created, users of non-standard program gives warning that may arise from errors in the drawings.

The roadeng software is used, the change in the way forest to forest planner shows scheduled quickly and evaluates visual effects with alternative road routes. In addition, properties owned through easier sections of the Location module is easier to profile and volume calculations easier. Turkey needs a forestry practice in this way.

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The Investigation the Effects of the Performance of an Independent Emotion Recognition of Model Used in the Dimensioning of Emotions

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Abstract

Emotion recognition aims at determining the state of emotion which is included in the speech or mimics of a person. Emotion recognition from speech is an area related to signal processing and psychology. Acoustic parameters obtained from speech signals through acoustic analysis, which is one of objective evaluation methods, is intensively used in emotion recognition studies. In this paper success in emotion recognition is examined in categorical aspects and the impact of dimensional model on independent emotion recognition success is investigated. Acoustic parameters were subjected to classification with Support Vector Machine in order to determine emotion recognition success. According to the obtained findings, emotion recognition success in categorical structure, dimensional structure and categorical-dimensional structure were 69.5%, 73.3% and 87.1%, respectively. Even if dimensional structure is higher in arousal than in valence, when emotion recognition success is examined on each emotion dimension, valence provided higher success.

Keywords: *Dimensional Emotion, Emotion Recognition, Acoustic Analysis, SVM*

Introduction

The emotional state of persons causes changes in the physiological structure of persons, which naturally affects voice. Objective and subjective methods are used for emotion recognition from speech. Perceptional recognition, which is a subjective method, is performed by listening by an expert and can show difference depending on the experience and probation of the expert. In order to overcome this problem of subjective evaluation, objective evaluation methods are employed. Acoustic analysis is used with the purpose of objective evaluation of voice disorders by obtaining several acoustic parameters from voice.

Features of voice signal and voice path change depending on the person, age, sex, sound path length, height, weight and emotional state. Therefore the emotional state of a person can be identified depending on feature vectors that will be obtained with sound analysis methods. Speech Emotion Recognition is not a new area of study; it was first developed in mid 1980s using statistical features of some acoustic parameters. In following years, with the development of computer architecture, more complicated emotion recognition algorithms began to be used (Ververidis & Kotropoulos, 2006). With acoustic parameters, language and discourse information were also used for emotion recognition (Chul Min Lee & Narayanan, 2005).

The most important limitation of Speech Emotion Recognition is about obtaining data whose validity is accepted and which can reflect emotions fully. With this purpose, there are ready datasets in the literature (EMO-DB, EMOVA, SAVEE, eNTERFACE, SUSAS) used in several studies whose validity is recognized; in addition, some researchers aimed at gathering their own datasets.

The basic purpose of the process in most emotion recognition studies is classification, and in most of these studies classification of emotional states is performed. Traditional classification techniques have been used in almost all of the proposed emotion recognition systems. Recent studies are focusing on the impact of hybrid classifiers and classifiers on acoustic parameters. The most widely used classifiers in the literature are Support Vector Machine (SVM), Gaussian Mixture Model (GMM) and Hidden Markov Model (HMM).

There are three basic approaches in modelling of emotions in psychology studies (Sezgin, Gunsel, & Kurt, 2012): categorical, dimensional, and appraisal-based approach. Since the appraisal-based approach is not prevalently used because of its complex and sophisticated measurements of change (Gunes, Schuller, Pantic, & Cowie, 2011).

Categorical approach is independent expression of basic emotions. Ekman (Ekman, 1992) defined emotions in 6 basic categories: happiness, sadness, anger, fear, surprise, and disgust. However, categorical approach can fail to reflect the real situation when people are not in a single emotion but in complicated emotions (Gunes et al., 2011).

Due to the deficiencies of categorical approach in reflecting complicated emotions, dimensional approach is employed. Dimensional approach states that emotional state of a person is not depending on a single category but on multiple categories. There are several emotional dimensioning models presented for this purpose (Sezgin et al., 2012). A three-dimensional emotion space is proposed: arousal (activation), potency (power), and valence (pleasure) evaluation (Schlosberg, 1954). Another alternative is simpler two-dimensional emotion space: arousal and valence. Yet, the most widely used dimensional model is based on the assumption of Russell (Russel, 1980) that each basic emotion is represented by a bipolar entity being a part of the same emotional dimension in two-dimensional emotion space.

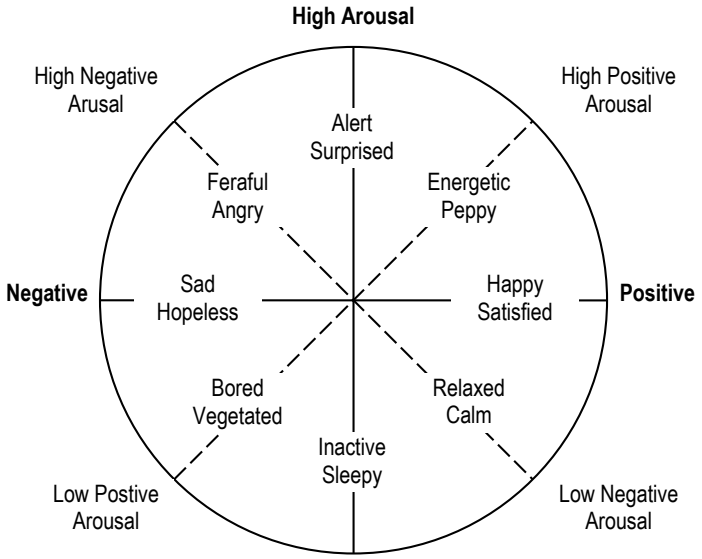

Figure 1. The two-dimensional structure of affect, showing the dimensions of Positive Activation and Negative Activation on the diagonals and their relationship to the alternative dimensions of Valence (horizantal) and Arousal (vertical), as well as the 16 affect terms used to measure current mood (Kallinen, 2006). Adapted from Larsen and Diener (Larsen & Diener, 1992) and Watson et al. (Watson, Wiese, Vaidya, & Tellegen, 1999).

In our study EMO-DB dataset is used; therefore, the studies which consist of categorical and dimensional emotion recognition using EMO-DB in the literature were examined. A summary of the literature search is given in Table 1.

Table 1. Related works

Emotions/Dimension	Class.	Par.Count	Acc.	Ref.
Arousal-Negative (boredom, disgust, neutral,sadness) Arousal-Positive (anger, fear, happiness)	SVM	6552	96.8%	(Schuller, Vlasenko, Eyben, Rigoll, & Wendemuth, 2009)
Valence-Negative (anger, boredom, disgust, fear, sadness) Valence-Positive (happiness, neutral)			87.0%	
Categorical			84.0%	
High arousal (anger, happiness, anxiety/fear), Low arousal (sadness, boredom, disgust, neutral)	ANN	133	83.7%	(Iliou & Anagnostopoulos, 2009)
Group 1…Group 8 (Watson and Tellegen's model)	HMM	39	81.2%	(Yun & Yoo, 2009)
High Arousal Low Arousal	ANN	24	47.0%	(Anagnostopoulos & Vovoli, 2009)
Anger, Disgust, Fear, Happy, Neutral, Sadness	SVM	121	78.3%	(Luengo, Navas, & Hernaez, 2010)
Anger, Fear, Happy, Neutral, Sadness, Boredom	SVM	~80	79.7%	(Giannoulis & Potamianos, 2012)
Arousal, Valence	SVM	-	86.3%	(Sezgin et al., 2012)
Anger, Disgust, Fear, Happy, Neutral, Sadness, Boredom	SVM	4368	93.8%	(Ivanov & Riccardi, 2012)
Anger, Disgust, Fear, Happy, Neutral, Sadness, Boredom	SVM	39	67.0%	(Vasuki & Aravindan, 2012)
Anger, Disgust, Fear, Happy, Neutral, Sadness, Boredom	SVM	95	79.5%	(Hassan & Damper, 2012)
Arousal, Valence	SVM	~70	90.5%	(Ramakrishnan & El Emary, 2013)
Anger, Disgust, Fear, Happy, Neutral, Sadness, Boredom	SVM	32	80.6%	(Garg, Kumar, & Sinha, 2013)
Anger, Disgust, Fear, Happy, Neutral, Sadness, Boredom	SVM	6552	85.2%	(Chiou & Chen, 2013)
Anger, Disgust, Fear, Happy, Neutral, Sadness, Boredom	SVM	90	80.4%	(Zhao, Zhang, & Lei, 2014)

Arousal, Valence	ANFC	41	91.9%	(Lika, Seldon, & Kiong, 2014)
Anger, Disgust, Fear, Happy, Neutral, Sadness, Boredom	SVM	204	78.8%	(Zhao & Zhang, 2015)
Anger, Disgust, Fear, Happy, Neutral, Sadness, Boredom	SVM	2641	85.9%	(Shahzadi, Ahmadyfard, Harimi, & Yaghmaie, 2015)
High Activation, Low Activation	SVM	-	90.3%	(Alonso, Cabrera, Medina, & Travieso, 2015)

When the literature search given in table 1 is examined, it can be seen that the highest success obtained with SVM classifier in categorical classification was 93.8 percent. In studies which use the same data, the reason of obtaining different classification successes is the difference in the number and types of acoustic parameters obtained from data. Studies which examine emotional dimensions looked in arousal-valence dimension and high success was obtained with 96.8 percent. In studies found in the literature, emotion recognition is examined in categorical and dimensional aspects and no studies are found which evaluate each dimension categorically within itself.

The purpose of this study is to examine with SVM classifier the emotion recognition success in categorical and dimensional aspect of the seven emotions (anger, boredom, disgust, anxiety/fear, happiness, sadness, neutral) found in the Berlin Database of Emotional Speech (Emo-DB) database. In addition, the emotions in every emotion dimension are evaluated categorically.

Materials and Method

In our study EMO-DB is used. Emo-DB includes voice recordings consisting of 7 different emotions (anger, boredom, disgust, anxiety/fear, happiness, sadness, neutral) spoken by actors within the project developed by department of communication science at Institute of Speech and Communication of Technical University of Berlin. The database was created by emotional expressions of 10 different sentences by 10 actors in 20-35 age interval. Voice records have 16 kHz sampling frequency and 16 bit mono features (Burkhardt, Paeschke, Rolfes, Sendlmeier, & Weiss, 2005).

In the study 535 voice records are examined, the distribution of data-specific features of which are given in Table 2.

Table 2. The features belonging to the data used in the study

Emotion	**Male**	**Female**	**Age1 (30-35)**	**Age2 (20-29)**	**Total**
Anger	60	67	90	37	**127**
Fear	34	33	50	17	**67**
Boredom	35	46	60	21	**81**
Disgust	11	35	31	15	**46**
Happiness	27	44	53	18	**71**
Sadness	25	37	47	15	**62**
Neutral	39	40	50	29	**79**

Total	233	302	381	154	**535**

Acoustic analysis of speech records in both databases was performed with Praat (Boersma & Weenink, 2002) software and 15 acoustic parameters were obtained from each speech record. In the pre-processing of speech records, frame size 25ms, 50% overlap and Hamming windowing were used. Acoustic parameters obtained with acoustic analysis are given in Table 3.

Table 3. The acoustic parameters used in this paper

Acoustic Parameters	**Descriptive Statistics**	
	Mean	**Std.Dev.**
Fundamental Frequency (F0)	✓	✓
Formant Frequency (F1, F2, F3)	✓	✓
Jitter (Local, Rap)/ Shimmer (Local, apq3)	✓	
Unvoiced Frame	✓	
Intensity	✓	✓

Fundamental frequency (F0), reflects vibration of speed of vocal fold and determines the individual's sound (Zupan, Neumann, Babbage, & Willer, 2009). Formant is resonant on the sound path. There are an infinite number of format theoretically. but in practice, only the first 3 or 4 contains important informationFormantlar are defined with formant numbers as F1, F2 ve F3 (Rezaei & Salehi, 2006). Jitter, indicates the change between periods and contains the resulting involuntary irregularities. The periodic variation between amplitude peak is called as shimmer. Unvoiced frame shows the ratio of pauses during speech. Intensity shows the energy created as a result of the amplitude change in sound signal (Zupan et al., 2009).

In the evaluation of emotion recognition success, Support Vector Machine (SVM) classifier and WEKA (Hall et al., 2009) package program were used. SVM is a method based on statistical learning theory. The basic purpose is based on the principle of defining the function which best distinguished classes, in other words, the hyper-plane. It is one of the most widely used classifiers in SER systems in the literature.

Two groupings were made in order to dimensionally evaluate emotions, which are;

- Arousal-Negative (boredom, disgust, sadness, neutral) ve Arousal-Positive (anger, fear, happiness)
- Valence-Negative (anger, boredom, disgust, fear, sadness) ve Valence-Positive (happiness, neutral)

Results

Emotion recognition successes are realized in three different patterns, namely categorical, dimensional and categorical for each dimension. The categorical emotion recognition successes are given in Table 4.

Table 4. Categorical emotion recognition

	Happiness	Neutral	Anger	Sadness	Fear	Boredom	Disgust	AVG
Accuracy	56.3%	64.6%	84.3%	85.5%	60.9%	76.5%	37.0%	69.5%

The highest success in categorical emotion recognition is sadness and the lowest success is obtained in the emotion of disgust. The reason for such low success in disgust emotion is that its number in the entire data is few. Classification successes obtained for arousal and valence dimensions is given in Table 5.

Table 5. Dimensional emotion recognition

	Arousal Negative	Arousal Positive	Arousal AVG	Valence Positive	Valence Negative	Valence AVG
Accuracy	90.3%	92.9%	91.6%	12.7%	97.9%	74.0%

When the results given in table 5 are examined, it can be seen that the success of arousal dimensioning is higher compared to valence. The very low success in valence positive dimension is due to the fact that it consists of two emotions and the neutral emotion does not lead to essential change on the parameters. Table 6 gives the results obtained when emotions in each dimension of the dimensional structure are categorically classified.

Table 6. The categorical classification of emotions contained within the dimensional structure

	Arousal Positive			Arousal Negative			
	Happiness	Anger	Fear	Neutral	Sadness	Boredom	Disgust
Accuracy	56.3%	81.9%	69.6%	67.1%	87.1%	74.1%	71.7%

	Valence Positive		Valence Negative				
	Happiness	Neutral	Anger	Sadness	Fear	Boredom	Disgust
Accuracy	95.8%	93.7%	92.1%	90.3%	59.4%	86.4%	47.8%

When the results given in Table 6 are examined, even if the emotion recognition success is higher in arousal dimensional structure, valence is more successful in categorical classification of the dimensional structure. Table 7 gives the emotion recognition success rates according to the categorical and dimension-based categorical result.

Table 7. Emoton recognition accuracy according to the results categorical based on dimension and categorical

Emotions	Accuracy

	Categorical	Arousal-Categorical	Valence-Categorical
Anger	84.3%	81.9% ⇩	92.1% ⇧
Fear	60.9%	69.6% ⇧	59.4% ⇩
Boredom	76.5%	74.1% ⇩	86.4% ⇧
Disgust	37.0%	71.7% ⇧	47.8% ⇧
Happiness	56.3%	56.3% ⇔	95.8% ⇧
Sadness	85.5%	87.1% ⇧	90.3% ⇧
Neutral	64.6%	67.1% ⇧	93.7% ⇧
AVG	69.5%	73.3% ⇧	87.1% ⇧

According to Table 7, recognition success in some emotions is increasing in arousal-categorical structure whereas some others witnessed decline. In valence-categorical structure, only recognition success in the emotion of fear declines slightly whereas recognition success in other emotions increased considerably. When average success rates are examined, arousal dimensioning increased dimension-based categorical success slightly and valence dimensioning increased dimension-based categorical success considerably. These results show that usage of dimensional structure in emotion recognition provides considerable increase in the success of emotion recognition.

Conclusion

The emotional state of persons can cause changes in their physiological structures, which, therefore, is reflected on their voice. Sometimes the feelings of a person do not consist of a single emotion but a variety of emotions. In such cases effort is paid to perform dimensional analysis of the emotion and to increase the success rate of emotion recognition. Emotion recognition aims at determining the emotional state of a person by examining their speeches through signal processing methods. In this paper, categorical, dimensional and dimensional-categorical emotion recognition success rates in emotion recognition are examined. According to the obtained results, dimensional structure provided higher success compared to categorical structure. Dimensional-categorical structure increased the success rate obtained through each emotion considerably. In the light of these findings, higher success rates will be achieved by using valence dimensional structure followed by categorical structure for each dimension in emotion recognition.

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Comparison of Different Time and Frequency Domain Feature Extraction Methods on Elbow Gesture's EMG

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Abstract

Objective: In this study we will get EMG signals from arm for different elbow gestures, than filtering the signal and later classification the signal. The reason for doing is that, EMG signals are used for many rehabilitation and assistive prostheses of paralyzed or injured people. **Methods:**Filtering a biological signal is the key point for these type studies. Filtering the EMG signals needed and starts with the elimination of the 50 Hz mains supply noise. After filtering the signal, feature extraction will be applied for both wrist flexion and wrist extension cases. There are many feature extraction methods for time and frequency domain. After feature extraction, classification of hand movements will be studied using extracted features. Classification is made using K Nearest Neighbor algorithm. The dataset used in this study is acquired by the EMG signal acquisition tool and belong to us. **Results:**90 % accuracy performance is obtained by K Nearest Neighbor algorithm purposed signal classification. **Conclusion:**This system is capable of conducting the classification process with a good performance to biomedical studies. So,this structure can be helpful as machine-learning based decision support system for medical purpose.

Keywords: Elbow Gesture's EMG,Feature Extraction, Time and Frequency Domain.

1. Introduction

EMG signal is one of the main signals produced by the human body especially by the muscles. Although the results of electromyography are nonspecific electromyography is very sensitive [1]. EMG signal is widely used in many applications recently. The most active area of this application is prosthesis hand control. EMG signal also used for human-machine interface. EMG has advantages compare to other biological signals. Because EMG signals are powerful and have high signal to noise ratio.

2. Theory

2.1. EMG Data Acquisition

EMG signals are generated by the exchange of ions across the muscle membranes and detected with the help of electrodes as shown fig. 1.

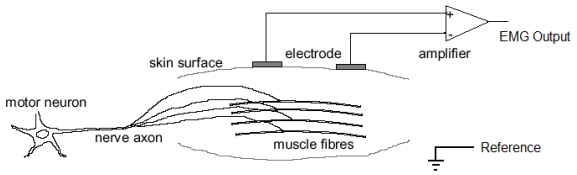

Figure 1. EMG acquisition from muscles [2]

Olimex Shield EKG/EMG device is used inorder to acquire EMG signals from arm. This device has one channel and 10 bit resolution. The sampling frequency of the device is 256Hz. This device amplifies the amplitude of the EMG which is acquired by the electrodes from skin surface of arm. The electrodes are disposable gelled silver-silverchloride(Ag-AgCl) type.

2.2. Filtering the EMG Data

Amplitude of the EMG signals vary between 0 to 10mV(peak to peak) or 0 to 1.5mV(rms). The meaningful signal is between 0 to 500Hz range[3]. Meaningful signals are those with energy above the electrical noise level. In order to get meaningful signal, filtering the EMG signal is very important. The most available noise signals in the EMG are AC mains power line noise and movement artifacts. So high pass filtering is necessary in order to eliminate low frequency movement artifacts(typically <10Hz)[4]. Notch filter is necessary for AC mains power line artifact removal. Also low pass filter can be used in order to remove high-frequency components to avoid signal aliasing.

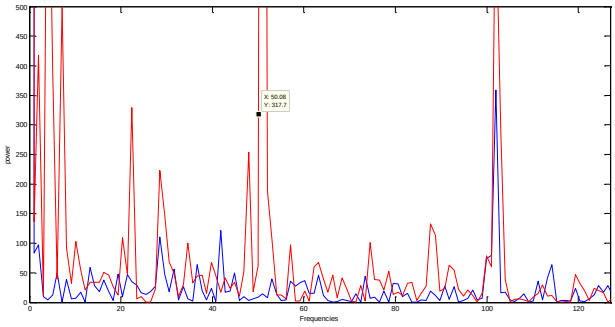

Figure 2. Raw and Filtered EMG Data

In figure 2 there is a plot of raw(red) and filtered(blue) EMG signal. According to plot there are dominant signals available at below 10Hz, at 50 Hz(also marked by data cursor) in red plot. These signals represent 50Hz power line interferenceand motion artifact interference(<10Hz). In blue plot these dominant signals are eliminated using 50 Hz notch filter and high pass filter.

2.3. Feature Extraction

Feature extraction is necessary for identifying the surface EMG signals. In this work two hand gestures will be identified. These gestures are as declared before wrist flexion and wrist extension as shown in fig 3.

Figure 3. Hand gestures [5].

Both flexion and extension gestures will be realized by muscles. Muscles will work different for two cases. We will get two different EMG signals. Sometimes when EMG signals are visualized the difference for two different gesture may be

observed by human eye. But the difference of two signal should be revealed by statistically or mathematically. In order to realize this signal must be handled in time domain and frequency domain. Table 1 shows the common feature extraction

methods for time and frequency domains.

Table 1. Time and Frequency Domain Features

Time Domain Features		Frequency Domain Features
Average Amplitude Change	Max. Fractal length	Amplitude of the first burst
Approximate Entropy	Multiple hamming windows	Critical exponent analysis
Autoregressive Coefficients	Multiple trapezoidal windows	Max to min drop in power density ratio
Box-Counting Dimension	Myopulse percentage rate	Frequency ratio
Cepstral Coefficients	Root mean square	Max. amplitude
Difference absolute stdev value	Sample Entropy	Median frequency
Detrended fluctation analysis	Skewness	Mean frequency
Higuchi's fractal dimension	Slope Sign Change	Mean power
Histogram	Simple square integral	Power spectrum deformation
Integral abs. value	Absolute temporal moment	Peak Frequency
Standard deviation	Variance	Power spectral density fractal dimension
Kurtosis	Variance Fractal Dimension	Power spectrum ratio
Log detector	v-order	Spectral moment
Modified mean abs val 1	Willison amplitude	Signal to motion artifact ratio
Modified mean abs val 2	Waveform length	Signal to noise ratio
Meanabs deviation	Zero Crossing	Total power
Mean abs val. slope	Mean	Variance of central frequency

In this work features used are written bold in the table1. As seen in table1. 17 features are used for feature extraction. 11 features are time domain features 6 features are frequency domain features.This statistical methods will identify the EMG signal for two class which are wrist flexion and wrist extension.

2.3.1.Time Domain Features

Time domain features are extracted from raw EMG signal so they are easy to implement. The easy implementation is an advantage of EMG signals but major disadvantage of time domain features comes from a non-stationary property of the EMG signal, changing in statistical properties over time, but time domain features assume the data as a stationary signal[6]. Time domain features are calculated from signal amplitude values, so much interference that is acquired through the recording come to be another disadvantage of these features.

a. Mean

Mean is the most common and easy implemented feature of the time domain. It only finds the mean of EMG amplitude values over sample length of the signal.

$$\text{mean}(\mu) = \frac{1}{N}\sum_{n=1}^{N} x_n \qquad (1)$$

b. Variance

Variance is also most common statistical method for time domain feature extraction.

$$\mathrm{var} = \frac{1}{N-1}\sum_{n=1}^{N}(\mathrm{x}_n - \mu)^2 \quad (2)$$

c. Standard Deviation

$$\mathrm{std}(\sigma) = \sqrt{\frac{1}{N-1}\sum_{n=1}^{N}(\mathrm{x}_n - \mu)^2} \quad (3)$$

d. Skewness

Skewness is measure of asymmetry of a signal or measure of third order cumulative[7].

$$skew = \frac{\frac{1}{N}\sum_{n=1}^{N}(X_n - \mu)^3}{\sigma^3} \quad (4)$$

e. Kurtosis

Kurtosis is measure of peakness of probability distribution or measure of fourth order cumulative.

$$kurt = \frac{\frac{1}{N}\sum_{n=1}^{N}(X_n - \mu)^4}{\sigma^4} \quad (5)$$

f. Mean Absolute Deviation

The average of the absolute deviations of data points from their mean[8].

$$\mathrm{MAD} = \frac{1}{N}\sum_{n=1}^{N}|x_n - ORT| \quad (6)$$

g. AR Coefficients

AR coefficients are popular feature extraction method for biological signals. AR modeling is getting an equation which fits the signal. AR modeling tries to model the signal by previous data points of the signal.

$$x[n] = -\sum_{k=1}^{p} a_k \, \mathrm{x[n-k]} + \mathrm{e[n]} \qquad (7)$$

Here p is degree of the AR model, $\mathrm{x[n]}$ is data signal which composed of n data points, $\mathrm{a_k}$ is real valued AR coefficients and $\mathrm{e[n]}$is white noise term which is independent from previous samples[9]. Choosing AR model order is an important issue. Because lower order of AR model cannot represent signal exactly, higher order of AR model overfit the signal and represent too much noise. In this work Akaike Information Criterion(AIC) is used in order to estimate optimal AR model order.

$$AIC(\rho) = \ln\left(\sigma_\rho^2\right) + \frac{2\rho}{N} \qquad (8)$$

Here ρ is model order, N is signal length and $\sigma_\rho^2$is variance of error array at order ρ.

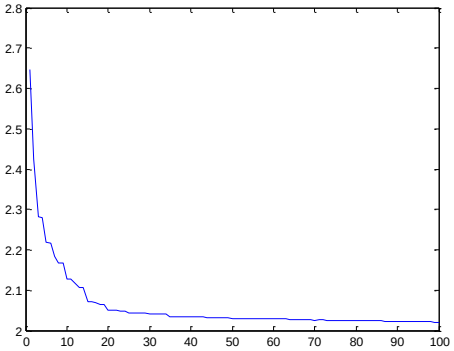

Figure 4. AR model selection criteria plot

According to plot of the AR order of EMG signal until 100th order, there is no change after 20th order of AR model as shown in fig. 4. So there is no need to use AR order more than 20th order. Much of the change is realized at orders until 10. Also some change after 10 to 20. So we can choose an order of between 10 and 20. In this work AR model order is chosen 13.

h. Waveform Length

Waveform length is a measure of complexity of the EMG signal. It is defined as cumulative length of the EMG waveform over the time segment.

$$WL = \sum_{n=1}^{N-1} |x_{n+1} - x_n| \qquad (9)$$

i. Zero Crossing

Zero crossing is a representation of frequency information of the signal at time domain. Zero crossing is count of thetimes that amplitude values of the EMG signal cross zero amplitude level. In order to eliminate voltage fluctuations or background noises, threshold can be used in the calculation.

$$ZC = \sum_{n=1}^{N-1} [sgn(x_n \times x_{n+1}) \cap |x_n - x_{n+1}| \geq threshold]; \quad (10)$$

$$sgn(x) = \begin{cases} 1, & if\ x \geq threshold \\ 0, & otherwise \end{cases}$$

j. Willison Amplitude

Willison amplitude also related with the signal frequency information in time domain.

$$WAMP = \sum_{n=1}^{N-1} [f(|x_n - x_{n+1}|)]; \quad (11)$$

$$f(x) = \begin{cases} 1, & if\ x \geq threshold \\ 0, & otherwise \end{cases}$$

g. Slope Sign Change

It is a count of number of times that slope of the EMG signal sign change. This feature is a method for representing frequency information of the EMG signal. Threshold is used in order to eliminate background noise of the EMG signal. The mathematically expression of slope sign change is like below.

$$SSC = \sum_{n=2}^{N-1} [f[(x_n - x_{n-1}) \times (x_n - x_{n+1})]]; \quad (12)$$

$$f(x) = \begin{cases} 1, & if\ x \geq threshold \\ 0, & otherwise \end{cases}$$

2.3.2. Frequency Domain Features

Frequency domain features are extracted widely using Power Spectral Density(PSD). In this work Periodogram is used in order to estimate Power Spectral Density. 6 frequency domain features are extracted from PSD and their mathematical definitions are given below.

a. Mean Frequency

Mean frequency is an average frequency which is calculated as sum of product of the EMG power spectrum and the frequency divided by total sum of the spectrum intensity[5].

$$MNF = {\sum_{j=1}^{M} f_j P_j} \Big/ {\sum_{j=1}^{M} P_j} \quad (13)$$

Here, f_j is frequency of spectrum, P_j is EMG power spectrum and M is the length of the frequencies.

b. Median Frequency

Median frequency is a frequency at which the spectrum is divided into two regions with equal amplitude.

$$\sum_{j=1}^{MDF} P_j = \sum_{j=MDF}^{M} P_j = \frac{1}{2}\sum_{j=1}^{M} P_j \quad (14)$$

c. Maximum to Minimum Drop in Power Density Ratio

Maximum to Minimum Drop in Power Density Ratio is the ratio of the highest mean power density value and lowest mean power density value, with a frequency band user defined.

d.Signal to Noise Ratio

Signal to Noise Ratio is a ratio of the signal power and noise power[10]. The signal power and noise power are estimated separately.

e. Power Spectrum Deformation

The Power Spectrum Deformation ratio is sensitive to changes in spectral symmetry and provides a indication of spectral deformation [10].

$$\Omega = \frac{\sqrt{M_2/M_0}}{M_1/M_0} \quad (15)$$

M_n is the n^{th} spectral moment defined as:

$$M_n = \sum_{i=0}^{i_{max}} P_i f_i^n \quad (16)$$

Here $P_i$is the power spectral density value at frequency f_i.

f. Signal to Motion Artifact Ratio

As stated before motion artifact is low frequency artifact ofEMG signals. They are below 20Hz. The signal to noise artifact ratio was computed as a ratio of the sum of all power densities for frequencies below 600Hz and the sum of all power densities that exceed a straight line between the axis origin and the highest mean power density value, with a frequency above 35Hz[10].

2.4. EMG Signal Classification

After features are extracted from both time and frequency domains the EMG signals belong to elbow gestures are ready for classification. There are many classification algorithms are available. The most common classification algorithms are K-Nearest Neighbor Algorithm(KNN), Linear Discriminant Analysis(LDA), Artificial Neural Networks(ANN) and Support Vector Machines(SVM). In this work KNN algorithm is used because of its robustness and easy application.

2.4.1.K-Nearest Neighbor Classification Algorithm

KNN algorithm is one of the most common used algorithm in classification problems. Distances of one of the test class sample to all samples in the training class are calculated. Shortest distance of the training sample gives the class of the test sample. Assume two featured, two class of samples belong to A class and B class and assume one test sample like below. Nearest neighbor to X is belong to A training sample, so we can say X belong to A class.

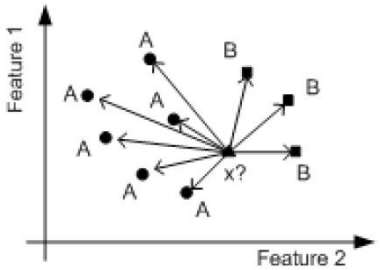

Figure 5. K-nearest neighbor algorithm[9].

Euclidian theorem is commonly used theorem for distance calculation in the KNN algorithm as shown in fig. 5. Distance between two pointsis calculated by Euclidian theorem like below.

$$d_E(p,q) = \sqrt{\sum_{i=1}^{R}(p_i - q_i)^2} \quad (17)$$

Here R is feature quantity. KNN classifier takes consideration of k number of nearest neighbor and uses majority rule. K is commonly small and odd number. Bigger k helps to reduce the impact of noisy samples but increases de calculation difficulty. The impact of the k is explained below.

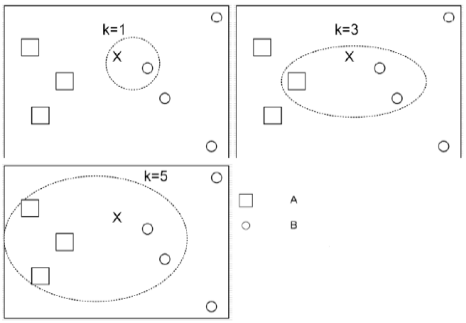

Figure 6. K- selection criteria[9]

In the example in fig. 6 when k=1 x is classified as it belong to class B, when k=3 and k=5 x is classified B and A respectively. This should be noted that k should be chosen like k=3. Because optimal k should be chosen $\sqrt{N}$ here N=7, and $\sqrt{7} \cong 3$.

3. Results and Conclusion

Using 17 features of the two classes of hand gestures (one for elbow flexion and elbow extension) EMG signals are classified separately from eachother by K-NN classification algorithm. The classification accuracies of the each feature are given in the table below. Here classification accuracies are the count of true classified pattern number in 100 pattern.

Table 2: Feature performances

Time Domain Features		Frequency Domain Features	
Feature	**Performance**	**Feature**	**Performance**
AR	93%	mtom drop	45%
std	81%	median fre.	83%
kurtosis	74%	mean freq.	65%
meabdev	83%	PSD	50%
skewness	72%	SMR	61%
slp.sgn.ch	49%	SNR	35%
var	79%		
wamplitude	71%		
wflength	80%		
zerocrossing	58%		
mean	91%		

According to table 2 the most successful features in time domain is Auto Regressive Coefficients(AR) and mean, median frequency is the most successful feature in time domain.

4. Acknowledgement

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Utilization Trends of Endocrine Therapies for Breast Cancer in Albania During 2004-2014

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Abstract

Aim: To evaluate the patterns of use of the out-of-hospital endocrine therapies for breast cancer in Albania during the period 2004-2014. Methods: The study was retrospective and we analyzed the prescription and consumption of these drug classes in the primary health care in Albania during 2004-2014. All data were collected from Health Insurance Institute (HII)(1) and analysed reflecting the ambulatory and outpatient use for the period 2004-2014. The data about the consumption of drugs were expressed as a number of Defined Daily Dose (DDDs) /1000 inhabitants/day. Utilization was measured in DDD/1000 inhabitants/day and was also compared with breast cancer morbidity/1000 inhabitants, to understand the covering of the population from the reimbursement scheme. For all the period under study 2004-2014, there were collected and analysed the data of import and domestic production of drugs, which altogether represent the real consumption of drugs in the country. These data were subsequently included in a comparative analysis with the utilization data according to the HII. Results: The drug with the highest values of consumption is Letrozole 0.05-0.37 DDD/1000 inhabitants/day2004-2014). Anastrazole was introduced to the scheme in 2008. Its consumption in2014 was 0.26 DDD/1000 inhabitants/day. The consumtion of Tamoxifen is reduced through these years with values 0.32-0.17 DDD/1000 inhabitants/day respectively 2004-2014. Breast cancer morbidity data indicate that there does exist a correlation statistically significant between this disease and the trend of consumption of endocrine therapies drugs (p = 0,0009) Conclusions: It is evident that a non-small part of the patients remain untreated under the scheme. There is noted a shift in use of endocrine therapy from tamoxifen to aromatase inhibitors. This trend is consistent with major international clinical guidelines that recomend preferential use of aromatase inhibitors in post-menopausal women.

Keywords: Drug utilization, DDD, endocrine therapies, breast cancer

Introduction

Breast cancer is the leading cause of cancer deaths in women around the world, with approximately 522 000 women dying of the disease in 2012.(2)

Hormonal therapy, also called endocrine therapy, is an effective treatment for most tumors that test positive for either estrogen or progesterone receptors (called ER-positive or PR-positive), in both early-stage and metastatic breast cancer. This type of tumor uses hormones to fuel its growth. Blocking the hormones can help prevent a cancer recurrence and death from breast cancer when used for early-stage disease either by itself or after adjuvant or neoadjuvant chemotherapy.

Tamoxifen. Tamoxifen is a drug that blocks estrogen from binding to breast cancer cells. It is effective for lowering the risk of recurrence in the breast that had cancer, the risk of developing cancer in the other breast, and the risk of distant recurrence. Tamoxifen is also an effective treatment for metastatic hormone receptor-positive breast cancer. **Aromatase inhibitors (AIs).** AIs decrease the amount of estrogen made by tissues other than the ovaries in postmenopausal women by blocking the aromatase enzyme, which changes weak male hormones called androgens into estrogen when the ovaries

have stopped making estrogen during menopause. These drugs include anastrozole, letrozole, and exemestane. All of the AIs are pills taken daily by mouth. Treatment with AIs, either alone or following tamoxifen, is more effective than tamoxifen alone at reducing the risk of recurrence in post-menopausal women. AIs are also an effective treatment for metastatic hormone receptor positive breast cancer. Women who have gone through menopause and are prescribed hormonal therapy have several options: start therapy with an AI for up to 5 years, begin treatment with tamoxifen for 2 to 3 years and then switch to an AI for 2 to 3 years, or take tamoxifen for 5 years then switch to an AI for up to 5 years, in what is called extended hormonal therapy. Recent research has shown that taking tamoxifen for up to 10 years can further reduce the risk of recurrence following a diagnosis of early-stage breast cancer, although side effects are also increased with longer duration of therapy.

Premenopausal women should not take AIs, as they are not effective. Options for adjuvant hormonal therapy for premenopausal women include the following:

Five or more years of tamoxifen, with switching to an AI after menopause begins

Either tamoxifen or an AI combined with suppression of ovarian function.

Objective, Materials and Methods

Objective:

To assess the out-of-hospital endocrine therapiesfor breast cancer use in Albania during the period 2004-2014.

Materials and Methods:

The data were obtained from the HII. All data were collected for the period 2004-2014 and analyzed.

The analysis included, the total number of prescriptions made, and quantities of drugs used.

The data about the population were obtained from the Institute of Statistics (INSTAT)(3). The data about the consumption of drugs were expressed as a number of Defined Daily Dose (DDDs)/1000 inhabitants/day. All drugs were classified by groups of Anatomic Therapeutic Chemical Classification (ATC).

Data on the levels of morbidity

From the database of HII there were extracted the general number of patients reported for each diagnose, for each year. Following, there were calculated the respective levels of annual morbidity (based on the respective code-diagnoses) for 1000 inhabitants.

Data on real consumption (import and domestic production)

For all the period under study 2004-2014 there were collected and analysed data from the import and domestic production of the drugs,(4) which represent the real consumption of drugs in the country. It was noted that the increase in consumption from one year to another was small, e.g. the consumption from 2010 to 2014 (i.e. 4 years) was increased by only 2.98%. Consequently, in order to obtain an updated study, there were chosen the data of import and domestic consumption only for the last three years, 2012, 2013, 2014, and those were involved in a comparative analysis with the equivalent consumption data according to HII. In order to minimize the effect of variations between consumption and stock inventory balances from one year to another, it was calculated and put to analysis the annual average value of the three chosen years (on one hand that of the import and domestic consumption, and on the other hand that of HII).

Presentation of the results and statistical elaboration. The database of HII was modified in Microsoft Office Excel 2007, whereas the statistical elaboration of the obtained results was conducted with the statistical package StatsDirect (version 2.7.2.). A descriptive statistics was used to report all data on drugs consumption and the results obtained were displayed in tabular form as well as through the histogram method.

Average annual values of consumption in the country level and for each district were used as a basis to generate the overviews and the graphics that illustrate the trends of consumption for each class of drugs during the 8-years period 2004-2014. The linear regression model was used to evaluate the trends of consumption of drugs relative to the time. A value of $p \leq 0.05$ was considered as significant.

In order to asses if there exists a correlation statistically significant between the level of consumption of drugs and the level of morbidity, it was applied the Spearman correlation (with a significance level of ≤ 0.05).

Results

The drug with the highest values of consumption is Letrozole 0.05-0.37 DDD/1000 inhabitants/day2004-2014). Anastrazole was introduced to the scheme in 2008. Its consumption in2014 was 0.26 DDD/1000 inhabitants/day.

The consumtion of Tamoxifen is reduced through these years with values 0.32-0.17 DDD/1000 inhabitants/day respectively 2004-2014.

Breast cancer morbidity data indicate that there does exist a correlation statistically significant between this disease and the trend of consumption of endocrine therapies drugs (p = 0,0009) (Figure 1).

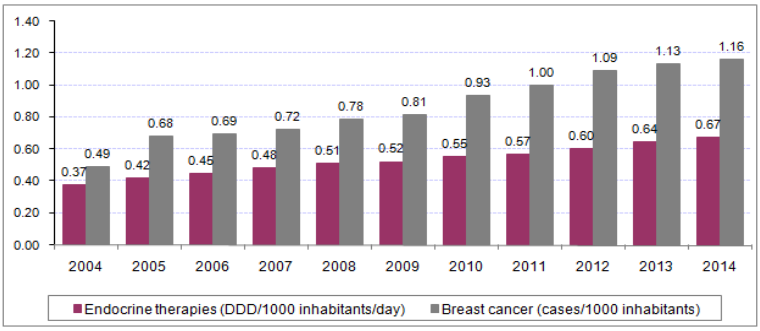

Figure 1 Consumption of Endocrine therapies drugs at the national level (DDD/1000 inhabitants/day) versus breast cancer morbidity (cases/1000 inhabitants);

(p = 0,0009; correlation coeficient is statistically significant)

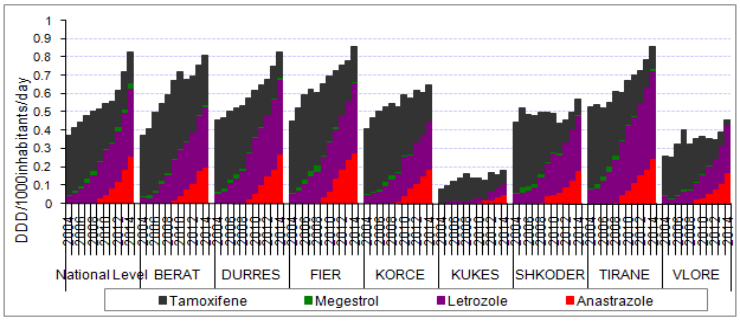

Figure 2 Consumption of endocrine therapies drugs in different regions and at the national level (DDD/1000 inhabitants/day).

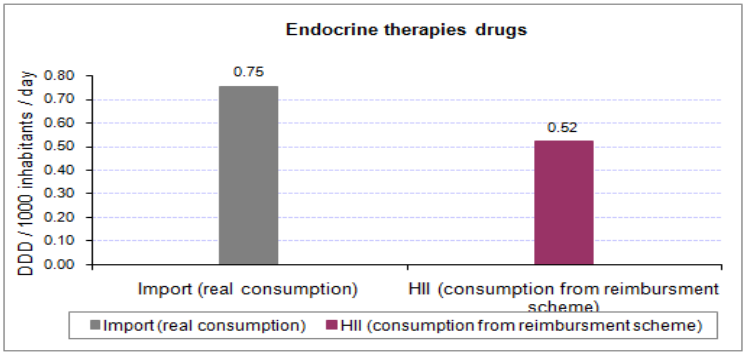

Figure 3Annual average value of consumption of total Endocrine therapies drugs: consumption based on import (real consumption) [*] versus consumption based on HII.

[*] The "Import" item includes the consumption based on import data as well as the consumption based on domestic production: this represents the factual consumption.

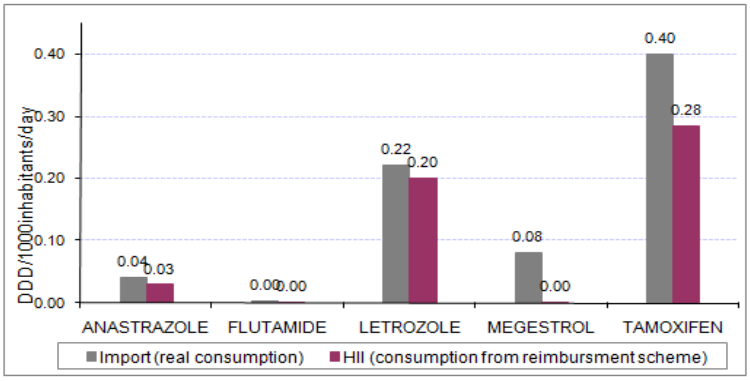

Figure 4 Annual average value of consumption of each Endocrine therapie drug: consumption based on import (real consumption) [*] versus consumption based on HII.

[*] The "Import" item includes the consumption based on import data as well as the consumption based on domestic production: this represents the factual consumption.

Discussion

It results that the increase in consumption of the anti-tumour drugs goes in line with the data on breast cancer morbidity, but in lower values. Particularly in recent years, the difference has become deeper, indicating that a non-small part of the patients remain un-treated.

One possible reason for this situation may be the delayed diagnosis of the disease, in an advanced phase. This phase may coincide with the passage from the hormonal therapy to classic cytostatic drugs, or with the preliminary termination of the treatment due to lethal complications of the base disease.Another reason may be the delayed inclusion of anastrazole under the scheme (only after 2008).

The breast cancer at females consists in a major public health problem due to the number of patients affected by this disease. The incidence of breast cancer increases with aging and around 80% of the cases with breast cancer appear at women of over 50 years old (5). Around 30% of all malignant tumours at females pertain to breast cancer, thereby causing

a more frequent tumoural diagnosis (6). After determination of the diagnosis, the prognosis and the choice of the protocol treatment depend on the progress level of the disease. Approximately 2/3 of the women with this diagnosis have positive tumour receptors to oestrogens. The aim of the therapy is to deter the growth of tumour cells by inhibiting the estrogenic proliferative stimulus. The ovarian inhibition and the treatment with tamoxifen has demonstrated an improvement of the 5-year survival rate even in cases where the condition or type of the estrogenic receptors is not known (7). Tamoxifen is indicated for the treatment of breast cancer at the preliminary and ER+ advanced phase (with 'oestrogen receptor-positive' invasive breast cancers) in the females at pre- and post-menopause (8). Differently from the females in pre-menopause, in which oestrogen is produced in ovaries, in women in post-menopause it is produced as a result of the action of aromatase enzyme in peripheral tissues of the body. Given that in the majority of cases breast cancer responds to estrogenic stimulation, the decrease of its production in the tumour tissue (e.g. breast adipose tissue) through inhibitors of aromatase enzyme (anastrazole, letrozol, exemestan) has been proved effective in the treatment of hormone-sensitive tumours at women in post-menopause(9).

With the aim to obtain a better understanding of the situation, the consumption data based on import were included in the analysis by comparing them with the consumption data based on HII. As a general rule, this group of drugs get reimbursed 100%, hence it is expected that the import data are in line with the consumption data based on HII (Figure 3, Figure 4). However, as it can be understood from the analysis obtained, a significant part of the patients are treated outside of the scheme. Around 30% of the consumption of anastrazole, tamoxifen and the whole class in its entirety occurs outside of the scheme. We can obtain the expected matching between the real consumption of anti-cancer drugs and the morbidity data, only by including these values.

The consumption of anti-tumoural medicaments has increased, although in minor values, in all the regions under study within the period 2004-2014 (Figure 2). The minimum values of consumption of these medicaments appear in Kukes, and then Vlora and Shkodra. Whereas, the maximum consumption values are noticed in Berat, followed by Fier, and then Tirana and Durres. In the majority of regions, we note the progressive decrease in the consumption of tamoxifen, against the increase in consumption of and anastrazole, which is in line with the recommendations of therapeutic guides and the literature. The regions of Berat, Kukes and Vlora represent an exception, thereby indicating the lack of adherence of doctors to therapeutic guides and reflecting probable lack of update of information and therapeutic knowledge. Other reasons may be the poor social-economic standard of the women-patients in these regions, the low level of access of these patients to the medical system, the poor coverage by specialist doctors, as well as reduced diagnostic skills.

At the national level, the consumption of these medicaments shows an increase of 79,37% (0,37-0,67 DDD/1000 inhabitants/day, 2004-2014). Nevertheless, this increase results low, as it does not match with the data of morbidity of breast cancer, which show an increase of the disease of 137,78% (0,49-1,16 cases/1000 inhabitants).

As regards the prescription tendency (DDD%), there can be noted that the medicament most described is tamoxifen, which however, incurs a decrease in the period under study: from 85,92% in 2004 to 35,23% in 2014. The decrease in prescription of tamoxifen is in line with the literature and clinical studies conducted, which indicate a reduced efficacy of tamoxifen versus an increased risk from its usage after 5 years of therapy.

Meanwhile, we find an increase of prescription in enzymatic inhibitors: anastrazole and letrozole. Anastrazole included in the list of 2008, occupies the first place as regards the increase in prescription: 1,05%-9,20%, 2008-2014. Whereas, letrozole, which appears in the list since 2004, is characterised by a prescription in higher amounts but with a lower increase: 12,61%-44,38%, 2004-2014.

This increase in the prescription of aromatase inhibitors goes in line with therapeutic guides, according to which:

For women in post-menopause with breast cancer, tamoxifen remains the treatment chosen as adjuvant initial therapy. In case of presence of counter-indications relative to its consumption (high risk for thromboembolic, or endometrial disorders), or in case of intolerance, the medicament needs to be substituted with an aromatase inhibitor;

For patients in post-menopause, it should be considered the change of therapy towards an aromatase inhibitor after 2, 3 or 5 years of treatment with tamoxifen.

For women in post-menopause at an advanced phase of the disease, it should be considered right at the beginning the initiation of treatment with medicaments of the III-d generation of aromatase inhibitors, before the usage of tamoxifen, or of megestrol acetat(10).

Conclusions

As a result, the increase in consumption of anti-tumoral drugs goes in line with the breast cancer morbidity data, but in lower values. Particularly in recent years, the difference becomes deeper and it is evident that a non-small part of the patients remain un-treated under the scheme.

There is noted a shift in use of endocrine therapy from tamoxifen to aromatase inhibitors. This trend is consistent with major international clinical guidelines that recommend preferential use of aromatase inhibitors in post-menopausal women.

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Declaration of authorship: Laerta Kakariqi contributed to the data acquisition, study conception

and design, performed statistical analyses. Eduard Kakarriqi contributed by critically revising the manuscript.

The Authors declare that there is no conflict of interest.

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Study of the Effective Factors on Air Pollution in Iran Cities

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Abstract

Nowadays, air pollution in cities with regard to its harmful outcomes has been turned in to one of the serious challenges in urban management. Carbon dioxide emission is one of the most principal factors in the environmental pollution, the world efforts are concentrated to reduce it due to its devastating effects on climatic change and global warming. In the current research, the effective factors on air pollution in Iranian cities were studied, considering CO2 emission level as the pollution index in the period 1993-2013 and for analyze effective factors, econometrics models were applied. The research findings demonstrated, with increase per capita income and Urbanization rate, air pollution, has been increased. Also Study of the effective factors on cities air pollution in Iran showed that per capita oil and natural gas products consumptions have a significant positive effect on CO2 emission while per capita natural gas consumption had a more important effect (4.04% compared to 3.4%). Therefore, important sources of energy in Iran, which oil and natural gas products, were found as the most dominant factors in air pollution. Thus, the necessity of current energy carriers' replacement by clean energy sources as solar energy and geothermal energy is emphasized.

Keywords: Air pollution, Fossil fuels, Greenhouse gases.

Jel cod: Q56, R4, C22

1-Introduction

In the recent decades, environmental issues have been among the important challenges in the national and global policies due to the increased greenhouse gas emissions. Greenhouse gases increase such as CO_2 led to the phenomena as climatic change, global warming, depletion of ozone shield, and melting polar ice sheets. However, the effects of greenhouse gases increase as NOX, CO, and SO_2 are observed in the national and regional scales like acidic rain, sanitary and hygienic dangers to human being and other creatures, the effects of CO_2 emission is considered on the global scale. International seminars and protocols like Rio conference, Kyoto protocol, and Copenhagen summit all indicate the importance of this issue in the entire world and account for the efforts to make policies in order to control global warming and climatic change – which greenhouse gases increase have had a significant role and among them, CO_2 is the most important one (Karbasi & Rahimi, 2000:2). According to the World Bank reports of the environmental pollutants causing climatic change, 76% of the total greenhouse gases were allocated to carbon dioxide in 2010. CO_2 emission had a rising trend in Iran as well and has been increased from 302 million tons in 2001 to 587 million tons in 2013; while carbon dioxide share among all the polluting and greenhouse gases was 98%.(E.B.S,2013)

In accordance with Kyoto protocol, Iranian government is obliged to reduce the total carbon dioxide gas emission. The extensive energy consumption and utilization of fossil fuel in various economy sectors are the major reasons of greenhouse gas emission.

The urban lifestyle and consumption patterns in large cities enhance energy resource usage in a higher amount than other smaller cities. As cities are developed and enriched, the demand for urban infrastructure, transportation, and individual resource use all grow; consequently, the challenges regarding the energy consumption and pollution emission are emphasized (Pomny & Kaniko, 2010).

Carbon dioxide is considered as the indicator of environmental pollution due to its particular importance in air pollution and intensification of global warming in most of the experimental studies. CO_2 emission and global warming resulted in climatic change which might pose noticeable risks to physical infrastructure, city societal context, and safety of societies; therefore, the research objective is to investigate the effective factors on air pollution of cities in Iran based on CO_2 emission indicator.

2- Literature review and research background

According to the definition by the superior council of environmental protection, air pollution involves existence of one or several pollutants in the open air in such an amount and duration that changes the air quality so that it dangers human being and other creatures' lives, plants, as well as built environment. Public transportation services, thermo-electric power plant, domestic, agricultural, and fishery industries are the air pollution sources.

There are plenty of evidences of the positive correlation between energy consumption and improvement of economic macro variables. Improvement of the economic macro variables leads to pollution spread due to energy consumption increase. Gross domestic product, is one of the significant economic variables considered as an indicator for the economy growth measurement. The correlation between economic growth and environmental pollution in the last two decades has been widely analyzed by statistical methods.

The practical framework for the aforesaid evaluation is based on the Environment Kuznets Curve (EKC) theory which reveals the correlation between environmental index and the per capita income. According to this theory stated by Grossman and Krueger (1991) and became known by the global development report of the world bank in 1992, the correlation between per capita income and environment deterioration indices is an inverse U. Based on this theory, the correlation between economic growth and environmental quality, either positive or negative, is not constant along the country's development; in the beginning, pollution increases due to per capita income increase, but it later decreases after reaching a specific level of per capita income. Indeed, as a country arrives at a situation that the demands for a cleaner environment are enlarged and the efforts to achieve more efficient infrastructure broadens, the sign of correlation alters from positive to negative (Nasrollahi & Ghaffari goolak, 2010:79).

There are two viewpoints regarding urbanization development effects; the first one declares that the economy structure changed from agricultural basis to industry due to urbanization growth and thus pollution has increased. Although air pollution is attributed to automobile traffic and industrial pollution, another significant factor particularly in large cities is related to nonstandard construction systems and high-rise buildings in downtown and suburbs which block the natural wind paths and accumulate pollutants. The second viewpoint believes that urbanization leads to more efficient infrastructure, transportation system and energy; consequently, energy consumption efficiency in cities is higher than rural areas and pollution decreases. Hence, the correlation between urbanization and environmental pollution might be positive or negative (Alam et al., 2007).

Several experimental studies in term of effective factors on air pollution in different countries were carried out as follows:

Alam et al. (2007) investigated the correlation among economic growth, energy intensity, CO_2 emission, population rate, and urbanization in Pakistan by data derived in 1971-2005. The findings demonstrated that increment of 1% in gross domestic product results in 0.84% increase in carbon dioxide emission; while increment of 1% in energy intensity causes 0.24% increase in carbon dioxide emission. In addition, urbanization development and population growth have significantly made pollution emission, however these two factors decrease economic growth in a long term scale.

Say and Yucel (2006) studied the correlation between energy consumption and CO_2 emission in Turkey in the period 1970-2002. For this purpose, the total energy consumption was estimated by means of economic growth and population growth which are two major factors in energy consumption of developing countries; then, the correlation between total energy consumption and CO_2 emission was evaluated by regression analysis. The results indicate a strong correlation between energy consumption and CO_2 emission.

Schipper et al. (2009) studied the impacts of transportation sector on carbon dioxide emission in Asian developing countries in 2000 and 2005. It was found out that transportation-related CO_2 emission in the developing countries has a greater share compared to the global CO_2 emission. Heavy vehicles as trucks consume a large amount of fuel and emit more CO_2 than light-weight vehicles; so, CO_2 emission might be directly decreased by transportation system in the development of urban and rural areas.

Gaeser and kahn (2010) in a research entitled as "City greenness: CO_2 emission and city development" have analyzed cities development and CO_2 emission in various regions across US in 2000. According to the findings, the lowest CO_2 emission was related to California; while the highest CO_2 emission was observed in Texas and Oklahoma. Besides, there

is a negative correlation between emissions and land use regulations. In general, CO_2 emission is considerably lower in cities compared to suburbs.

Arouri et al. (2012) in a paper entitled as "energy consumption, economic growth, and CO_2 emission in middle-east and North African countries" have investigated the correlation between CO_2 production, energy consumption, and gross domestic product on twelve middle-east and North African countries in the period 1981-2005. A positive correlation was found between non-renewable energy consumption and CO_2 production.

Sebri and Salha (2013) in a study regarding BRICS countries (including Brazil, Russia, India, China, and South Africa) in 1971-2010, found a long-term correlation among economic growth variables, renewable energy consumption, trade openness, and CO_2 emission.

Akpan and Abang (2014) surveyed the correlation between environmental quality and economic growth in 47 countries in the period 1970-2008. The findings demonstrated that economic growth, energy price, export to gross domestic product ratio, and energy consumption have a significant positive effect on CO_2 emission; while population growth and import to gross domestic product ratio showed a significant negative effect on the pollution.

Shafiei and Salim (2014) in a paper named as "renewable/non-renewable energy consumption and CO_2 production in OECD countries" studied the effective factors on CO_2 production in these countries in the period 1980-2011. The results denote that CO_2 production is decreased by renewable energy consumption whereas non-renewable energy consumption increases greenhouse gas production.

Begum et al. (2015) investigated the dynamic effects of gross domestic product, energy consumption, and CO_2 emission in Malaysia. The research findings have not confirmed the Environment Kuznets theory. Study of the destructive effects of economic growth on CO_2 emission in long term has been one of the important results of this study.

Asgari and Mohammadi (2016) studied Intra industry trade on air pollution in Iran applying data panel and various industries data in the period 1980-2014. The effects of Intra industries trade in the air pollution in Iran were found to be positive.

4- Data and model prediction

As seen in Table 1, CO_2 had the greatest portion among all polluting greenhouse gases in Iran in 2009-2013; as its value increases from 492 million tons in 2007 to 587 million tons in 2013.

Table 1.

The diffusion of pollution gases from production and consumption energy in Iran 2007-2013

(Ton)

Year	Co	Nox	So_2	Co_2
2007	8456502	1378957	1424973	492264957
2008	8973628	1808553	1598617	523293617
2009	8651070	1836265	1678078	538527894
2010	201223	1805823	1355656	532324843
2011	8033989	1843831	1425800	547014571
2012	8523752	1861374	1540500	556866442
2013	9136589	1946838	1612823	587445727

Source: Energy balance sheet, Ministry of power, I.R.I , 2013.

In total, the highest energy consumption in different sectors in Iran was related to oil and natural gas products (about 90%); and according to Table 2, oil products consumption has been decreased while natural gas consumption has been

increased during the time; however, urbanization rate has been rapidly developed in Iran and has reached more than 70% nowadays according to statistical center of Iran.

Table 2.

Energy carriers' consumption in domestic, public, commercial, industry, transportation, and agriculture sectors in the period 2006-2013 (million tons petroleum)

Year	Oil products[11]		Natural gas products		Electricity	
	Domestic, Public, Commercial, Industry, Transportation	Agriculture	Domestic, Public, Commercial, Industry, Transportation	Agriculture	Domestic, Public, Commercial, Industry, Transportation	Agriculture
2006	56.2	3.6	50.7	0.1	10.1	1.4
2007	56.4	3.6	59.6	0.2	10.71	1.4
2008	57.1	3.8	59.6	0.2	11.22	1.7
2009	57.2	3.9	65.2	0.3	11.82	1.7
2010	50.7	3.9	70.7	0.4	12.72	1.9
2011	46.9	3.9	78.2	0.5	12.53	2.4
2012	47.7	3.3	76	0.7	13.23	2.5
2013	48.7	3.2	80.4	0.9	13.53	2.7

Source: Energy balance sheet, Ministry of power, I.R.I , 2013

If energy consumption by domestic, public, commercial, industry, and transportation sectors is assumed as an indicator of urban consumption and energy consumption by agricultural activities as an indicator of rural consumption, it is observed that the highest energy consumption and pollution were attributed to cities in the period 2006-2013.

Fossil fuels amount and portion in CO_2 emission in 2013 are presented in Table 3. As it is seen, the highest share in CO_2 emission was allocated to natural gas.

Table 3.

Fossil fuel amount (Ton) and share (%) in CO2 emission in 2013.

	Liquid gas	Petrol	Kerosene	Gas oil	Fuel oil	Natural gas
Quantity	8335319	59460393	10695282	114314426	74171027	304924289
Percentage	1.42	10.12	1.82	19.46	12.63	51.91

[1] These products comprise liquid gas, petrol, kerosene, gas oil, and fuel oil.

Source: Energy balance sheet, Ministry of power, I.R.I, 2013.

An econometrics model derived by Alam et al. (2007) was utilized in order to investigate the effective factors on air pollution and measuring their impacts which is expressed as:

$$PERCO2 = f(PERI, SHE, URB) \quad (1)$$

Where:

$PERCO_2$: per capita CO_2 emission (Ton per person)

PERI: per capita income (constant in 2004)

SHE: energy consumption intensity (ratio of final energy consumption to gross domestic product)

URB: urbanization rate (ratio of urban population to total population)

It should be noted that other variables like per capita oil product consumption and level of industrialization (added value of industry sector out of gross domestic product) were also applied in the model which at last were omitted from the final model due to lack of statistical credit.

The data regarding the variables is in the form of annual time series in the period 1993-2013. In order to avoid the false regression estimations, the statistics of variables must be investigated before model prediction. Augmented Dicky Fuller test (ADF) has been utilized to determine the Stationary of variables.

As seen in Table 4, all variables are static (I(0)) and allow for the model prediction by OLS method.

Table 4.

Report of variables stationary

Variable		ADF statistics	Critical value in surface			Statistical condition
			1 %	5 %	10 %	
Per capita carbon dioxide	$PERCO_2$	2.58	- 2.68	- 1.95	- 1.61	I(0)
Real per capita national income	PERI	1.79	- 2.75	- 1.97	- 1.6	I(0)
Energy consumption intensity	SHE	- 4.65	- 3.8	- 3.02	- 2.65	I(0)
Urbanization rate	URB	- 4.52	- 3.8	- 3.02	- 2.6	I(0)

Source: research findings.

The regression estimation of equation (1) is as follows:

$PERCO_2$= -15/3 C +0/0001 PREI+0/003 SHE+27/8 URB + 0/66 AR (1)

t : (-2/6) (2/45) (0/54) (3/0) (5.1)

R_2=0/96 F=82/47 D.W.=1/66

As shown by the abovementioned findings, all variables (except for Y-intercept (C)) had a positive effect on the dependent variable and 96% of dependent variable changes is explained by independent variables changes, AR(1) is applied for removal the autocorrelation problem of variabes. According to F statistics, total regression has statistical validity.

The coefficient of real per capita national income (PERI) demonstrated that increment of 1% in the considered variable causes an increase of 0.0001% (averagely) in per capita CO_2 emission and holds a high statistical credit. Therefore, according to the Environment Kuznets Curve (EKC) - which expresses the correlation between the environmental indices

and per capita income - the pollution amount has been increased due to the per capita income increase in the studied period in Iran as a developing country.

The coefficient of energy consumption intensity (SHE) indicates that increment of 1% in the considered variable ends in an increase of 0.003% (averagely) in per capita CO_2 emission; however, this variable does not provide the sufficient statistical credit.

Urbanization rate (URB) is realized as the highest coefficient; in other words, per capita CO_2 emission increases by 28% (averagely) as increment of 1% occurs in the coefficient; it also has a high statistical credit. As mentioned earlier, numerous viewpoints look differently regarding the effect of this variable on air pollution and are dependent on the urban development structures. This phenomenon has considerably led to air pollution and CO_2 emission in Iran.

Effects of the final consumption of major energy carriers on CO_2 emission in Iran - in order to evaluate effective factors on air pollution in cities - were estimated according to the model below (assuming energy carriers consumption in domestic, commercial, industry, and transportation sectors are related to urban areas):

$$PERCO2 = f(PERFO, PREGA, PERBA) \quad (2)$$

Where:

$PERCO_2$: per capita CO_2 emission (Ton per person)

PERFO: per capita oil product consumption

PERGA: per capita natural gas consumption

PERBA: per capita electricity consumption

After the augmented Dicky Fuller test was carried out to investigate the variables Stationary (the results are shown in appendix), the estimated regression is derived:

$PERCO_2$=1/3 C +3/4 PREFO+4/04 PERGA (-1)-10/03D (PERBA (-1)) + 0/34 AR (1)

t : (2/05) (2/9) (10/35) (-0/96) (1/25)

R_2=0/97 F=117/8 D.W. =1/8

By abovementioned findings, 97% of dependent variable changes is explained by independent variables changes. As it was predicted and shown above, per capita oil and natural gas products consumptions have a significant positive effect on CO_2 emission while per capita natural gas consumption had a more important effect (4.04% compared to 3.4%). In other words, in the studied period, an increment of 1% in per capita oil product consumption made per capita CO_2 emission increase by 3.4% (on average); while an increment of 1% in per capita natural gas consumption made an increase of 4.04% (on average) in per capita CO_2 emission. In contrast, the coefficient of per capita electricity consumption is negative (D (PERBA) is 1st difference of PERBA for removal the nonstationary problem), which means CO_2 emission decreases as per capita electricity consumption increases; however, the coefficient lacks the required statistical credit.

Therefore, energy sources in Iran - which oil and natural gas products show the greatest shares- were found as the most dominant factors in environmental pollution. AR(1) is applied for removal the autocorrelation problem of variabes.

5- Conclusions and recommendations

CO_2 emission is one of the most principal factors in the environmental pollution; the world efforts are concentrated to reduce it due to its devastating effects on climatic change and global warming. In the current research, the effective factors on air pollution in Iranian cities were studied, considering CO_2 emission level as the pollution index in the period 1993-2013. Econometrics models were applied to analyze the effective factors on air pollution in Iran.

The research findings demonstrated that 1% increase in real per capita national income averagely led to an increase of 0.0001 in per capita CO_2 emission. Hence, according to the Environment Kuznets Curve (EKC) determining the correlation between environmental indices and per capita income, the pollution has been increased as a result of per capita income increase in Iran as a developing country.

The coefficient of energy consumption intensity (SHE) indicates that an increment of 1% in the considered variable ends in 0.003% (averagely) increase in per capita CO_2 emission; however, this variable does not provide the sufficient statistical credit.

Urbanization rate (URB) is realized as the highest coefficient; in other words, per capita CO_2 emission increases by 28% (averagely) as an increment of 1% occurs in the coefficient and has a high statistical credit.

Study of the effective factors on cities air pollution in Iran showed that per capita oil and natural gas products consumptions have a significant positive effect on CO_2 emission while per capita natural gas consumption had a more important effect (4.04% compared to 3.4%). In other words, in the studied period, in per capita oil product consumption made per capita CO_2 emission increase by 3.4% (on average); while an increment of 1% in per capita natural gas consumption made an increase of 4.04% (on average) in per capita CO_2 emission. In contrast, the coefficient of per capita electricity consumption is negative which means CO_2 emission decreases as per capita electricity consumption increases; however, the coefficient lacks the required statistical credit.

Therefore, energy sources in Iran - which oil and natural gas products show the greatest shares- were found as the most dominant factors in environmental pollution. Thus, the necessity of current energy carriers' replacement by clean energy sources as solar energy and geothermal energy is emphasized.

In addition, automobile manufacturing with high standards and low pollution potentials, improvement of vehicle fuels, utilization of less-polluting energies as electricity in automobile manufacturing process, modification of regulations in large cities, eliminating worn out and nonstandard cars, encouraging people to avoid cars, upgrading public transportation, and setting carbon taxes are other solutions which might play roles in air pollution reduction created by industrialization and urbanization development.

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Appendixes

Null Hypothesis: D(PVAI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

Prob.*	t-Statistic		
0.0191	-3.516648	Augmented Dickey-Fuller test statistic	
	-3.831511	1% level	Test critical values:
	-3.029970	5% level	
	-2.655194	10% level	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: SHE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

Prob.*	t-Statistic		
0.0016	-4.652855	Augmented Dickey-Fuller test statistic	
	-3.808546	1% level	Test critical values:
	-3.020686	5% level	
	-2.650413	10% level	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: PERCO2 has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

Prob.*	t-Statistic	
0.9978	2.854703	Augmented Dickey-Fuller test statistic

-2.685718	1% level	Test critical values:
-1.959071	5% level	
-1.607456	10% level	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: URB has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=4)

Prob.*	t-Statistic		
0.0022	-4.520363	Augmented Dickey-Fuller test statistic	
	-3.808546	1% level	Test critical values:
	-3.020686	5% level	
	-2.650413	10% level	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: PERFO has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on t-statistic, lagpval=0.1, maxlag=4)

Prob.*	t-Statistic		
0.0890	-3.383928	Augmented Dickey-Fuller test statistic	
	-4.667883	1% level	Test critical values:
	-3.733200	5% level	
	-3.310349	10% level	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 16

Null Hypothesis: PERBA has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on t-statistic, lagpval=0.1, maxlag=4)

Prob.*	t-Statistic		
0.7618	-1.586284	Augmented Dickey-Fuller test statistic	
	-4.498307	1% level	Test critical values:
	-3.658446	5% level	
	-3.268973	10% level	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(PERBA) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on t-statistic, lagpval=0.1, maxlag=4)

Prob.*	t-Statistic		
0.0435	-3.102083	Augmented Dickey-Fuller test statistic	
	-3.831511	1% level	Test critical values:
	-3.029970	5% level	
	-2.655194	10% level	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 19

Dependent Variable: PERCO2
Method: Least Squares
Date: 08/03/16 Time: 23:39
Sample (adjusted): 1375 1392
Included observations: 18 after adjustments
Convergence achieved after 10 iterations

Prob.	t-Statistic	Std. Error	Coefficient	Variable
0.0609	2.051644	0.637271	1.307453	C
0.0124	2.900357	1.174519	3.406525	PERFO
0.0000	10.35659	0.390435	4.043574	PERGA(-1)
0.3533	-0.962640	10.42316	-10.03375	D(PERBA(-1))
0.2303	1.258535	0.270804	0.340817	AR(1)

5.660819	Mean dependent var	0.973164	R-squared
1.462727	S.D. dependent var	0.964907	Adjusted R-squared
0.478859	Akaike info criterion	0.274014	S.E. of regression
0.726184	Schwarz criterion	0.976088	Sum squared resid
0.512962	Hannan-Quinn criter.	0.690272	Log likelihood
1.813168	Durbin-Watson stat	117.8572	F-statistic
		0.000000	Prob(F-statistic)

.34	Inverted AR Roots

Infrastructure –Transportation and Networks: Thoughts on the City of Tomorrow

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Abstract

Cities, both large and small, assemble increasingly large numbers of population and activities. Acting as dynamic places of economic growth and culture production, cities thrive and their potential robustness can determine the character of each urban society and the developed social bonds.Increased population concentrations promote a big opportunity in terms of economic and societal evolution. Indeed this opportunity has still been little implemented due to segregation among different ethnicities and intense homogenization of modern activities. The terms of cultural osmosis in contemporary multicultural societes remain yet major issues. Economic development and culture present highly interrelated contexts when the economy thrives in terms of equality and solidarity as well as guarantee the alleviation of conflicts, justice and democracy. This new globalized conurbations could be less tight and more accessible, while bringing closer different traditions and experiences.

Keywords: Infrastructure –Transportation and Networks: Thoughts on the City of Tomorrow

Introduction

The current poor transportation infrastructure in several cities – in reference to the European standards- constitute a critical element on the ongoing traffic suffocation. The rapid increase of private car ownership in combination to the deficient management of the transportation system add ominus evidence to the evolution of transportation planning. The completed and ongoing transportation projects can only temporary relieve overburdened networks if not combined with supplementary interventions in terms of urban policy and planning. Planning should always be driven by Cervero's rationale (1994), what matters most about cities is people and places, not travelling. The impacts of transportation engineering in the urban and spatial planning environment have not yet been thoroughly researched, however the opposite regarding the impact of the city form in mobility choices has received much attention in the urban discourse. The key arguments on this unequal interest can be summarized as being the following:

Designing transportation policies and infrastructure planning do not always require thorough examination on the potential land use impacts,

It is a common scientific belief that land use impacts deriving from transportation project implementations can be resolved in retrospect with traditional methods,

Predicting land use impacts deriving from changes in transport system is believed to be highly demanding and complicated,

Traditionally qualified engineers are not sufficiently familiar with contemporary prediction methods of such impacts.

Nowadays, cities are facing major complicated issues like accidents, air and noise pollution, urban space degradation et cetera, demanding essential transformations in terms of policies, management and technical interventions. The economy of a city can attract visitors, assets and capital, elements inextricably linked to the quality of urban space, the protection of architecture and urbanism heritage, the quantity and quality of public space assigned to pedestrians and cyclists and lastly the restrictions imposed to cars in order to tackle climate emissions and environmental capacity. The above constitute the key parameters of a sustainable city particularly from a transportation perspective, heading to sustainable urban mobility. This prospect evidently means that urban planning and transportation engineering can well be regarded as equal partners in city planning and if coordinated can overrule traditional and long established planning methodologies. Combined urban planning and transportation engineering methods in modern urbanism implies that new projects and future interventions are directed according to the city's priorities and necessities which are highly integrated in its values and social as well as economical environment. Promoting combined planning prerequisites mutual understanding of current qualities, problematics and the interrelation among space and movement. Critical problems concern the environment, social cohesion, safety and economic development.

Understanding the issues

It is currently well known that the more dense and compact a city is, especially when activities are located close to public transportation stops (transit oriented development), the more opportunities will be given to its residents and visitors to travel by public transport. Mixed land use development (i.e. housing, commercial etc.) can also contribute to the use of public transport and hence decrease the travel times and costs. Planning cities for fewer cars, allows the actual social and financial needs of an urban environment to be revealed and strengthens its natural and social aspects. Productivity and development is shrinking in the contemporary Greek city for a number of reasons, including external and internal factors of the Greek economic crisis and uncertainty. Among others, arbitrary structures, poor design standards, unauthorized land uses, downgraded publc and road space, consist the scenery of a typical struggle in a daily basis. Profoundly all the above discourage future visitors, investors and other stakeholders to approach such places and degradation continues. The key infrastructure of the city, namely its public places, transportation networks and systems, along with its streets, being already downgraded are further devalued and sustain the poor image of the Greek city.

Modern urban planning science –after ages of structural misconceptions- suggests higher densities, mixed used development for city centers and urban centralities, ceasing of urban sprawl and the reduction of energy consumption. Moreover, urbanists try to introduce the 'sharing economy' in the city rationale in order to enhance social and economic cohesion and restore disrupted city bonds. This article presents briefly all those major issues that could help the Greek city recover from its disadvantages, compared to the other European cities.

Environment : the environmental footprint from urban development is currently well researched and proven to be a serious threat. The European Union and its member states are commited to decrease notably the levels of CO2 emissions from the transportation sector untill 2050 compared to those of 2000. Air pollution can be decreased locally, however research shows the long lasting impacts of microparticles. Moreover, the detection of new contaminants is always possible and concerning. Regarding the noise pollution, it is well known that the exposure to noises higher than 60dB for long periods can affect both physical and mental health. Policies against noise pollution are recognized as equally important to those from air pollution. The degradation of our visual landscapes (visual pollution) has lately been identified as a common issue in order to preserve and protect the urban heritage, as well as to reassess the consumption of public spaces. In terms of energy, numerous researchers and studies consider transport to be among the three most energy consuming activities, with the other two being the sectors of housing and food (Bakogiannis, 2016).

Social Cohesion: Traffic fatalities' indicators are showing a mild downturn in Europe, although the countries of the south present increased numbers related to vulnerable road users. Being on the road triples the probability of death, compared to any other daily activity. Policies and measures should aim at decreasing dramatically the number of all types of traffic accidents. Despite the remarkable increase on car ownership, one in six households living in cities worldwide does not own a car. Indeed transportation policies seek to ensure their accessibility through public transportation. Heart related deseaces and obesity remain serious problems and fortunately nowadays there is social consensus to mobility policies supporting a healthier lifestyle. The transport sector plays a major role in the social fabric of Europe (Extra Project, 2001), related to daily life, employment, accessibility to services, leisure and many more. Injustices in transportation sector reduce social equity and lead to long term impacts in quality of life, health, safety and land use distribution. Promoting non-motorized transport and developing fair transportation system can particularly contribute to social cohesion in planning terms. Moreover, urban planning can assist on the integration of any excluded zones or deprived areas by providing spaces that according to Schreiber and Carius (2016) increase the chances of interaction and the forming of social relations among people from differing ethnic backgrounds.

Economic development : In most European cities, after long-established policies, urban spawl has altered the economic operation of activities and changed the roles of centralities and their appeal as well as their investment potential. Stakeholders, politicians and enterpreneurs have been convinced that problems cannot been solved with the construction of new traditional networks such as roads, and rather lately can identify that car restriction policies do not lead to deterioration of profits but instead can boost the economy. The economic sector has realized the benefits of environmental protection and saturation is encountered as priority to be tackled.

Safety: safety is a parameter that encloses accidents, fatalities, criminality as well as quality of life, comfort, accessibility et cetera. Infrastructure and transportation systems should manage to ensure safety and accessibility for all.

Overall Aims and Particular Strategies

Setting generalized aims in transportation terms has led to several inconsistencies and misinterpretations as each centrality demands customised solutions and specialized timetables. The key aims arise from the formulation of a generalized strategy which should carry the special aims. Developing a strategy and setting the aims can better be applied through a bottom-up approach that has engaged the public and local stakeholders from the very initial steps of 'understanding the issues'. The progress should be recorded systematically and new objectives can be set to allow for further upgrade of the social inclusion regarding new developments.

Strategy design: The aknowledgement of good practices in urban planning and transportation engineering is proven to be a successful first step in developing a strategy. Each city should follow and comply with european, national and regional objectives, however must be allowed to develop a special framework meeting the local needs and comprehending with the general city objectives. Assessment of such strategies in terms of integrated urban and transportation planning, shall allow the use of both traditional and new models, testing of policy tools and adjustable techniques. Although a number of such models have became very complex, there is an adequate number of meta-models that can be useful for public debate and decision making.

Strategy Evaluation **:** The methods used for stategy evaluation have been modified lately in order to meet the wide range of objectives in integrated urban and transportation planning. Thus, instead of conventional cost- benefit analysis, emphasis should be given on multi- criteria analysis. The assessment should include weighted variables for each objective and evaluators (public, stakeholders, visitors etc.) should ckeck the sensitivity of the overall strategy in relation to the aims. Moreover, case studies' exploration can be a useful supplementary element in all stages of research and evaluation, due to the ability to transfer real world issues and outcomes in relevant schemes. According to Bakogiannis et al. (2014), presenting a supporting case study in a similar environment, could increase the understanding of a needed transformation or inform about potential inadequacies in implementation.

Financing : While the European Committee continues financing an important part of city strategies, lot of attention is being given on the income by the pricing of transportation services. Cities can distribute financing freely, depending on their strategies. The European Committee does not anymore finance individual infrastructure projects but those integrated in an

overall strategy which should be compatible with the European objectives. Cities are allowed to involve private sector in developing infrastructure however without yielding public control and allowing divergence of lawful processes.

Public participation: Citizens and all interested stakeholders should be encouraged to participate in all planning stages, namely the identification of problems and objectives, prioritization of issues, formulation of possible solutions, and lastly the planning- implementation and evaluation of the strategy. New public engagement tools should be implemented to facilitate participation processes, while special technology-related tools (i.e. social media, e- consultation, webinars) should be used to engage all commonly excluded groups of citizens. It is wellknown that public participation techniques increase the average time of planning completion and costs tiime and money to decision making which can lead to public conflict, political cost, implementation delays and many more. However, public commitment guarantee smooth transition to development, public acceptance and efficient implementation. Cities are lately encouraged to try innovative public procedures that involve assessment by the public, which demands deep knowledge of planning and a high level of managerial techniques in new paths of local government.

Urban policy measures: Legislative regulations shall be implemented -after the needed public engagement- in order to ensure that new urban plans and masterplans will target neglected urban zones (i.e. abandoned industrial areas) introducing new medium to high density mix-use development. The provided parking spaces should be limited and environmental friendly means must be promoted. An urban moratorium could ensure the ceasing of urban sprawl and regeneration of existing downgraded urban areas. New projects of regeneration have to design within the concept of 'cities for people', putting pedestrians, cyclists and all vulnerable road users on the core of public space. Complementary tax reductions for city center residents will also decrease the need for long distance travelling and urban sprawl.

New transport infrastructure: New transportation infrastructures have always high financial and environmental cost, and may lead to longer travel times. New design requirements should emphasize the ease of use, safety and convenience rather than speed. Environmental degradation should be kept to the minimum possible and urban cohesion should be preserved.

Management of infrastructure and public transport services: One of the key objectives regarding infrastructure management is the fair redistribution of road and public space to all users, including pedestrians, cyclists public transport users and permanently or temporarily disabled. Car circulation should be managed effectively and traffic safety should be the priority. Low cost interventions can assure improved public spaces and maintenance works are much needed especially in the countries of the South. Accessibility shall be prioritized over the traditional request on decreasing travel time and public transport systems must ensure that car users will consider it as an efficient alternative. Management of services could follow the service reform rationale from Cervero (1994) for adaptive transit.

Demand management: Encouraging the use of private car alternatives and decreasing car travel times are the key objectives on demand management. Parking management should aim at discouraging car usage in city centers and new tools, such as car pooling and car sharing, can take over the increased demand of mobility.

Information policies: Real time information systems play a leading role in convenient and effective modern transport systems, while telecommunications can become a substitute for some travels. Information services should include real time knowledgement of mobility choices for users, when at home, on the way and while being at transportation stations and stops. Variable message signs (VMS) can inform car users to avoid a certain overburdened area and choose alternatives.

Urban toll systems and parking pricing: Road pricing complies with the European directive 'the polluter pays'', when applied according to travel length and environmental sensitivity of the used networks. The extra travel cost is used as an equivalent to the marginal social cost the commuter charges the city by his/her choise. On the contrary public transportation cost reflects the minimum cost of travel and encourages integrated movement in the city. Parking pricing systems must reflect accordingly the cost for supply and use of an urban space and can change periodically to control incoming vehicles.

Walking and cycling enhancement measures: Walking and cycling can be considered as key alternatives to private car use due to their numerous benefits in human health and environmental pollution. The redistribution of road space in favour of these users will encourage safe, convenient and pleasant travels while public transport can complementary assist cyclists to accommodate their vehicles both in car and in stations/ stops, which will ensure coherent long distance travels

Freight service measures: Freight services deal with the key issues of traffic circulation dependency and environmental repercussions. Managing to reduce travels within the city limits and through traffic within neighborhoods can lightly avoid the afore-mentioned impacts, however contemporary sollutions promote the overall substitution of heavy vehicles within cities. Coordination and cooperation between different logistics companies can decrease needless travels while transshipment of goods from trucks to minivans can also minimize traffic saturation. Each city should have trucks' and lorries' parking storage areas in their territory, whereas freight villages can be located in selected cities to manage logistics and efficient transportation of goods.

Vehicle improvement measures: The European Commission has consistently supported research on improving vehicle technology as local contamination and noise pollution should be limited. Vehicles must become more secure and environmental friendly. Emphasis should be given to reducing emissions that contribute to global warming. Tax policies should discourage buying polluting vehicles and research on new fuels and fuel cells must be continued intensively.

Integrated Strategies: Combining the afore-mentioned policies can nearly form a complete strategy that would gain social consensus. However questions remain as to the ability of civil societies to tackle the traffic saturation in cities with greener cars and to achieve the ambitious targets for reducing carbon dioxide emissions.

Specialized suggestions for an upgraded transportation system*

* *resume of specific suggestions as developed for Implementation in the Greek Transportation Sector*

According to the Green Paper on Public Transportation of the Capital City of Athens (Transport for Athens, 1998), the current policies must be reviewed in order to address the upcoming isues such as the economy, modern business activity, international experience, current and future urbanism trends. Immediate enhancement should be launched regarding an integrated transportation plan, supported by major investments and based on explicit political decision for the development and promotion of new public transport services instead of extending the current road network. Since then -1998- progress has occurred regarding the development of a thriving metro- underground train as well as the modernization of specific services, however not in an integrated way.

A comprehensive strategy combining several factors is required regarding the overall enhancement of transportation infrastructure and services as well as the economic viability of the new system. According to the Hellenic Institute of Transportation Engineers (2002), the current state of Athens' transport system seems to be the beginning of a continued deterioration in terms of traffic suffocation. The rapid growth of car ownership rate combined with the deficient infrastructure and management of the current transport system are ominous signs for the evolution of the current situation, if serious and consistent action is not considered. The currently scheduled transportation projects -if not combined with a series of complementary interventions - will only relieve traffic suffocation in a temporary basis. Adding to this, Vlastos et al. (2004) argue that any reversal in the Greek transportation sector will only be managed if substantial changes in infrastructure are complemented with courage and persistence in decision making as well as the introduction of information and awareness policies for the general public.

Suggested Interventions include:

Unified management and planning of the transport systems that can ensure an effective control of all involved institutions and stakeholders (Ministries, Municipalities, Road Police Authorities, Public Transport Bodies etc.). The foundation of a robust coordinating body – from the merging of current complex or not authorities- will assist on a new integrated start with specific responsibilities and duties.

These may include:

Configuration of Policy and Planning

Planning of investments and priority setting

Configuration of pricing policy for the use of transport systems (public transport, parking, road pricing etc.)

General supervision and control of implementation planning (project implementation and operation of systems) based on specific requirements and timetables

Establishment of substantial and sufficiently financed participation of citizens in all phases of planning, design, implementation, operation and management of transportation projects and measures to create communication offices in all the services of transport operators

Institutional regulations for controlling illegal parking by independent authorities, collection of fines, rationalization of fines (frequent checks and lower fines)

Establishing a street hierarchy which will correspond to the street operation and its role in urban fabric. Ensuring high operational characteristics to primary roads (suitable signaling, parking restrictions and land use control) and appropriate assembly of different types of roads.

Completion of current construction works and promotion of progressive ring roads (internal, intermediary, exterior). Emphasis should be given on their integration to the overall road network.

Promotion of specific traffic regulations in the local road network in areas with exclusive residential use for ensuring road safety and the quality of life. Developing pedestrian and cycling networks in central areas will ease the movement residents and will upgrade the visual and environmental image of the city.

Appraisal and effective implementation of appropriate smart telematics systems for car restriction in peak hours with separate parking priorities for residents, employees, visitors etc.

Development of an integrated bus network with proper intervention in bus lanes and optimization of passenger information systems.

Drastic re-adjustment of public transportation pricing to address all groups of travelers and implementation of a single ticket system.

Development of park and ride areas in Transport stations located close to the outskirt of cities for the upgrade of multimodal transportation.

Traffic management policies and monitoring solutions for special supply and emergency vehicles. A special institutional framework should include apart from specific regulations, special interventions (i.e. speed bumps, boom barriers, vehicle access points etc.).

Development of an integrated both static and dynamic information system for public transport users, including public and customized announcement of timetables, operational signaling of urban highways, important nodes etc.

The improvement of environmental conditions, as needed for urban sustainability, requires a radical revision of the overall urban practices and processes of developing urban forms. It is common knowledge that a well-planned city can enhance socialization, multiculturalism, happiness, health and safety conditions as well as realize the needs of its residents for free time and urban spaces. Reducing energy consumption remains yet a determinant factor in modern wellbeing and urban structure can contribute highly in these terms. Haugton and Hunter (1994) argue that changing the shape, size, housing density, design and siting of activities in cities, can differentiate energy demand for around 150%.

Conclusions

Cities, being ultimately dynamic organizations, can accept a certain amount of motor vehicles without consequences (capacity), managing to enrich somehow their urban environment. Beyond this specific amount, vehicles should be replaced with other forms of sustainable modes in order to keep their vitality and spatial distribution. Removing this excess amount of vehicles (travelling and especially parked ones), is the great 21st century's challenge, as recognized by several authorities and organizations. If achieved, the city would alter its form, its air and visual environment. Sustainable mobility, as a scientific term, addresses this contemporary challenge: managing to achieve the sustainable compact city with fewer private cars, preserving its history and identity through a healthy lifestyle. Streets are not traffic pipelines, but instead the

foundations of social life. Sustainable city is the compact city that ensures its capacity within viability terms, covers its housing and commercial needs and provides street life in a human scale.

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The Transition to Democracy in Bulgaria: Much-Needed Reforms, Showed by AI-Approach, AI-Methodology and AI-Cognitive G-Space Architecture

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Abstract

In this paper we review the leading barrier to democratic change - societies' limited command of democratic principles and practices and the lack of built-in device in the authority for mechanisms of civil control in democratic rule of law. Main contribution of this work is the illustrative example of the capabilities developed by Goshev & Goshev AI-tools: AI-approach, AI-methodology and AI-cognitive G-space architecture to improve the legal and statutory mechanisms of power. Below are elaborated comprehensive measures focused on the success of the transition to democracy. These measures include: a. A complete overhaul of the status-quo in education in democracy. Particularly, the existing cursory, unsystematic, and primarily targeted to children and youth educational patch-work would be replaced by a structured, comprehensive and all-inclusive progressively graduated educational system b. An exhaustive reform of the legislative base. This reform would be more comprehensive and rigorous than reforms mandated as part of EU integration/membership. Specifically, the reform would involve development of logically complete and consistent context-specific designs of democratic legal systems and institutions, their testing and writing into legislation c. Development of mechanisms for permanent monitoring and improvement of the legal system and state governance. Mechanisms of such type would provide for early detection and swift rectification of practices inconsistent with the values and norms of democracy.

Keywords: Ttransition to democracy; AI-approach; AI-methodology; and AI-cognitive G-space architecture

Introduction

In a fairly long period of time a number of researches about the problems of democratic development were published. The numerous papers and books, fed up with pessimistic scenarios about future of democracy, must have been very disturbing for the global democratic community. Equally disturbing is the possibility of recurrence of authoritarian and totalitarian regimes under the flag of in fact deceptive democracy. The analysis of the transition countries in Central and Eastern Europe and the attempted democratization of the regimes in the Arab Spring, seriously suggest a need for a new qualitatively different approach for transition to a democratic social order.

Tracing the origin and development of the democratic process in the leading democracies in the world, we see the following picture:

In England and America democracy was the result of naturally occurred public attitudes and social practices, proclaimed and legalized through documents. This way these countries entered into their own way of setting up a democratic civil society. In the next period, democratic practices and public device management were improved in terms of several critical areas: a safeguards protecting the individual rights were introduced to the legal system along with independent judiciary, thus realizing democratic judicial procedures and market regulation of economic relations. This was accompanied with development of the market infrastructure and education.

Magna Carta (1215), The Declaration of Independence (July 4, 1776), and the US Constitution, as documents constituting these public device management were created and adopted by people with a democratic mindset which allow them to lay down the principles of a democratic society. Fathers of Democracy, declared democracy, such as public policy, and then for many years they built into public device.

All these took enormous amount of time. But in today's rapidly changing socio-economic environment, time is deficit and the old public device management need an update. These facts, lead us, to the conclusion that the time has come for serious human interference in the democratic process in order to improve the democratic public device management. It is necessary to mobilize our significant scientific potential and to use the human knowledge and technology in all areas to improve the public device management mechanisms in order to be able to ensure optimal and socially efficient functioning of the social system in the spirit of democracy and protection of human rights. We see an opportunity to implement Ai approach for constructing democratic mechanisms and democratic social practices. We see an opportunity to use of constructive methods for designing democratic legal systems and designing the organization and functioning of the three independent authorities.

This article presents the results of qualitatively new approach, philosophy and AI-tools such as cognitive G-space architecture. Their use permits designing of logically complete, consistent and efficient normative systems and Social Practices, as a descriptive model – constructed as an artifact. Such normative systems establish regulating mechanisms and procedures, incomparably broader than the familiar interpretations of the 2000 year Roman slave law.

By the created by Goshev & Goshev toolkit and constructive theory, can not only legislating occurred social practices of democracy, as Magna Carta 1215 in England , and American Declaration of Independece July 4, 1776 . The toolkit and constructive theory is use to build the elements of natural law and morality, in to the legal mechanisms and to design (constructed as an artifact) legal systems and social practices. These organizational systems and control mechanisms are much more sophisticated than the existing ones, as these constructions include also the logic of:

mechanisms and procedures of: Decision Theory; Game Theory; Theory of Auctions; Organizational Theory; Control theory; Cybernetics;

new models of regulating the distribution and exchange of goods and services; financial regulation; banking regulation;

models of psychology and modern methods of content analysis and sociology.

The proposed toolkit allows a radical change in the approach for creating legal systems. We are not guided by the principle that "Everything that is not forbidden is allowed", and we are not trying to "make a fence" by the norms of material law. Instead, following the logic of AI-approach, allows us to build in decision procedures, democratic criteria respecting the rights of all persons. These decision procedures are a logical standard for creation of procedures reflecting the specifics of the particular case.

The approach contains requirement for the decision procedures. They in no way should create conditions for further undemocratically regulated relations. This is achieved by tracking examination of potential deviations from democratic criterion defined as a standard by procedures of distributive and retributive justice. This monitoring should be available, for every person, affected by the distorted application of legal procedures. Every affected, must be able to start, prompt and effect action to implement a procedure for violations prevention. So the approach not only imposes restrictions on the possibility of totalitarian or authoritarian relapse, but also ensures sustainable development of the democratic process.

The created powerful toolkit, allows us to design organization of society and public device management as well as structural and procedural rules for the mechanisms and operation of all authorities. This way they can be constructed as really independent from one another and subtle mechanisms differentiating their powers and interaction to be created.

This article examines the structural elements of the social structure, distinguishing design features of the transition, and raises issues related to creating the necessary structures and mechanisms implementing and ensuring the realization of the principles of democratic civil society. These principles require respect to the rights of every citizen, as declared in the International Charter for the Protection of Human Rights and accepted as universal values of civilized humanity.

The approach and logical structure shown in this article were made possible as a result of the implementation of the developed by Goshev & Goshev AI-approach; AI-methodology; and AI-cognitive, G-space architecture.

Model of the social structure

The structural scheme of any social model or a regulatory mechanism no matter its scale covers at least two main channels carrying out its function. These two channels can be accepted as regulatory. They are:

Channel naturally occurring structure of the regulatory scheme - such as market regulation, various schemes shown in trade theory, game theory, etc. with varieties and stock exchange regulation, different interpretations and all ending with OUTCOMES, which are identified by certain parameters or variables, including quantitative expressions imbedded in the descriptions of channels – material substantial or financial flows.

Correcting channel of social decisions, taken by persons authorized under the structure of society to represent average citizens in their multitude, as a barrier against the pressure of money and the requirement of effectiveness on the vital personal interests and rights of citizens. These social corrective solutions are mandatory correction of decisions in the other channel and are required to be met by natural and legal persons and authorities.

According to the regulatory effects of the two channels and their weight in the regulatory outcome - the operation of public device, can distinguish two polar and an intermediate circuits.:

When the regulation is implemented through the channel of social solutions - it inevitably degenerates into polar diagram of authoritarian or totalitarian regime;

When the regulation is implemented canal regulatory scheme of material - material or financial flows - regulation of type free market "Lesse fair lesse pace", free market economy, it can degenerate into polar scheme fetishization profit and efficiency, dominant more than subjective judgments of people and destroying the ability to control their social price.

Democratic social order is implemented in the intermediate scheme, a metered for optimal

socio-efficient operation, simultaneous impact on both channels.

Much-needed reforms

An analysis of recent events as finance and economic system of the leading countries in the world with democratic social order, using AI- toolkit G-space - Visualization of financial and arising from its general crisis in the economy leads to the following general conclusion: The crisis was caused deliberately and is associated with poor legal system: regulation / deregulation

Those who demand deregulation are right that the regulation restricts the initiative of persons to achieve better results from their activities. On the other hand, demanding regulation are right in their request for limiting the possibility of using freedom from regulation for taking actions inconsistent with the public understanding of the correct action that benefit society.

It can be concluded that the measure of the socially necessary and optimizing results from the activity regulation/deregulation is determinable. This is done by dividing into "golden section" the buffer interval regulation/deregulation, which is similar to zone in the hysteresis loop. From all this follows a lack of reliable protective regulatory mechanisms, responding in predetermined situations. This is so in a number of stages of implementing the functioning, development and control of the vital activity of managing the economy through control of financial instruments, flows and investment policy.

As an analysis of the facts in the movie "Inside Job" to Charles Ferguson, can be determined deficiencies of legislation in the US Regulators regulating mechanisms allowed to happen this crisis. Using this analysis we can seriously narrow the uncertainty regarding the type, logic and certain features of the controller, which must be designed. And it is therefore essential to ensure a procedure applied by those concerned when they find the conditions laid down.

Similar problems are found in the analysis of regulators of public devices in countries in transition.

While the countries with established democratic traditions can achieve focused, suspension of the operation of regulators, designed to prevent illegal conduct and results, it is clear that for countries with fragile civil society in lack of well-developed legal system and flawlessly existing regulatory mechanisms such situations simply can be accepted as the status quo, destructive to the process of democratization.

This requires general conclusion that extensive changes are needed in the design of regulatory mechanism embedded in the legal systems. These regulators need to be with a high sensitivity, regarding deviations from the specified function of public device, or deviations in its components, respectively the deviations implemented by the subsystems of the public device.

Particular attention should be paid to the legal systems of the countries in transition. The classic scheme: the organization of free elections in which supposedly guaranteeing the free expression of will by participating, selecting representatives to the governing authorities and inventing new statutes is definitely ineffective for countries experienced heavy totalitarian period.

Expecting that created by the new statutes management will be of a democratic type is naive and unrealistic. The reason is that these Detailed Structure laws are created and adopted by the people, for the most part, if not overwhelming - beneficiaries of the old regime that not only have sufficient inertia in thinking, but do not know the democratic decision making procedures related to social practices.

Designed legal systems must be designed as mechanisms of decision. In that mechanisms must be build precise procedures limiting deviations to the field of well known old manipulative methods of violence

They must be designed standard mechanisms assembled in standard social practices in the most sensitive in terms of totalitarian relapse areas.

These are important areas of public democratic social mechanism (device): structure and procedures of the constitution and organization of the three branches of government, as independent; procedures of selection of people in positions of public and polity;

These are important areas of public democratic :

Distribution procedures: allocation of resources (procedures of lease of state and municipal property, allocation of resources (concessions and restrictions);

Procedures of market regulation, auctions, exchanges commodity markets, regulation of financial relationships and resources;

Procedures protection of private property; procedures of security; procedures healthcare procedures on freedom of speech, wills and individual human rights. procedures and mechanisms of environmental protection and biodiversity.

This analysis shows that the problems of the development of democracy have a different character in different countries, but we believe, that the problems require application of modern achievements of science and serious work of research, analysis and design of structures of democratic devices.

For the decision of such problems are designed AI-approach, AI-methodology and AI-cognitive G-space architecture, as a AI-toolkit.

Overcoming complexity

The legal system is extremely complex. Extremely complex are also its components: those constituting the state and public structure, those regulating social practices and the mechanisms of their realisation, and those regulating social relations. The complexity of the legal system is also conditioned by the extremely complicated interrelated and all-embracing mechanism that puts into effect a function, which must motivate the natural and legal persons in society in all their actions. And in order to put into effect a motivational influence, the legal system must be described and presented by means of information, which is comprehensible and approachable for all natural and legal persons, in a natural language.

This complexity is a challenge for the professionals who participate in the processes of legislation and law enforcement. Errors, such as abbreviations, inconsistencies, ambiguous provisions in the law systems, and inconsistent rulings in cases which share the same established case-law logic, made by different formations of the court, are an indication of the fact that the complexity of the regulatory systems probably exceeds the human capacity for comprehending them.

The enormous volume of texts and linguistic structures of legal mechanisms and procedures, in many cases built in mixed, propositional and predicate logic, additionally greatly complicates comprehension.

The mechanisms and social practices of organisation, management and control over society are of at least the same degree of complexity as the most complex systems in biology and technology. But whereas in each of these fields there exists a specialised formal system for description, visualisation and calculation, the experts in the field of jurisprudence do not have

at their disposal a formal system which compensates, illustrates and logically "calculates" regulatory systems in a way that is convenient to understand and work with.

G-space allows overcoming the complexity in the analysis, construction and application of regulation systems. It is a means (a tool) for the creation of G-models, which visualise the logic built in the regulation systems.

Overcoming complexity through the use of G-space, on the other hand, allows the research and creation of analytical and design methods united by joint methodology and technology for the creation of logically sound and unambiguous models of regulatory systems, and the stipulation of correct administrative, judicial and legislative acts.

AI approach, AI law-orientated methodology and G-space[1] philosophy

The study[2] which led to the creation of the AI approach, AI Law-orientated methodology and G-space philosophy is based on the wide understanding of human activity, such as: perception, decision, and influence, within two parallel contours. One of them – human activity aimed at the alteration of a given object from the surrounding world; and the second parallel contour – human activity aimed at altering one's own knowledge, algorithms of thinking, and facts.

In both contours the subject of human activity creates a picture of the surrounding world designed for simulation thus helping the actions leading to the desired alterations and events chosen by a person are revealed: of the alteration of a specific object in the surrounding world, as well as of alterations in the person's own knowledge – algorithms of thinking and facts[3].

In order for the desired results to be achieved through experiments based on simulation (which includes serious games) carried out for the purpose of choosing goals, strategies, amendments of regulation limitations, optimisation and structure, organisation and technology, the created Abstract picture must correspond to the object under study.

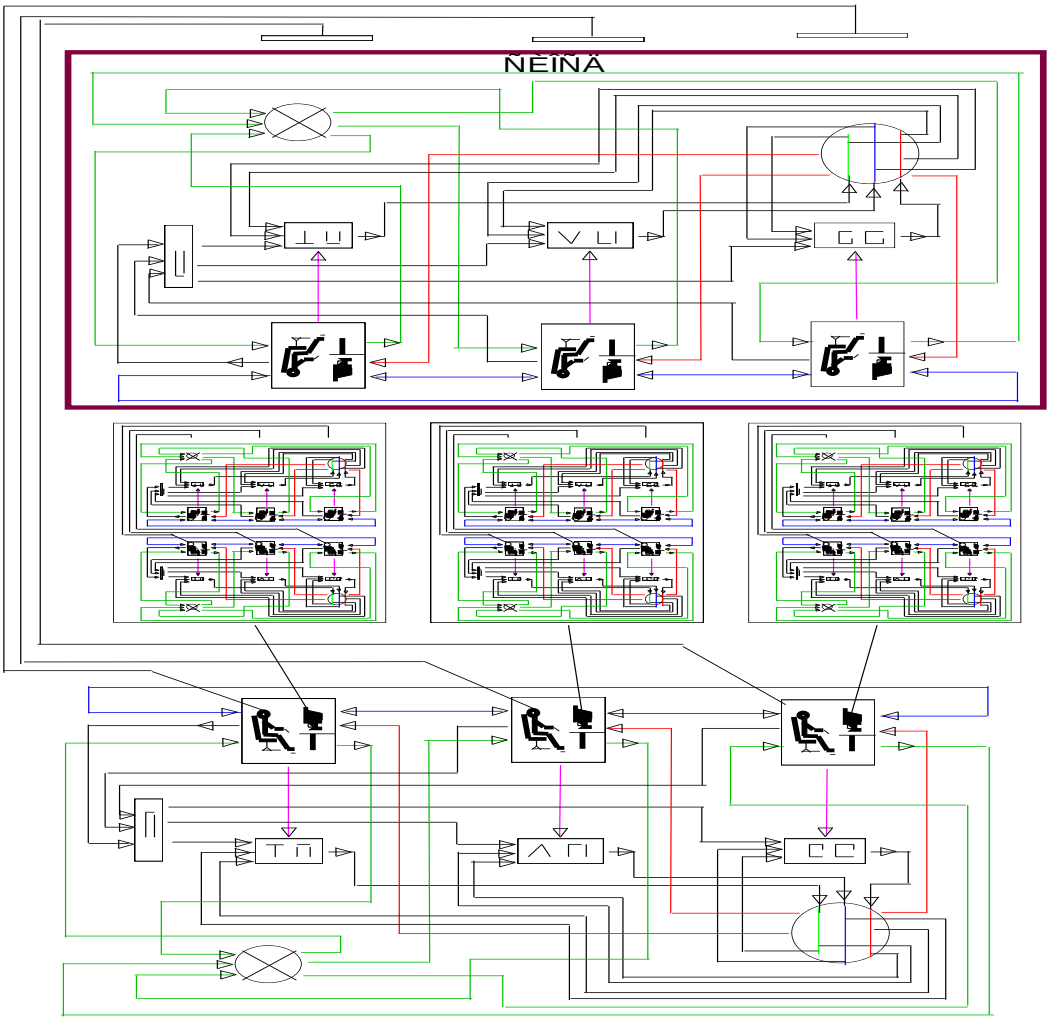
But this does not mean that it is necessary to have the most detailed and complete "snapshot" of the object, complete with all relationships and influences in it, and with all relationships with the surrounding world and its influences over the object. In other words, the object must be presented as a "snapshot"-interpretation of the surrounding world with a focus on the object under study.

If we assume that the tool for creating that "snapshot" is a reflecting sphere (like the one in Escher's lithograph print), and in the snapshot – a reflection of the surrounding world, there could be "separated" and highly magnified, and zoomed in on (as with a magnifying glass) with a high degree of detail, the picture of a specific object in the snapshot – the object of study for the analyst-researcher; as well as a picture of the natural person who is in the studied object – or in other words, the analyst-constructor. Thus the mental model – the picture for experiments based on simulation, must be constructed as being a "world-like" model that involves an active human presence.

The creation of a world-like model with a focus on fundamental acts of the regulatory system presupposes studying the object-society, and the models of the decisions made in society, presented as a mechanism. The model for this mechanism involves: society (presented as a socio-economic unit (social device) – an organisational mechanism); interpreted as a system - as a structure and function. On a lower level of detail, the organisational mechanism is viewed as natural and legal persons connected by relationships and performing appropriate activity, which could be interpreted as perception, decision and action, in its two manifestations: thought and consequences in the surrounding world.

The appropriate activity (thinking), is realised in the conditions of a regulatory system as something that motivates, regulates and limits the actions of natural and legal persons. The mechanism of motivation and the mechanism that regulates the resolution of social relationships are part of the mechanism of thinking, which realises the perception, decision and action of every natural person, and part of the mechanism, which integrates the results of the thinking of natural persons who form a legal person.

The algorithms of perception, decision and action through which the modelling of everything described so far is accomplished, are similar to cognitive architecture – a network of a connectionist type.



A structural model of social device with built-in levels: perception, decision, impact

AI approach

A researcher who follows the AI-approach is oriented towards an extended object of study, which contains “object of study – toolkit – subject of study”. The extended object is a result of the constant tendency to deepen scientific research toward ever more detailed study of the object, and ever more precise and comprehensive results in terms of illustration.

The presented: by Louis de Broglie new and completely different from classical physics field of knowledge – quantum mechanics; by Heisenberg – the possibility for a significant distortion of the result caused by the tool of research; and by Hofstadter – the peculiarities of the human perception of the world, are the reasons for rethinking the approaches and methods of scientific research.

This is also a reason for extending the object of research for the purpose of creating a model for “world-like” experiments by simulation with an active human presence. The extended object already contains not only the “classical object” - the motivational regulatory system, but also the toolkit – the research methods and models of analysis, modelling and construction; and the picture – a result of the research toolkit and the specific human characteristics.

By defining this extended object, in which the motivational regulatory system is part of the mechanism that performs an appropriate activity, a structure of logic that corresponds to the philosophy presented in this article is created absolutely deliberately and purposefully.

Every person studies (creates logical models or thoughts) the way the motivational regulatory system influences his/her process of appropriate activity, and what the requirements that the motivational regulatory system must fulfil are, in order to motivate the subject under motivation to take actions so that to realise results, to achieve aims given to it from the outside and/or generated by itself. The analysis of the logical structure outlined, which describes the extended object, is of the "expanding nodes" type by D. Hofstadter, and unambiguously presents the direction of research as being in the AI field, and the approach itself as an AI approach.

The following are accepted, in terms of structure, as a specific extended object of study in the systemic interpretation: "the surrounding world – tool of decision-making – subject", in which the element "tool of decision-making" includes the motivational regulatory system; and in terms of function, "meaningful human activity" as a model of the research process "perception – decision – impact", realised both in the structure, and by the elements of the structure.

The AI approach of overcoming the complexity of the legal rule system is completely different from the classical approaches in jurisprudence and social sciences. By means of this approach one could search for, identify and apply in the construction of the models for simulation the lowest level of detail elements (atomic frames, according to Marvin Minsky) of the object's image (the world through the filter of the limiting conditions of the knowledge about it, and the goals defined). By altering the elements or altering the connections, and therefore the configuration in which they are connected, the motivation that conditions an alteration in the function, or action, of the subject under motivation, is also altered.

We are looking for a picture of elements on the lowest (atomic) level of detail in order to avoid possible errors, inconsistencies or ambiguities in the creation of logical models and the description of legal rules. As well as to remove the possibility of overcoming bans and limitations defined by the legal rule through "going down" to lower levels of detail of the logical models, and the creation of "bypasses" to limitations by "hackers" whenever the level of the legal rule is lower than that of the atomic level.

But in order to make such a textual description, in natural language, of the picture on the motivational regulatory system's highest atomic level is even more difficult than the classical description, with a much bigger volume and more excruciatingly complex.

But precisely the systemic identification to a high level of detail (an approach in technical sciences), which allows schematic interpretation (as in Jay Forrester – the models) of the content and logic of the text is the necessary prerequisite for the next decisive step toward overcoming complexity.

The next step toward overcoming complexity is a schematic interpretation called G-model, which was created by applying cognitive G-space architecture.

G-model benefits the researcher with an additional advantage to classical schemes. G-model allows the visualisation and compensation of information which describes the model of a rule the way it is done by means of analogue transformer models, but also allows its presentation in a picture made up of sequentially ordered fragments, as a procedure.

The display of the specified fragments in a picture allows for the extremely easy diagnostics of errors, omissions and ambiguities. (It plays the role of a scanner).

By visualising a text using natural language, in the classical scheme of the analogue transformer type, what is achieved is compression of the information down to two digits, but this is completely insufficient for overcoming the complexity of the logical model and describing the motivational regulatory system to a satisfactory extent.

The means for radically overcoming a legal act–law system' analysis complexity is G-model. G-model overcomes the complexity of a legal act to the level of complexity of checking for the isomorphic correspondence of logical configurations of the structure. Applying the principle ingredients is carried out following execution of that operation in a text of up to half an A4 page. The successive addition of fragments or ordering (structuring), processing, checking and typing in of text from a complex legal act – law system (laws, codices, etc.) in G-space following a specific algorithm by a person is accepted by the creators of cognitive architecture* as being a type of thinking

In order to reach to a G-model and to test the logical structure in a text or symbol-based format, one has to go through three stages, fragment by fragment:

The first stage is systemic identification of the world, together with man and everything that he reflects, including the influence of everyone and everything around him and in him, or a world-like (world-similar) model, as a system with active human participation, or as a socio-economic unit.

The second stage is identification, adaptation and construction of a toolkit for analysis and construction of motivational regulatory system models.

The third stage is applying the toolkit for reengineering or construction of motivational regulatory systems.

The AI-approach is integral and is created so that it can combine selected advantages of already existing approaches from the different branches of the scientific AI field:

and the modelling of mental processes (the functioning) in the human brain, Cybernetics and brain simulation – structural modelling and visualisation and Symbolic AI – manipulation through symbols of the information from the person and the surrounding world, which is presented formally by means of mathematical (incl. Logical) relations;

and Cognitive simulation – simulating the techniques which people use for solving problems (cognitive architectures).

The AI approach described in this article follows the logic of Cognitive simulation. But not realised (Cognitive simulation) in formally presented, but over structurally presented, logical structures (in a map or a picture, or a scheme with pictographic symbols, or in the shape of tables that contain textual data).

The following processes are also structurally presented: perception; decision making; and influence (also educational), in models built upon the logic of cybernetic-type mechanisms (input-output transformations with a built-in automation). And not for brain simulation, but for symbolic representation, which is, however, realised through "structural" manipulation of the information resulting from the research of the relation "person – surrounding world".

Or simulating human thought in a structural aspect – through a world-like model. The structural manipulation of information resulting from the research of the relation "person – surrounding world" is defined as thinking.

The approach is holistic and leads to the construction of a "world-like" model. This model reflects the picture of the object detailed to the level necessary for analysis and construction, interpreted as a mechanism (motivational), and committed to the "shrunken" around it, compressed surrounding world.

Thus the object of analysis is the part of the correlated picture "surrounding world", together with the object "magnified" through a conditional magnifying glass (depending on the interests of the analyst-constructor), which allows the identification of the necessary level of detail of the structure, elements and relationships assembled into the object.

Methodology. Methods for identification and analysis of social device.

For the identification and analysis and construction of a world-like model, it is necessary to combine approaches and methods from different fields of knowledge, and build them into a methodology.

In the presented methodology, built-in are the methods of the systemic approach, combined with cascading identification, in order to achieve decomposition of the system on a higher level, and on a lower level of sub-systemic elements, which allows the identification of graphs of elements to which there are respective graphs of functional elements (the steps into which the process-describing procedure is broken) and graphs of element characteristics.

In the analysis of the systemically identified world-like model (system with an active human presence) analytical methods of mathematical description and the methods of structural and analogue modelling are used

Social device, interpreted as a structure – a structural model of appropriate activity, which realises the function "appropriate activity", is described by a simultaneous equation presented in the model of the function of social device.

This model presented as a functional structure (in which elements are operations defined as steps of a procedure of appropriate activity, which accomplishes a decision, visualises key characteristics of social device: multi-contours and multi-correlations.

And though the analysis of the structural interpretation of the function of social device by means of structurally interpreted stages of appropriate activity: perception, making of a decision (also an object of AI) – as a model of appropriate activity, which accomplishes motivation, the key characteristics of isomorphism, recursion and multiple planes are achieved.

As a result of the application of mathematical, social science and technical cybernetics methods, a characteristic that defines the type of systemic structure in which appropriate activity is realised – a Kalman filter or a tracking system, is found through the analysis of simultaneous equation of appropriate activity. This characteristic can be interpreted through the use of terms from the motivational regulatory system as a criterion for quality assessment of the motivational regulatory system.

The methods of cognitive science are applied in the analysis of the structural model of perception, making decisions and taking action, in which the filter of limiting conditions and aims is identified and analysed as a separate object.

This filter contains the motivational regulatory system, limiting conditions from the surrounding world, including the actions of all factors that do not depend on the subject. It transforms the information coming from the surrounding world by assembling it into an image of the subject's decision.

By introducing the filter (similarly to introducing the toolkit into the extended object of the AI approach), two important results are accomplished. One is the possibility for "descending" to the levels of detail, where the elements that construct the motivational model are located, and the construction of the motivational model itself.

The other is a cognitive picture, of a holistic type, of the integrated influences of the surrounding world and the person in an isomorphic-recursive interpretation, and opening opportunities for transitions and a language of translation between levels of differing nature, described in languages which until now did not have translation dictionaries.

The indeterminacy of time and space are overcome in the process of social device analysis by means of two-way substitutions on structural levels, and structurally presented functional levels applied on a cascading scale. That indeterminacy is a result of the impossibility to show proof of the finiteness or infiniteness of space, and a similar impossibility concerning time, and creates modelling problems.

Methods for identification and adaptation of toolkits

In the process of identification and adaptation of a toolkit for analysis and construction of world-like motivational regulatory system models, the following must be overcome: the paradoxes of systemic thinking; the indefiniteness of the limitation of one's own knowledge; and the issues of incompleteness – in order to fulfil the requirements of Whitehead-Russell in the Theory of types, and to cope with Russell's paradox.

Another problem, although not of the same rank, is the creation of typological networks of elements, of relationships, of configurations, and their respective typological networks of characteristics.

The paradoxes of systemic thinking are overcome through a holistic approach and adapted to the specifics of the studied object methods of cognitive science based on the definition of the object as a picture of the world-like model – a result of a recursive isomorphism between the world and the natural person in it.

The problems of incompleteness find their solution as a presentation of a logical structure in predicate logic on a higher level in the fields of G-space[5], transformed through isomorphism from the respective logical structure described by propositional logic on the respective lower level.

Typological networks are a result of the application of the superposition of isomorphisms principle, ordered in a sequence, encompassing the full spectrum: from order of reflection to object of influence of the regulations[4].

By extending the structural isomorphism of Bertalanffy the possibility for shrinking the surrounding world into a systemic world-like structure, which possesses the characteristics of a picture is achieved – result of the intellect of the researcher.

Based on extended Bertalanffy's structural isomorphism is also the filter for transition ("translation dictionary") among different description languages on the different levels.

The principle of the Principle of the relatively positioned observer[5] allows the picture of the world to be closed together with the observer, and for the images to be observed overcoming spatial relativity and to work with the ideal (mental) model of the world, together with the observer within it. The layering of the object in the graphic construction by using G-space

creates conditions and completes the requirement for coping with Russell's paradox (Theory of Types). The transition as “a process taking place at a time – procedure” is also a manifestation of the transition of propositional into predicate logic demonstrated as a proof of Gödel's theorem of incompleteness (of the arithmetics and the completeness of the calculation of predicates).

Methods for construction of intelligent legal models

For the creation of an object-oriented semantic network of words or a table of codes for the correspondence between words and elements – symbols of: the structurally active (person) and passive (all the rest) and functional frames describing social device what are used are combined methods of modelling and the creation of networks.

It is compulsory for the building of a semantic network that the relationships between elements, for which an atomic level is strictly required, to be numbered in the sequence of chronology of the systemic actions, part of the motivational regulatory system.

The object-oriented semantic network , by necessity resulting from a larger volume and a more complicated solutions of social relations, can be built by the elements which possess phenotypical characteristics that define them as belonging to each and every one of the structures on each level.

In realising G-space, it is necessary to go through an analysis of the contours of realising the motivation and regulation of actions on the multi-level stages of management.

Last but not least, for the successful realisation or re-engineering of the motivational regulatory system is determining the channels for regulating the schemes in which the regulating mechanism types are configured, as well as for testing the regulation mechanisms for efficiency and level of goal realisation.

The presented methodology for researching the creation of a methodology for studying the motivational regulatory system, is in fact a structure of the “expanding nodes” type and therefore it is in itself, together with the approach, built in the model of cognitive architecture that has been created.

G-space

In order to achieve a simulation model of analogue transformation and structural interpretation of the transformation, the fields of G-space are modified into fields which present means for manifestation of specifics – (highlight characteristic specifics) of the elements of G-space (a standard), of the way of ordering (configuring according to an algorithm (a standard) – situationally, depending on the phenotype of the specific motivational system) of the motivational regulatory system elements.

These fields, as every element recognised by its genotype characteristics present in the G-space field, are introduced into the motivational regulatory system in a sequence following the isomorphism recognised by the phenotype characteristics, build up the structure of the G-model.

Procedures that regulate the finding and regulation of social relationships that motivate toward the realisation of a specified in the regulation system behaviour, are presented in the G-model. The G-model is designed for simulation experiments in the conditions of a serious game for testing relativity - “goals – realisation of behaviour”, as well as for finding the structure in the motivational system that “programmes” the behaviour assigned by the constructor. The G-model allows assessment of logical integrity, efficiency and optimality by criteria chosen by the natural and legal persons under regulation themselves.

G-space allows finding existing, unknown to the constructor strings of causal relations between elements, which belong to different levels.

Through introducing a specific motivational regulatory system (law, statute, and contract) in G-space, the following process is simulated:

diagnostics of the logical integrity, respectively efficiency and;

narrowing relativity when it comes to:

belonging to a certain type of structure and;

a place in the chain of cause-and-effect relationships; on the missing parts of the diagnosed object.

The missing elements, or fragments, from the chain of the cause-and-effect relationships in the G-model are found by analysis of the components that describe the procedures with the indicator “undefined presence of attributes on one of the levels”. The missing links of a regulating mechanism's structure are found during the testing with the help of the criteria for efficiency, logical integrity, socio-economic efficiency and optimality.

The impact that a structure realises depends on the configuration and the specifics of the elements (into which an analogue function is built). This peculiarity allows for the analysis and evaluation of schemes in visual form, and not in a shape presented by a formal system of differential equations.

Of utmost importance for the quality of the motivational regulatory system, as a regulator of social relationships, is the opportunity for a global criterion for efficiency, logical integrity and unambiguity, which could be even undefinable, to be “interpreted” and attached for testing through the use of G-space, in the terms describing a given fragment.

G-space allows simulation and transformation on the principle of “one looks at a unit globally and makes a decision, but then acts on a separate fragment”. In other words, G-space gives the analyst-constructor the opportunity “to see globally and act locally, depending on the situation”.

Democratic Legal System

A legal system or its design are democratic and optimal when the following is available: perfect normative system, satisfying the subjective right of every legal subject to look for justice and to receive it; realizability of the subjective right without financial barriers, without social pressure and obstructive behavior of the administrative workers; and perfect organization of the administration (understood as institutions and organizational technology).

Democratic normative system as a regulator of the socio-economic relations, including the legal subjects themselves, with an accent on the regulation, applied by the judicial and the administrative bodies to solve the conflicts, guarantee equality before the law in the realization of the interests and the potential of every legal subject.

The regulatory procedures, which are built in perfect legal system, have the following characteristics: justice; equfinality; transparency; conflict prevention; and appropriate decision; and guarantee safety and optimal and socially efficient social device or social-economic unit.

Optimal Organization of the Administrative Bodies Realizing the Law

The optimal schematic configuration of the administrative organization comprises of: optimal organization of the technological chains and optimal organizational technology.

The optimal organization of the technological chains comprises of: optimal organization of the technological infrastructure of each position of the technological chain – the organization of the process of activity realization is being designed by the popular methods of operations management; and optimal allocation of the staff – it is being accomplished through the “distributive justice”* procedure, which is adapted to the specificity of the activity realization.

The optimal organizational technology, which guarantee transparency, comprises of: personalization of rights and duties; transparency of the actions and registration of the results – the project is being accomplished through “retributive justice” procedure, adapted to the specificity of the activity; quality control; and review of the contracts and other documents related to the contracts.

The optimal organization of the administrative bodies is a reviewed and corrected model, transformed, at the relevant languages of the levels, in relevant documents.

The optimal organization of the administrative bodies ensures full transparency of the individual behavior and effective control against prohibited actions; eliminates the conflicts, which have negative influence on the activity realization; and ensures efficient utilization of the resources.

The optimal organization of the administrative bodies considerably increases the motivation of each of the citizens or member of the personnel of the SEU for the achievement of high socio-economic results and it also increases significantly the socio-economic efficiency.

Social practices (which bind in a tracking system (servomechanism or Kalman filter in Cybernetics) everyone's interests to the results, achieved by himself/herself, and which allow the relevant participation in the process of decision-making and a relevant manifestation and protection of the personal interests), built in the institutional framework of the optimal social device or SEU, premise optimal decisions as integrated individual decisions.

Conclusion

The most serious obstacle to democratic transition, and the development of a democratic system, is the missing knowledge in the community about the opportunities offered by the approach and tools - such as AI-methodology and G-space cognitive architecture.

The lack of these knowledge does not allow analysis of the social democratic practices and their improvement and control as well as prevention of the negative social consequences of the introduction of development tools in finance, economic and political fields.

Training for acquiring knowledge for this modern instruments stimulating democratic thinking and democratic attitudes in society should start from primary school - like education and continue as continuous training, analysis and research to democracy. Because democracy is the work of all citizens overcoming authoritarian attitudes can be achieved only by literate people in this area.

This barrier prevents the development of a democratic legal system, and that highly sensitive regulators socio-economic interests motivating citizens and officials to actions and decisions consistent with the democratic values of civil society.

Together with the training necessary creation of a system of institutions for permanent audit of the development of democratic institutions, analyzing, documenting and notifying the public, the design of every available piece of legislation together with the preliminary assessment of its impact on the functioning of public device and dangers for democratic legal order.

A network of scientific research topics centers is necessary and the global democratic community. To overcome the negative trends in the democratic process and the development of democratic social order is necessary launch a large-scale program to create think tanks for research and advisory services and training and scientific development of cadres. Shots for analysis and design of legal systems and especially motivational mechanisms regulating basic democratic social practices.

It is overcoming isolationism in legal science and the development and direction of enrichment achievements of modern technological knowledge in the spirit of the General Systems Theory by Ludwig von Bertalanffy and AI . It is reviewing the directions for the development of legal science in the interest of increasing the courses, projects and training time on analysis and design of logic structures of legal acts regulating social relations in the spirit of democratic rule of law.

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Theory of Architectural, Social Participation and “Contact” by Robert Zemeckis

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Abstract

The paper shows the importance of memory in architecture and how social participation influence the formation of cultural memory. The article examines the issue of the importance of memory and how the popular culture coexists with highly symbolic places. The research will be conducted on the case of the "Memorial to the Murdered Jews of Europe" in Berlin, built by architect Peter Eisenman. The aim of the paper is to show that architecture of memorials restores ideas and messages to protect the community from future mistakes. Social participation supports shaping public spaces and thus participates in the creation of culture. Article points out that creating memorials is connected with a great responsibility, because they strongly affect our memory and guide future generations.

Keywords: labyrinth, memorial, social participation, architecture

1. Introduction

In this article I will try to examine the description of architectural, social participation presented in the famous science fiction movie "Contact" by Robert Zemeckis, which was based on a novel by Pulitzer Prize winner, Carl Sagan.

I will use one of the most popular social participation models, "The ledder of citizen participation" by Sherry R. Arnstein. Before we will analyse the process of portal construction, I will briefly explain the idea of social participation in the field of architecture.

2. Architectural Democracy and Architectural Tyrany

At the time when human kind was approaching the renaissance period a significant change has taken place in the world of building construction. The architects stopped being anonymous and their names started to be associated with the work they created. For example one of the first well-known architects of the era in my homeland, Poland, was named Henryk Brunsberg (Gierke, 2015).

We can perceive this moment of time as a beginning of monarchy or dictatorship in the architectural world - one person started to rule, control and be responsible for the whole construction process. With an approval of an investor the architect could do whatever he wanted.

However, soon people started to realise, that many other people may be interested in the form of the new building. For example a neighbour from the other side of the road will soon look at the new facade every day, so his opinion should be taken into consideration, when designing its shape. An ecologist will be interested in preserving a large tree which grows in the middle of the designed building. The city president has always wanted to build a new road, which would pass the property. Social participation is about listening to and trying to reconcile all these people.

The amount of ideas and problems is as large as the planned construction process. The movie I am going to talk about is telling a story of the biggest construction in the history of mankind. Therefore the director could not resist the temptation to beautifully paint the social background of the investment.

3. The Plot

A young female scientist is analysing radio - signals which come to our planet from different places in the universe. The research leads to the discovery, that one of the transmissions contains plans of a mysterious building.

Is this giant construction of unknown origin a trojan horse or a part of a communicational system, which will help to accelerate the development of the Earths technology? The people decide to check this in an empirical way.

4. The Ladder of Citizen Participation

When we think about the story in the context of the Sherry R. Arnstein theories we can perceive the construction of the portal as the process of climbing the "ladder of citizen participation". The involvement of people grows as the building takes its shape.

Shortly after the discovery we can see the non-participatory processes. For example the idea of concealing the message from the stars can be regarded as a manipulation. However, many scientists are against this way of thinking - the building plans were surely given to the whole human kind.

The next step on the ladder of citizen participation is called "the therapy". When politicians and scientists inform the people about the forthcoming construction, they try to convince them that it is extremely important.

The research facility starts to be surrounded by the people, who want to take part in this extraordinary discovery. Some of them are for and some against the experiment. The most controversial aspect is connected with selecting the person, who will pass the portal - the one which will be a representative of the whole human kind. The committee, which is formed on the basis of the partnership (the sixth step on the ladder of Citizen Participation) creates a kind of casting and finally finds an appropriate candidate.

When the construction is completed and the experiment is about to begin, social participation reaches the highest possible level. "Citizen control" leads to the tragedy - the opponents of the project take control of the experiment and the construction is destroyed.

In my opinion this point in the screenplay shows a critical diagnosis of the social participation ideas. As we can see social disapproval may lead to the failure of one of the greatest chances of mankind.

However, despite the collapse of democratically created construction the experiment is still possible - it can be conducted in a twin copy of the portal, which was build secretly by the government on a far-away island. The justice, which is a feature of projects created with the help of citizen participation is compared with the effectiveness of those built without it.

Can we agree, that in certain circumstances, social participation can be regarded as something negative?

5. Critical look on the social participation

In the history of my country the democratic rule of "Liberum Veto" - according to many historians - has weakened Poland's political position (Jasienica, 1988). Similarly the above mentioned portal did not bear the discrepancy of views and opinions.

Can we blame the authorities, that the second construction was created with the lack of social participation? Are they justified by their faith in the meaning of the experiment?

Apparently in the history of democracy we can find many examples of decisions, which served social justice but were made in a way which could not be regarded as democratic. It was proven that Abraham Lincoln used bribery and traded positions in order to impose the thirteenth amendment to the constitution of United States, which illegalised slavery (Foner, 2010).

In Poland one of the biggest national holidays is the third of may - the day, when the country imposed the second constitution in the world. However, not all the people know, that in order to achieve this success work on the document was kept in secret (Foner, 2010) and during the vote political opposition was cheated and kept guarded (Adamkiewicz, 2012).

If a man believes strongly in an idea, but knows that in order to achieve the goal he has to violate the rules of democracy - what should he do? Do the ends justify the means? How far in marginalising the role of social participation can the authorities go, when working on the project of high economic, scientific or aesthetic value?

All these questions can only be left unanswered. However, there is one particular problem, which the movie tries to solve at its very ending. It can be stated in a following way: what should we do to make the freedom, democracy and social participation possible? To show the intentions of the director we will have to analyse one of the most interesting threads of the movie - the relation between science and religion.

6. Science and Religion

In the background of the main, science - fiction action we can find a love story between Ellie Arroway, an earlier mentioned female researcher who is an atheist and Palmer Joss, a theologian who is a would-be priest. Their discussions, which are a confrontation of scientific and emotional way of thinking, become surprisingly important in the context of the ending of "Contact".

The portal experiment finally takes place. The heroine has an interesting vision of meeting alien life forms, as she falls in special capsule between rotating rings. However, her cameras do not record any image. Arroway, who cannot show material evidence of the adventure must refer to the criteria of faith and trust - what unexpectedly helps her understand Palmer Joss.

In my opinion the message of the movie can be analysed in the context of the topic of this article. Social participation is a great idea as long as we will try to understand the beliefs of other people, who take part in the negotiations. An attempt to perceive the disputed matters from our opponents' point of view not only can help us find the best solution to the problem, but also begin a new friendship.

7. Conclusion

To sum up, "Contact" by Robert Zemeckis can be read as a critical essay on the topic of social participation in the world of architecture. Although the reflection is rather pessimistic a careful audience may also see the final, hidden message of tolerance and brotherhood.

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