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COMPARATIVE ANALYSIS
OF ELECTROMAGNETIC FIELD STUDY USING
OPERATOR DIAGONALIZATION METHODS

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Abstract. *Two types of operator diagonalization procedures are analyzed for the differential Maxwell system in its classical form and in the specific case of electromagnetic field expofunctional excitation. The first diagonalization approach concerns operator analogy of the algebraic Gauss method. The second one deals with the inverse matrix operator construction. In both cases, the general wave PDE (partial differential equation) is got with respect to all unknown scalar components of electromagnetic field intensities. Detailed comparison of the suggested methods is done basing on their virtues and drawbacks. The common features and essential differences of the aforesaid Maxwell systems of PDEs are found owing to the obtained general wave equations.*

Keywords and phrases: *classical Maxwell system, symmetrical Maxwell system, operator analogy of Gauss method, general wave equation.*

1. Introduction

Though, so many computer numerical programs are used nowadays solving various industrial and engineering problems including technical electrodynamics and so on, analytical explicit methods basing on the respective mathematical models are encouraged as well [1, 2]. Really, it is better putting the given experimental data into the known exactly obtained expression, than dealing with the approximate numerical algorithm taking into account its all computing inaccuracies. Moreover, all of them should be in conformity with the original physical or engineering problem statement.

In this case, analysis of the different constructive analytical methods becomes rather important, as from the theoretical, as from the applied viewpoints. Since systems of PDEs (partial differential equations)

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represent the main mathematical models in electromagnetic field theory, their research remains rather urgent just in this scientific direction.

Basing on the fundamental differential Maxwell system [3], so many other versions of it were considered in the current engineering phenomena [1, 2]. In particular, it concerns the so called expofunctional excitations in the framework of the classical electromagnetic field theory [4].

Further, even analytically almost precise solving procedure has its own virtues and drawbacks. That is the main reason why in the present paper, two new pure mathematical methods are compared in terms of their influence on exact study of electrodynamic problems.

The first one is the operator analogy [5] of the algebraic Gauss method [6]. The second approach deals with the inverse matrix operator construction [7], again basing on the well known numerical algebraic technique [6]. Both methods act only in the class of ordinary, non generalized functions, simplifying and not infringing the original industrial problem statement. Later, this functional class can be modified taking into account the particular boundary problem conditions.

2. Preliminaries

At first, let the symmetrical differential Maxwell system [4, 5] be given for homogeneous isotropic linear media in the presence of "expo functional" influences when their kernels are studied

$$\begin{cases} \mathbf{rot}\vec{H} = (\sigma \pm \lambda\varepsilon_a)\vec{E} + \varepsilon_a\partial_0\vec{E} + \vec{j}^{OS} \\ -\mathbf{rot}\vec{E} = (r \pm \lambda\mu_a)\vec{H} + \mu_a\partial_0\vec{H} + \vec{e}^{OS}. \end{cases} \tag{2.1}$$

In (2.1): the unknown vector functions $\vec{E}, \vec{H} = \vec{E}, \vec{H}(x, y, z, t)$ with scalar components $E_k, H_k = E_k, H_k(x, y, z, t), (k = \overline{1, 3})$ represent electric and magnetic field intensities; positive constants $\sigma, \mu_a, \varepsilon_a$ are the specific conductivity, absolute and dielectric permeability of the medium respectively; vector functions $\vec{j}^{OS}, \vec{e}^{OS} = \vec{j}^{OS}, \vec{e}^{OS}(x, y, z, t)$ are known and describe the outside current sources and intensities. Their scalar components look like $j_k{}^{OS}, e_k{}^{OS} = j_k{}^{OS}, e_k{}^{OS}(x, y, z, t), (k = \overline{1, 3})$. Parameter of the signal exciting medium is $\lambda = const > 0$. Sign reversal in front of λ corresponds to the absorption of signal for "+" and activity of the medium for the "–". Theoretical constant $r > 0$ is assumed at the current research stage only. It is responsible for the system symmetry and simplification of the further mathematical computation. At the end, it can be omitted not

influencing the original problem statement and final numerical calculation. Partial differential temporal operator and classical rotor definition look like

$$\partial_0 = \frac{\partial}{\partial t}, \quad \mathbf{rot} = \det \begin{bmatrix} \vec{i} & \vec{j} & \vec{k} \\ \partial_1 & \partial_2 & \partial_3 \\ F_{i1} & F_{i2} & F_{i3} \end{bmatrix}, \quad \text{where} \quad \partial_1 = \frac{\partial}{\partial x}, \partial_2 = \frac{\partial}{\partial y}, \partial_3 = \frac{\partial}{\partial z}.$$

Functions $F_{ik} = F_{ik}(x, y, z, t)$, $(i = 1, 2; \ k = \overline{1, 3})$, designate scalar components of the appropriate vector electromagnetic field intensities $\vec{F}_1, \vec{F}_2 = \vec{F}_1, \vec{F}_2(x, y, z, t)$; $\vec{F}_1, \vec{F}_2 = \vec{E}_1, \vec{H}_2$.

Solution of (2. 1) was got using two operator diagonalization methods [5, 7] in the meaning of this system reduction to the general wave equation with respect to all scalar components of the original unknown electromagnetic field vector intensities. The first approach [5] dealt with operator analogy of the classical algebraic Gauss method and simply fulfilled diagonalization procedure constructing equivalent matrix problem whose all equations depended on the only one scalar component of the initially unknown vector field function. The second procedure [7], though pursued the same goal of getting general wave equation, was more diverse in its direct applications. Thus, it allowed obtaining explicit solvability conditions of (2.1), and corresponding criterion of the solution existence was proved.

Nevertheless, elegant technique of the second algorithm based on the matrix operator kernel study [8], could not be used for the diagonalization of homogeneous systems. It was completely explained by the main tendency of the given procedure of inverse matrix operator construction generated by the analogous algebraic numerical matrix theory [6].

Before coming to the straight analytic realization of the aim of the present paper, the "diagonalization" term should be reminded. In general, it means the reduction of the original matrix problem to the equivalent system of scalar ones, where each of them depends on the only one component of the initially unknown vector field function.

3. Two diagonalization methods in short for the symmetrical Maxwell system

At first, the outline of operator analogy [5] of the classical Gauss method [6] is proposed as the corresponding diagonalization procedure for the symmetrical Maxwell system (2.1).

Using additional operator notations

$$A = \mathbf{rot}; \quad C = \sigma + \varepsilon_a \partial_0^*; \quad P = r + \mu_a \partial_0^*; \quad \partial_0^* = \partial_0 \pm \lambda \qquad (3.1)$$

system (2.1) can be rewritten like that

$$\begin{cases} A\vec{H} - C\vec{E} = \vec{j}^{\,OS}, \\ -P\vec{H} - A\vec{E} = \vec{e}^{\,OS}. \end{cases} \qquad (3.2)$$

Then, diagonalization of (3.2) "by blocks" begins. It means operator P, A application to the first and the second equations of (3.2) respectively and term-by-term addition of both transformed equations. Further, to the first and the second equations of the new equivalent system

$$\begin{cases} -(PC + A^2)\vec{E} = P\vec{j}^{\,OS} + A\vec{e}^{\,OS}, \\ -P\vec{H} - A\vec{E} = \vec{e}^{\,OS} \end{cases} \qquad (3.3)$$

two operators $(-A)$, $(PC + A^2)$ are applied, and both transformed equations are added again term-by-term. It is easy to notice that the first equation in (3.3) depends only on $\vec{E}$ now.

The last equivalent system at this diagonalization stage is the following

$$\begin{cases} -(PC + A^2)\vec{E} = P\vec{j}^{\,OS} + A\vec{e}^{\,OS}, \\ -(PC + A^2)P\vec{H} = PC\vec{e}^{\,OS} - PA\vec{j}^{\,OS}, \end{cases} \qquad (3.4)$$

and its second equation depends only on $\vec{H}$. So, diagonalization procedure of (2.1) on its "block stage" is closed, and after application to the second equation of (3.4) the inverse operator P^{-1}, the general wave vector equation regarding two electromagnetic field vector intensities is got

$$-(A^2 + PC)\vec{F}_i = \vec{\varphi}_i, \quad (i = 1, 2). \qquad (3.5)$$

In (3.5):

$$\vec{F}_1 = \vec{E}, \ \vec{F}_2 = \vec{H}; \ \vec{\varphi}_1 = A\vec{e}^{\,OS} + P\vec{j}^{\,OS}, \ \vec{\varphi}_2 = C\vec{e}^{\,OS} - A\vec{j}^{\,OS};$$

$$A^2 = \mathbf{grad} \ \mathrm{div} - \Delta; \ \Delta = \sum_{k=1}^{3} \partial_k^2, \qquad (3.6)$$

and last two formulas are classical operators from the electromagnetic field theory [3].

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Taking into account symbols (3.6) and introducing operator polynomial

$$\tilde{\partial}_0^2 = PC = (\sigma + \varepsilon_a \partial_0^*)(r + \mu_a \partial_0^*) = \varepsilon_a \mu_a (\partial_0^*)^2 + (\sigma \mu_a + r\varepsilon_a)\partial_0^* + \sigma r, \quad (3.7)$$

partial differential operator from the left side of (3. 5) can be expressed as follows

$$A^2 + PC = \mathbf{grad}(\partial_1 + \partial_2 + \partial_3) - \Delta + \tilde{\partial}_0^2. \quad (3.8)$$

Using (3.7), (3.8), the former general vector wave equation (3.5) can be described in the coordinate form

$$
\begin{cases}
A_{23}F_{i1} - B_{12}F_{i2} - B_{13}F_{i3} = \varphi_{i1}, \\
-B_{12}F_{i1} + A_{13}F_{i2} - B_{23}F_{i3} = \varphi_{i2}, \\
-B_{13}F_{i1} - B_{23}F_{i2} + A_{12}F_{i3} = \varphi_{i3}, \ (i = 1, 2).
\end{cases}
\quad (3.9)
$$

In (3.9): operators

$$A_{jk} = \partial_j^2 + \partial_k^2 + \tilde{\partial}_0^2, \ (j \neq k); \ B_{jk} = \partial_j \partial_k, \ (j \neq k), \ (j, k = \overline{1, 3}) \quad (3.10)$$

and scalar functions

$$F_{ik}, \varphi_{ik} = F_{ik}, \varphi_{ik}(x, y, z, t), \ (k = \overline{1, 3}; \ i = 1, 2) \quad (3.11)$$

are given in terms of (3. 6), where

$$\vec{F}_i = \{F_{ik}\}_{k=1}^3; \ \vec{\varphi}_i = \{\varphi_{ik}\}_{k=1}^3; \ (i = 1, 2). \quad (3.12)$$

Applying directly diagonalization procedure from [5] to (3.9) – (3.12) one gets the required diagonal matrix problem equivalent to both systems, – (3.9), (2.1). Moreover, the latter can be expressed as the general wave scalar equation regarding all unknown components of the electromagnetic field vector intensities

$$\tilde{\partial}_0^2(\tilde{\partial}_0^2 - \Delta)F_{ik} = (\partial_k^2 - \tilde{\partial}_0^2)\varphi_{ik} + \partial_k(\partial_\nu \varphi_{i\nu} + \partial_l \varphi_{il}),$$

$$(\nu \neq l, k \neq \nu, k \neq l; k, \nu, l = \overline{1, 3}; \ i = 1, 2). \quad (3.13)$$

In other words, (3.13) represents the attainment of (2.1) solution in terms of diagonalization procedure based on the operator analogy of the algebraic Gauss method.

Now, as it was mentioned above, the main features of the inverse matrix operator construction should be proposed here in comparison with the preceding analytic approach. Turning to [7], it is useful to show how both diagonalization methods can act together successfully. Thus, after the

previous algorithm action "by blocks", the inverse matrix operator construction for (3.9) appears. Writing (3.9) in a matrix form:

$$KF_i = \varphi_i, \quad (i = 1, 2);$$

$$K = \begin{bmatrix} A_{23} & -B_{12} & -B_{13} \\ -B_{12} & A_{13} & -B_{23} \\ -B_{13} & -B_{23} & A_{12} \end{bmatrix}, \quad F_i = \begin{bmatrix} F_{i1} \\ F_{i2} \\ F_{i3} \end{bmatrix}, \quad \varphi_i = \begin{bmatrix} \varphi_{i1} \\ \varphi_{i2} \\ \varphi_{i3} \end{bmatrix} \quad (i = 1, 2) \quad (3.14)$$

the inverse matrix operator regarding K can be obtained

$$K^{-1} = (\det K)^{-1} \begin{bmatrix} K_{11} & K_{21} & K_{31} \\ K_{12} & K_{22} & K_{32} \\ K_{13} & K_{23} & K_{33} \end{bmatrix}, \quad (3.15)$$

where

$$\det K = -\tilde{\partial}_0^2 (\tilde{\partial}_0^2 - \Delta)^2; \quad K_{mm} = (\Delta - \tilde{\partial}_0^2)(\partial_m^2 - \tilde{\partial}_0^2);$$

$$K_{mn} = K_{nm} = \partial_m \partial_n (\Delta - \tilde{\partial}_0^2), \quad (m, n = \overrightarrow{1, 3}; m \neq n). \quad (3.16)$$

In (3.16), the first expression is the determinant of (3.14), and all others are operator analogies of algebraic adjuncts from (3.15) with respect to the original matrix K from (3.14). Substitution of (3.16) for (3.15) gives

$$K^{-1} = (\tilde{\partial}_0^2)^{-1} (\tilde{\partial}_0^2 - \Delta)^{-1} \begin{bmatrix} \partial_1 - \tilde{\partial}_0^2 & \partial_1 \partial_2 & \partial_1 \partial_3 \\ \partial_1 \partial_2 & \partial_2 - \tilde{\partial}_0^2 & \partial_2 \partial_3 \\ \partial_1 \partial_3 & \partial_2 \partial_3 & \partial_3 - \tilde{\partial}_0^2 \end{bmatrix}. \quad (3.17)$$

Simple verification confirms $K^{-1}K = KK^{-1} = I = \text{diag}\{1, 1, 1\}$ and agrees with algebraic matrix analogy [6].

Application of (3.17) to (3.14) leads to the following equivalent diagonal system

$$F_i = \begin{bmatrix} F_{i1} \\ F_{i2} \\ F_{i3} \end{bmatrix} = K^{-1} \varphi_i = K^{-1} \begin{bmatrix} \varphi_{i1} \\ \varphi_{i2} \\ \varphi_{i3} \end{bmatrix} \Leftrightarrow$$

$$\Leftrightarrow \begin{bmatrix} F_{i1} \\ F_{i2} \\ F_{i3} \end{bmatrix} = (\tilde{\partial}_0^2 (\tilde{\partial}_0^2 - \Delta))^{-1} \begin{bmatrix} \partial_1^2 - \tilde{\partial}_0^2 & \partial_1 \partial_2 & \partial_1 \partial_3 \\ \partial_1 \partial_2 & \partial_2^2 - \tilde{\partial}_0^2 & \partial_2 \partial_3 \\ \partial_1 \partial_3 & \partial_2 \partial_3 & \partial_3^2 - \tilde{\partial}_0^2 \end{bmatrix} \begin{bmatrix} \varphi_{i1} \\ \varphi_{i2} \\ \varphi_{i3} \end{bmatrix}, \quad (i = 1, 2). \quad (3.18)$$

It is easy to find that in reality (3.18) is identical to (3.13) and looks like

$$\tilde{\partial}_0^2(\tilde{\partial}_0^2 - \Delta)\begin{bmatrix} F_{i1} \\ F_{i2} \\ F_{i3} \end{bmatrix} = \begin{bmatrix} (\partial_1^2 - \tilde{\partial}_0^2)\varphi_{i1} + \partial_1(\partial_2\varphi_{i2} + \partial_3\varphi_{i3}) \\ (\partial_2^2 - \tilde{\partial}_0^2)\varphi_{i2} + \partial_2(\partial_1\varphi_{i1} + \partial_3\varphi_{i3}) \\ (\partial_3^2 - \tilde{\partial}_0^2)\varphi_{i3} + \partial_3(\partial_1\varphi_{i1} + \partial_2\varphi_{i2}) \end{bmatrix}, \; (i = 1, 2). \quad (3.19)$$

Further detailed study of the inverse operator (3.17) existence brings the following

Solvability criterion. System (2.1) is solved in the meaning of its equivalence to the general scalar wave PDE $(3.13) = (3.19)$ if such conditions are true

$$\begin{bmatrix} \Delta < -\left(\dfrac{1}{2}\left(\sigma\sqrt{\dfrac{\mu_a}{\varepsilon_a}} - r\sqrt{\dfrac{\varepsilon_a}{\mu_a}}\right)\right)^2 \\[4mm] \begin{cases} \Delta \geq -\left(\dfrac{1}{2}\left(\sigma\sqrt{\dfrac{\mu_a}{\varepsilon_a}} - r\sqrt{\dfrac{\varepsilon_a}{\mu_a}}\right)\right)^2 \\[4mm] \partial_0 = \dfrac{\partial}{\partial t} \neq \begin{bmatrix} -\lambda \\ +\lambda \end{bmatrix} - \dfrac{1}{2}\left(\left(\dfrac{\sigma}{\varepsilon_a} + \dfrac{r}{\mu_a}\right) \mp \sqrt{\left(\dfrac{\sigma}{\varepsilon_a} - \dfrac{r}{\mu_a}\right)^2 + \dfrac{4\Delta}{\mu_a\varepsilon_a}}\right) \end{cases} \end{bmatrix}, \quad (3.20)$$

and only non generalized functions are taken into account.

In (3.20), sign reversal in front of λ is independent of the sign value near the square root, and inequalities are understood in the meaning of the corresponding operator influence on the functions from certain classes.

4. Diagonalization procedure in the case of the classical differential Maxwell system

Let the classical differential Maxwell system with constitutive equations be given in macroscopic theory of electromagnetic field [3, p. 10]

$$\begin{cases} \mathbf{rot}\,\vec{E} + \dfrac{1}{c}\dfrac{\partial \vec{B}}{\partial t} = 0, \\[4mm] \mathbf{rot}\,\vec{H} - \dfrac{1}{c}\dfrac{\partial \vec{D}}{\partial t} = \dfrac{4\pi}{c}\vec{j}, \\[4mm] \vec{D} = \varepsilon_0\vec{E}; \;\; \vec{B} = \mu_0\vec{H}; \;\; \vec{j} = \sigma\vec{E}. \end{cases} \quad (4.1)$$

In (4.1), the unknown vector functions $\vec{E}, \vec{D} = \vec{E}, \vec{D}(x, y, z, t)$ and $\vec{H}, \vec{B} = \vec{H}, \vec{B}(x, y, z, t)$ characterize both the electric and magnetic fields correspondingly; $\vec{j} = \vec{j}(x, y, z, t)$ is known and describes current density; $\sigma, \varepsilon_0, \mu_0$ are parameters of the medium and represent its specific conductivity, electric and magnetic permeability. Those mentioned attributes are positive constants in the case of homogeneous media and become functions regarding (x, y, z) for heterogeneous ones. Light speed in vacuum $c \approx 3 \cdot 10^{10}$ cm / sec.

The aim of the present section consists of explicit solution of (4.1) basing on the diagonalization procedures of the preceding section 3. It should be reminded once more that diagonalization implies reduction of the original matrix problem regarding the unknown vector field function $\vec{F}$ to the equivalent system of such equations where each of them depends on the only one required scalar component of $\vec{F}$.

At first, substitution of the last three equations in (4.1) for the first and the second ones reduces (4.1) to the equivalent homogeneous system of PDEs:

$$\begin{cases} \mathbf{rot}\,\vec{E} + \dfrac{\mu_0}{c} \partial_0 \vec{H} = 0, \\[4mm] -\dfrac{1}{c}(\varepsilon_0 \partial_0 + 4\pi\sigma)\vec{E} + \mathbf{rot}\,\vec{H} = 0, \quad \partial_0 = \partial / \partial t. \end{cases} \qquad (4.2)$$

It is easy to notice that diagonalization of (4.2) using method of inverse matrix operator construction (look previous section 3) is impossible because of the last system homogeneity. Really, basing on [6] (4.2) has non zero solutions when the following condition is true:

$$\det \mathbf{M} = 0, \quad \mathbf{M} = \begin{bmatrix} \mathbf{rot} & \dfrac{\mu_0 \partial_0}{c} \\[4mm] -\dfrac{1}{c}(\varepsilon_0 \partial_0 + 4\pi\sigma) & \mathbf{rot} \end{bmatrix}, \qquad (4.3)$$

where $\mathbf{M}$ is the matrix operator generated by (4.2), and $\det \mathbf{M}$ is its determinant.

In its turn, the inverse matrix operator $\mathbf{M}^{-1}$ with respect to $\mathbf{M}$ from (4.3) exists then and only then when $\det \mathbf{M} \neq 0$. This fact eliminates presence of non trivial (non zero) solutions. Thus, only operator analogy of the classical Gauss method from section 3 can be applied here.

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Influences of **rot** and $-\dfrac{\mu_0}{c}\partial_0$ upon the first and second equations from (4.2) respectively, after term-by-term addition of those transformed equations give the equivalent system where the first equation depends on the only one vector field function

$$\begin{cases} \left(\mathbf{rot}^2 + \dfrac{1}{c^2}\mu_0\partial_0(\varepsilon_0\partial_0 + 4\pi\sigma)\right)\vec{E} = 0, \\[3mm] -\dfrac{1}{c}(\varepsilon_0\partial_0 + 4\pi\sigma)\vec{E} + \mathbf{rot}\,\vec{H} = 0, \ \ \partial_0 = \partial/\partial t. \end{cases} \qquad (4.4)$$

Further application to the first and the second equations from (4.4) operators $\dfrac{1}{c}(\varepsilon_0\partial_0 + 4\pi\sigma)$ and $\left(\mathbf{rot}^2 + \dfrac{1}{c^2}\mu_0\partial_0(\varepsilon_0\partial_0 + 4\pi\sigma)\right)$ respectively and again term-by-term addition of both transformed equations lead to the final diagonal system regarding each of the required vector field intensities

$$\begin{cases} \left(\mathbf{rot}^2 + \dfrac{1}{c^2}\mu_0\partial_0(\varepsilon_0\partial_0 + 4\pi\sigma)\right)\vec{E} = 0, \\[3mm] \mathbf{rot}\left(\mathbf{rot}^2 + \dfrac{1}{c^2}\mu_0\partial_0(\varepsilon_0\partial_0 + 4\pi\sigma)\right)\vec{H} = 0, \ \ \partial_0 = \partial/\partial t. \end{cases} \qquad (4.5)$$

Introduction of new operator notation:

$$\overline{\partial}_0^2 = \dfrac{1}{c^2}\mu_0\partial_0(\varepsilon_0\partial_0 + 4\pi\sigma) \qquad (4.6)$$

allows writing determinant of the initial system (4.2), and it is equal to $\det\mathbf{M}$ from (4.3):

$$\det\mathbf{M} = \det(4.2) = \mathbf{rot}^2 + \overline{\partial}_0^2 = \mathbf{grad}\,\mathrm{div} - \Delta + \overline{\partial}_0^2. \qquad (4.7)$$

The right part of (4.7) is obtained owing to the well known formulas of classical electrodynamics [3] and expression (4.6).

In its turn, (4.5) in the symbols of (4.6), (4.7) looks like

$$\begin{cases} (\mathbf{rot}^2 + \overline{\partial}_0^2)\vec{E} = 0, \\[2mm] \mathbf{rot}\,(\mathbf{rot}^2 + \overline{\partial}_0^2)\vec{H} = 0, \ \ \partial_0 = \partial/\partial t, \end{cases} \qquad (4.8)$$

and

$$(\mathbf{rot}^2 + \overline{\partial}_0^2)\vec{E} = (\mathbf{grad}\,\mathrm{div} - \Delta + \overline{\partial}_0^2)\vec{E} = (\det(4.2))\ \vec{E}. \qquad (4.9)$$

Taking into account (4.8), (4.9) and [6], we can assert that non trivial (non zero) solution of homogeneous system, (4.2) in particular, exists only of its determinant zero value $(\det(4.2) = 0$ here). But in the case of $\det(4.2) = 0$ and (4.9), the first equation from (4.8) is zero identically while $(4.7) = 0$ in vector sense. It means that even at this first diagonalization stage (4.8) and (4.9) need very accurate detailed analytic further investigation.

5. Conclusions

Comparing virtues and drawbacks of both diagonalization methods it is easy to find that operator analogy of the Gauss procedure effectively acts as for homogeneous, as for inhomogeneous systems. Also, it can be applied to arbitrary block matrix structure beginning from the external and coming to the required inner block, moving through all levels of vector function and stopping at any desired step. Moreover, this algorithm does not depend either on the coordinate system, or specific boundary problem statement. The latter is suggested only at the end, when the equivalent system of scalar equations appears. It is obvious that formulation of the appropriate scalar boundary problem and creation of its solution is incomparably more evident than dealing with the initial matrix form.

The main drawback of the same method consists of the natural requirement of all matrix operator elements' invertibility. It implies here investigation of all operator kernels and their intersection. Such computation and analysis are rather complicated and even vast, especially for matrices (systems of operator equations) whose order is greater than two.

Turning to the method of inverse matrix operator construction, it is not difficult to confirm that its main shortcoming is impossibility to work with homogeneous systems of operator equations. Nevertheless, the proposed algorithm allows constructing solvability conditions that are very useful in correct theoretical and physical scalar boundary problem statement instead of the vector one. Moreover, both methods can be applied in the framework of one and the same problem simultaneously.

At last, precise analysis of final results from section 4 is under consideration yet and is prepared for nearest publications.

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MODELLING A NETWORK WHERE THE OPINION OF EACH UNIT VARIES ACCORDING TO A "MAJORITY RULING" OF ITS NEIGHBOURING UNITS

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Abstract. *The complexity of human behaviour can lead to very unpredictable patterns in social activity and structure. Here we demonstrate the instability of a community network controlled by majority ruling, where an element adopts the most popular opinion of their peers. We modelled a community as a square lattice, and performed sequential "time step" numerical calculations upon each cell in parallel. Depending on the initial ratio of two opinions, the community can segregate either into separate "gangs", or get dominated by a single opinion. We also note that gangs are separated by neutral or confused groups of individuals, buffering the transition. The behaviours shown by this model can be comfortably applied to many other real life situations, such as neural or ecological networks.*

Keywords: *social networks, opinions, political party, elections, financial, economical, ecological and biological networks, majority rule, game of life.*

1. Introduction

The complexity and unpredictable nature of human behaviour creates very interesting and diverse interactions in society. Society consists of a multitude of factors in various communities, each with its own hierarchies and social structures. These many factors, such as ideologies, conventions, morals and environment, can lead to complex dynamics in the generation of a dominant opinion in a certain group of individuals, whether the opinion is for which political party a group should vote for, what football team they support, and even more fundamental which signals may be sent in neural network within our brains.

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Gabriel Tarde was the first who indicated that public opinion forms through interpersonal influence and conformity [1]. This issue is especially valid today due to the proliferation of online social media and chat networks, where individuals can spread or receive varying influences by their numerous contacts geographically spread over the whole world. Such various dynamics have been intensively studied in sociology [2,3,4] with the use of physics-like models and concepts [3,5,6] and use of statistical physics methods [7]. This approach to social networks was in general named "sociophysics".

There are many ongoing discussions in the world, where various groups are trying to convey disputable opinions to the overall public, whether they are supporting or are against contentious topics, such as nuclear energy, genetic engineering on living organisms, climate change and newly developed medicines. Each individual may or may not adopt new states in behaviour and opinion through the influence of their peers and neighbours. In general a consensus can be formed by an adoption of competing ideologies, traditions, and attitudes [8,2,3,9]. There have been original approaches to this dynamic opinion formation by Granovetter (the threshold model) [3] and by Bass (the diffusion of opinions) [10]. In both these models the key feature is that once an individual adopts a new state, his state remains unchanged at all subsequent times. In another approach, the opinion dynamics is described by the class of voter models [11,12]. In this approach, every node in the system may have one of two possible opinions, and at each time step a random nodes then copies the state of one or more of its randomly selected neighbours.

However, these previous models are less suited to studying the chaotic dynamics of competing opinions in situations where the opinion is likely to switch multiple times and in an unpredictable sequence until an overall consensus is reached. Such behaviour can in general be described with the use of a type of Ising spin model [13,14,15], which have been studied using statistical physics methods. There an individual's opinion is represented as a spin state, which can then be modelled as ferromagnetic ordering of spins in the Ising model associated with the ground state [16,13]. In many realistic situations the opinion-flips, during the evolution of a system, happen unconsciously [17] and in a very unpredictable chaotic

way. However, in these spin flip processes, the dynamical, chaotic aspects have not been properly addressed.

Social communities and networks consist of a large number of socially interacting agents, and so can be compared to many-body systems in physics. The whole or part of such systems may exhibit macroscopic collective properties very similar to many situations arising in traditional statistical mechanics or physics. However the forces involved in social interactions which drive social dynamics are quite different in nature from forces existing in physical systems, and as such their mathematical description is far from complete. Traditionally, it is believed that social dynamics are driven by influence [3,7], homophily [18], attitudes and cognitive structural organization [20,21], social balance [22], reciprocity and topological network structure [23,24]. Recently a series of binary network models have been introduced, where the chaotic dynamics and decision making processes have been described with the aid of equations describing the temporal states of individual Ising spins [26,27,28]. Such an approach allows consideration of the many interacting and inter-coupled networks, including multiplex networks, that had also been introduced recently [29,30,31,32].

The social infrastructures of any community can be represented as a network of interacting elements with varying connectivity structures. Here we will consider a system that will contain 10,000 units that will adapt according to "majority ruling", where a unit will adopt the most dominant opinion amongst its neighbours.

2. Model and Numerical Experiments

For this experiment a functional array of 100×100 will be used, with each element having an input from 4 neighbouring elements: above, below, left and right (see Figure 1). Each element can take one of three opinions: A, B or undecided, corresponding to the numbers 1, –1 and 0. Each element can be thought of as the variable x_{ij}, which is calculated according to the equation:

$$x_{ij}(t+1) = \text{sgn}(x_{i+1j}(t) + x_{i-1j}(t) + x_{ij+1}(t) + x_{ij-1}(t)) \qquad (1)$$

where the sum $(x_{i+1j} + x_{i-1j} + x_{ij+1} + x_{ij-1})$ is taken from the neighbouring four sites of the square lattices (see Figure 1).
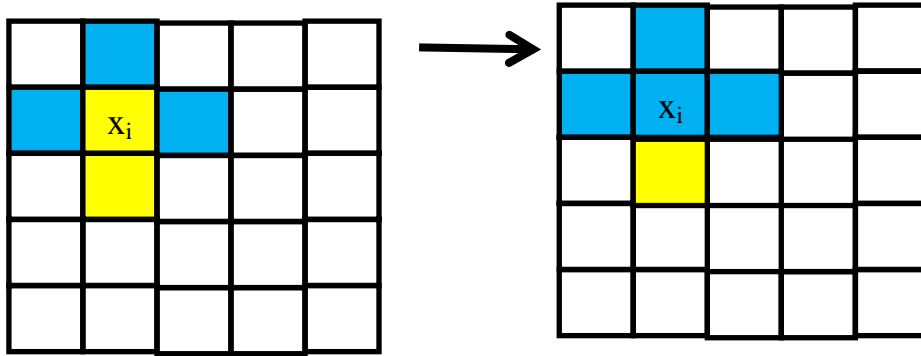
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Figure 1. A schematic illustration of equation (1). Opinion A is coloured blue and associated with $x_{ij} = 1$, opinion *B* is coloured yellow ($x_{ij} = -1$). Here you can see x_{ij} is surrounded by a majority of *A* opinions, and so after a time step iteration it too takes up the *A* opinion. Note $x_{ij} = 0$ corresponds to an undecided individual, say colourless in this figure; and only the labelled cell has had the iteration applied to it.

A set of scripts were created in python, using the modules numpy, random and mathplotlib in addition to the already present functions. The basis for each script was a square array that is filled randomly with either a random or known proportion (dependant on the desired area of analysis) of 1s and –1s. To simplify the calculations for each time step iteration, a border of 0s was left around the outside of the array. In these experiments, an array of 102×102 was used, leaving a functional area of 100×100 units (disregarding the 0 border).

A function, called iterate_1(*Z,n*), was created that would for each cell in the array sum the surrounding cells (4 in total), and then alter the value after that iteration is fully complete. If the sum is greater than 0, the cell becomes 1; if the sum is less than 0, the cell becomes –1, irrespective of what it was before. This form of iteration is known as parallel calculation, and was used for these experiments in order to remove bias of the various cells in the array. If a cyclic iteration method had been used, the cells appearing at the start of each cycle would have a greater effect on the final distribution, creating skew in the final results. In order to achieve parallel iterations, this function creates a new zero array *N*, fills it with the correct values collected from the original *Z* array, returning the new *N* array. To repeat the iteration until a constant final distribution is achieved, the original *Z* array is overwritten by the new *N* array, and this is repeated at least 20 times (value obtained by following the change in quantity of 1s and –1s in the array with increasing number of iterations. 20 iterations is always enough to reach a constant final distribution).

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This iteration procedure was repeated for 1000 different randomly generated arrays of known, set initial conditions, and the final distributions were collected in separate data lists for the total sum of 1s and –1s in the final arrays. This data was then used to produce histograms and colourmaps to illustrate the results. The experiment was done firstly with every cell containing a value other than 0, and again including 0s as half of the array, in the initial set conditions.

3. Results

First, we wanted to see how the array would change with each time step iteration. So using a script to collect the total sum of the 1s, –1s and 0s after each iteration and then plotting these values on a scatter graph, Figure 2 was obtained. We used the 100×100 array that we would then be using for the rest of the experiment. The "A votes" correspond to 1s in the array, "B votes" to –1s, and 0s correspond to "undecided" elements. As can be seen in Figure 2, the array reaches a final consensus fairly rapidly (after 15 iterations), which at first progresses in a linear fashion. We then decided to investigate whether increasing the number of 0s in the initial array would affect the rate of convergence to a consensus in the array. Hence we made an initial array with 5000 zeroes (50% of the array area), and followed its behaviour with each time step iteration, shown in Figure 3.

As can be seen in Figure 3, the array still converges to a solid consensus in roughly 15 time steps, and so this implies that the rate of convergence of our arrays according to the majority ruling is independent of the initial proportion of zeroes in the array. Due to this, we will be using at least 20 time step iterations to obtain the final distributions of each array in the later parts of this experiment. Also, in both Figure 2 and Figure 3, once the consensus had been reached, a slight fluctuation in the final numbers of As and Bs can be seen by the horizontal zigzag lines in the plots. This phenomenon is due to "confused" regions where the opinions of each element will switch continuously due to each element being surrounded by the opposite opinion. This will be visualised better in Figures 4 through 8 by the chessboard patterns (explained later).

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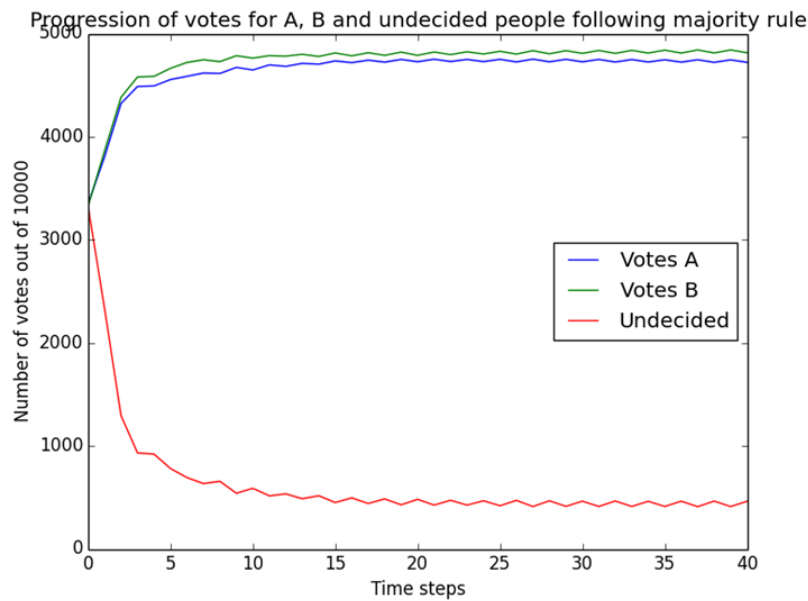
Figure 2. An example scatter line plot showing how the total amount of each value (1=A, –1=B, 0= undecided) varies as the number of iterations increases. The total number of cells was 10,000, aligned in a 100×100 array. The end zigzag pattern is due to continual switching of opinion after each iteration, which can be seen as a "confused" region in the later colourmap. The initial conditions were random in this example.
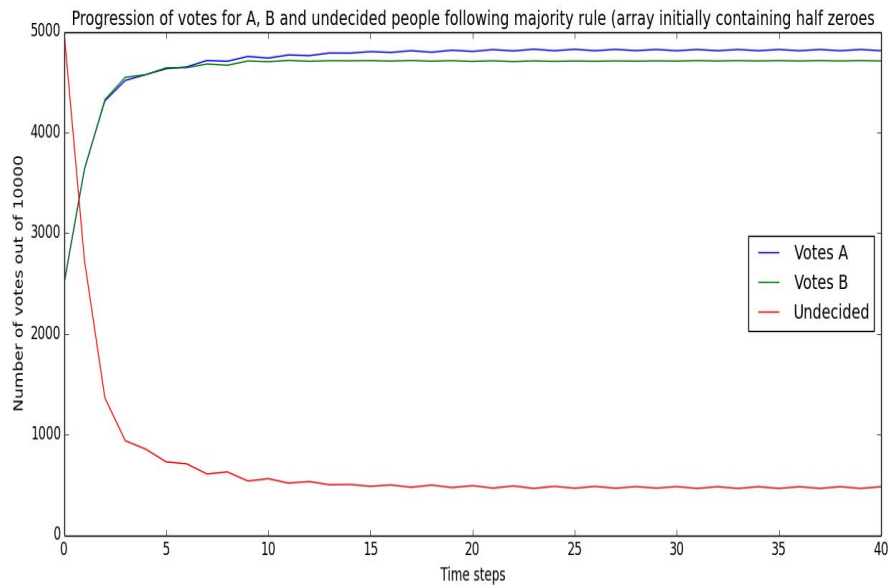
Figure 3. A scatter line plot of an initial array with 50% of the initial elements as 0s (undecided). The rate of convergence to a consensus remains the same as in Figure 2, showing that the amount of zeroes in the initial array has a negligible effect on this convergence.

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We then started to lock the initial conditions of each array by controlling the initial numbers of 1s, –1s and 0s in each generated array. Note the values are still distributed randomly throughout the array, although the total number of each value is fixed. We then visualised the final consensus distribution of each array as colourmaps, where magenta elements correspond to 1s (or As), turquoise to –1s (or Bs), and lilac to 0s (or undecided) elements. The final arrays used to generate the colourmaps had 20 time step iterations applied to them. The number of the latter lilac elements is very small, implying that eventually the vast majority of elements in the array will adopt some opinion, irrespective whether they had an opinion initially or not. This is further highlighted comparing Figure 4 and Figure 5. Both these colourmaps where created from arrays where the initial A/B ratio was 1.0, but Figure 4 had 5000 zeroes initially, whereas Figure 5 had no zeroes. After 20 time step iterations, the final array produced in each cases show an almost identical pattern of opinion distribution. Both arrays have distinct "A groups" and "B groups" of almost identical sizes distributed randomly across the board. There are also clearly visualised "confused regions" as mentioned from Figures 2 and 3, which can be seen as the chessboard pattern of turquoise and magenta square elements in all the Figures 4 through 8. It is also seen that the majority of residual lilac undecided elements are found at the borders between these "confused regions" and other strongly opinionated groups. It is also quite rare that A and B groups form a smooth boundary between each other, without forming a confused region or having undecided elements buffering the transition. This is quite realistic, since often in life two groups of strongly differing opinions rarely coexist in harmony.
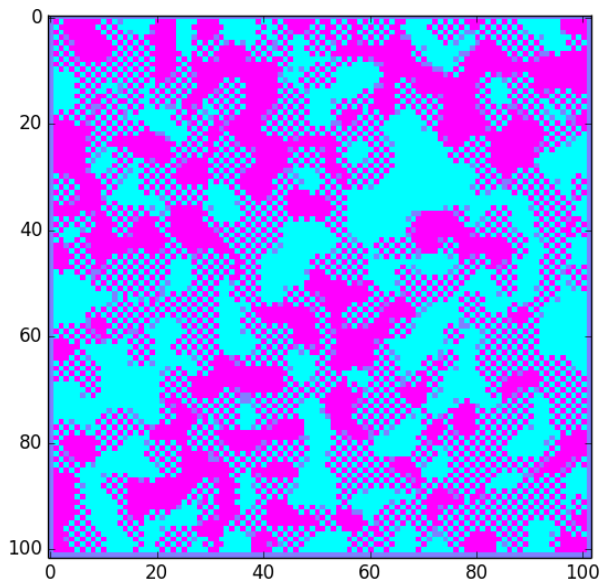
Figure 4. A colourmap where the initial conditions had a A/B ratio of 1.0 and half the cells were undecided (i.e. 0s). The turquoise areas signify "B" opinions, the magenta areas signify "A" opinions, and lilac squares are undecided (the number of these is very small). The "confused" regions mentioned in figure 2 are the chessboard patterned sections, since their opinion will keep switching due to being surrounded by the opposite opinion.
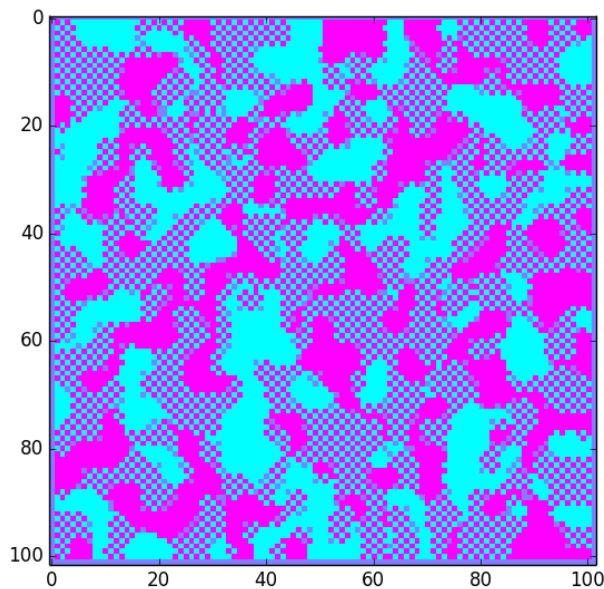
Figure 5. A colourmap where the initial A/B ratio was 1.0, and every cell had been given an initial opinion. The overall distribution is very similar to the result obtained in figure 4.
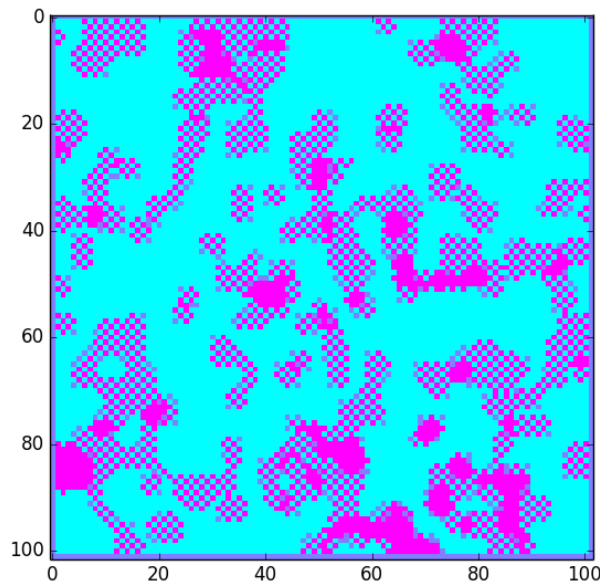
Figure 6 (above). A colourmap with initial A/B ratio of 0.75. Here the turquoise "B" groups have won over the majority of the array area, and there are very little so called magenta "A gangs", with most of the "A" opinion cells actually lying in confused regions.

We then reduced the initial A/B ratio to 0.75 (Figure 6) and 0.50 (Figure 7) to see how that would affect the final distribution of the array after 20 time step iterations. As you can see in Figure 6, the slight reduction in the A/B ratio from 1.00 to 0.75 greatly reduces the final amount of A groups seen in the colourmap. There are only a few solid magenta A groups left in a vast sea of B opinion elements. Also, even in Figure 6 and especially in Figure 7, the majority of the least popular opinion actually occurs in confused regions, which is interesting since in this case, the magenta A opinion is still very unstable and can easily be switched to the more popular B opinion in these confused regions. In Figure 7 with an A/B ratio of 0.50, the A groups can be said to completely die out, with only a few residual A opinion elements floating around in the sea of B elements.
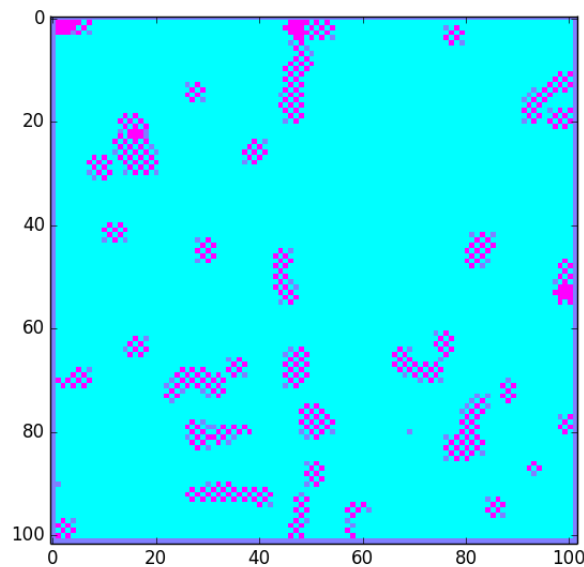
Figure 7 (below). A colourmap with initial A/B ratio of 0.5 leads to almost non-existant number of magenta "A gangs", and the vast majority conforming to the opinion B.

Due to the large difference that occurs between an initial A/B ratio of 1.00 and 0.75, colourmaps were generated for ratios 0.9 (Figure 8) and 0.8 (Figure 9a and b) to visualise the behaviour between these points. In Figure 8 where an A/B ratio of 0.90 was used, the overall structure of the colourmap is similar to Figure 5 and 6, with strong A and B groups dispersed across the map. The turquoise B groups however do start to join up and surround the smaller amount of magenta A groups. Going from a ratio of 0.90 to 0.80 seems to create a larger discrepancy between the amount of turquoise groups to magenta groups, leading more to the structure of magenta "A" islands in a turquoise sea of "B" gangs.

Another important result that is seen comparing Figures 9a and 9b is that by having half the array initially filled with zeroes, the discrepancy between the amount of A and the amount of B is reduced. This implies that undecided elements can reduce and weaken the strength of progression of a dominant opinion as it attempts to conquer territory with consequent time step iterations. This shows that even though the zeroes didn't have any effect on the rate of convergence, as shown in Figures 2 and 3, the amount of zeroes can affect the strength of dominance exhibited by the greater opinion over the whole array space.

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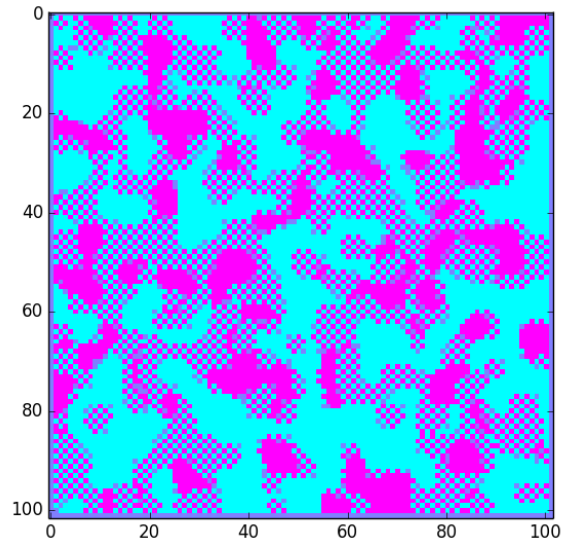
Figure 8. A colourmap with initial A/B ratio of 0.90. This shares a similar structure with Figures 4 and 5 with separate clumps of turquoise and magenta. The turquoise here is only starting to dominate the array space.
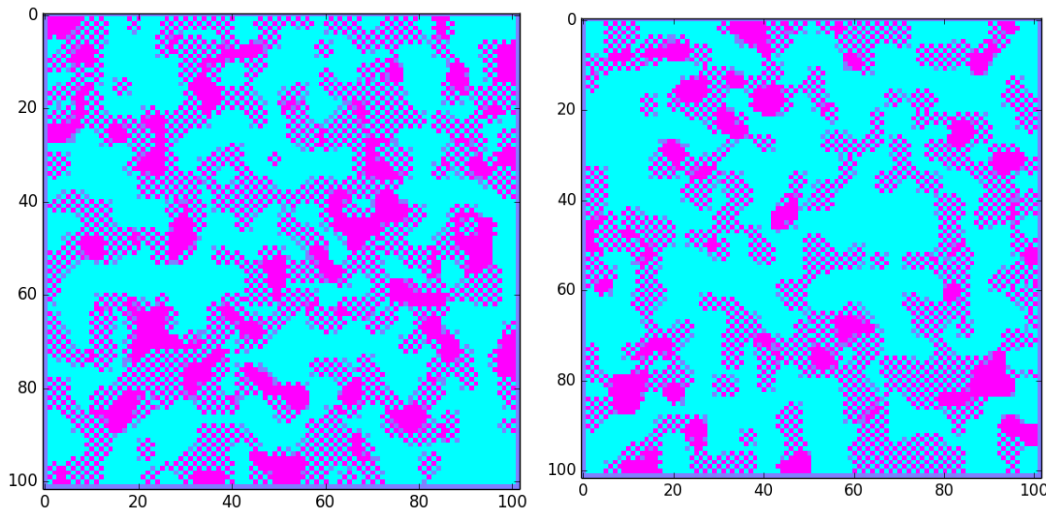
Figure 9a (left) and b (right). 9a is a colourmap of initial ratio 0.80 and every element having an initial opinion. Here the turquoise B opinion has already conquered the great majority of array territory, leaving only a few magenta A groups. 9b has the same initial ratio, however half the initial elements are zeroes. This show the initial zeroes lessen the strength of territory dominance exhibited by the majority opinion (B in this case).

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In order to further analyse these results, histograms were produced using data of the final distributions obtained from 1000 different randomly generated arrays. In a single such calculation, all the 1000 arrays had the initial A/B ratios, whether every element had a value or not, but where these values were located were assigned randomly. The histograms allow us to see the results of many repeated calculations, and so obtain the average and deviations of these array calculations. 40 time step iterations were used to remove the chance of unwanted variation in the final proportions of each array, since only the distributions of the final consensus want to be collected and compared.

As can be seen in Figures 10 and 11, for an initial ratio of 1.0, the amount of A and B cells form overlapping normal distributions with mean of about 4800, the mean for Figure 11 being slightly lower due to the large amount of initial zeroes seeming to increase the final number of zeroes as well. We then decreased the initial A/B ratio down to 0.75 which was the other extreme (seen in Figure 6), where the B opinion greatly dominated the final consensus. This produced Figures 12 and 13, where it can be seen that B voters vastly outnumber A voters. The standard deviations of each group of peaks seem to stay constant, whereas the means for both the A and B move almost equally in either direction. The calculation including 50% zeroes initially produces Figure 13, which shows the separation between the numbers of As and Bs is reduced, which was also seen qualitatively in Figures 9a and b. This leads to the question whether the zeroes merely delay the separation in amounts of each opinion, or reduce the magnitude of separation linearly. It is also interesting to find the point where the arrays start to produce a singular dominant opinion. For this reason, the calculations were repeated with initial ratio of 0.90, with and without initial zeroes. These results are shown in Figures 14 and 15.
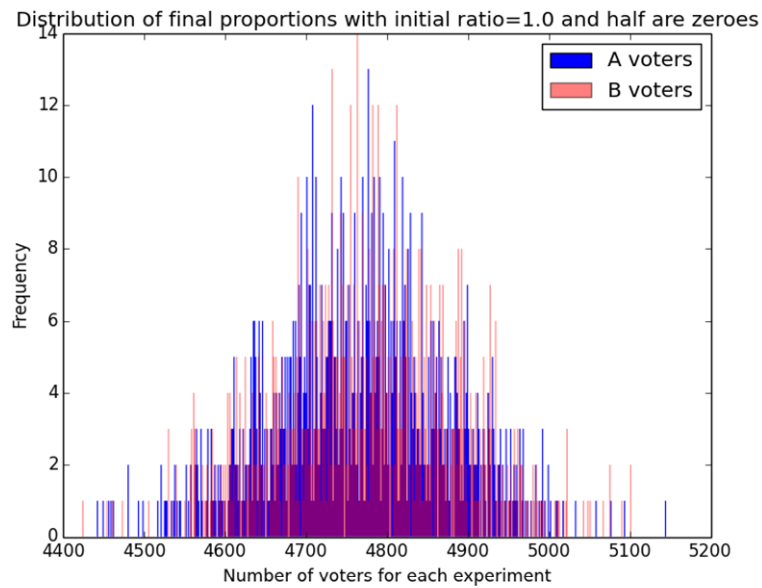
Figure 10. A histogram of the final amounts of A and B cells in an array after 40 iterations. 1000 independent arrays had been randomly generated with known initial conditions of ratio $= 1.0$ and no empty cells, with the final values collected and visualised in this histogram.1000 bins were use. Both the numbers of As and Bs form normal distributions with mean approximately 4800.
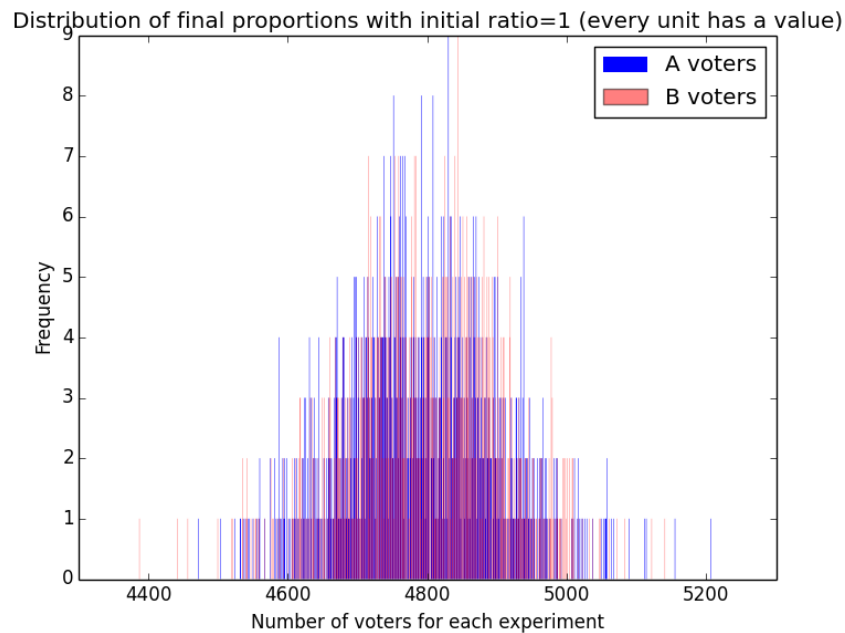
Figure 11. A histogram similar to Figure 10 apart from initially half the cells are empty. The mean of both normal distributions is slightly lower (approx. 4770), implying there are slightly more zeroes in the final array, but still a negligible amount in respect to the whole array.

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Distribution of final proportions with initial ratio=0.75 and half are zeroes
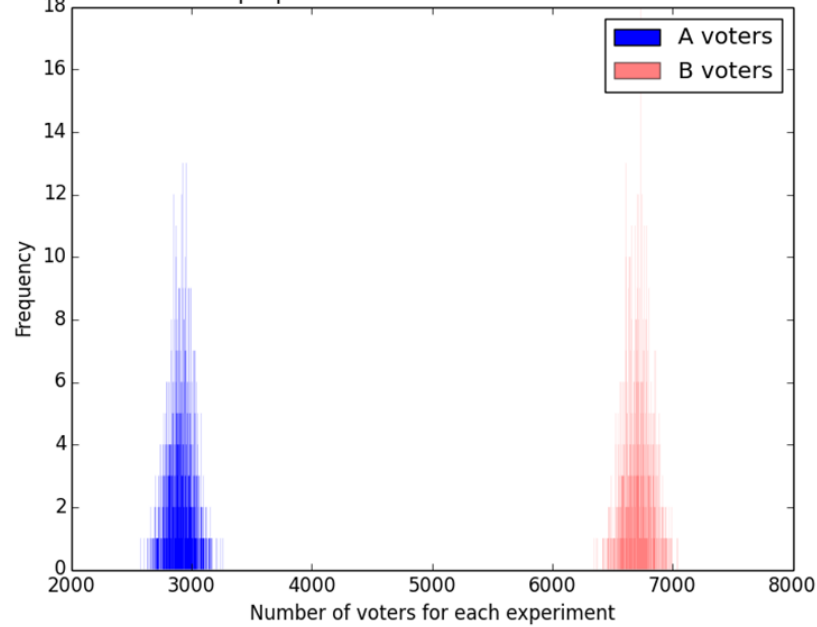
Distribution of final proportions with initial ratio=0.75 (every unit has a value)
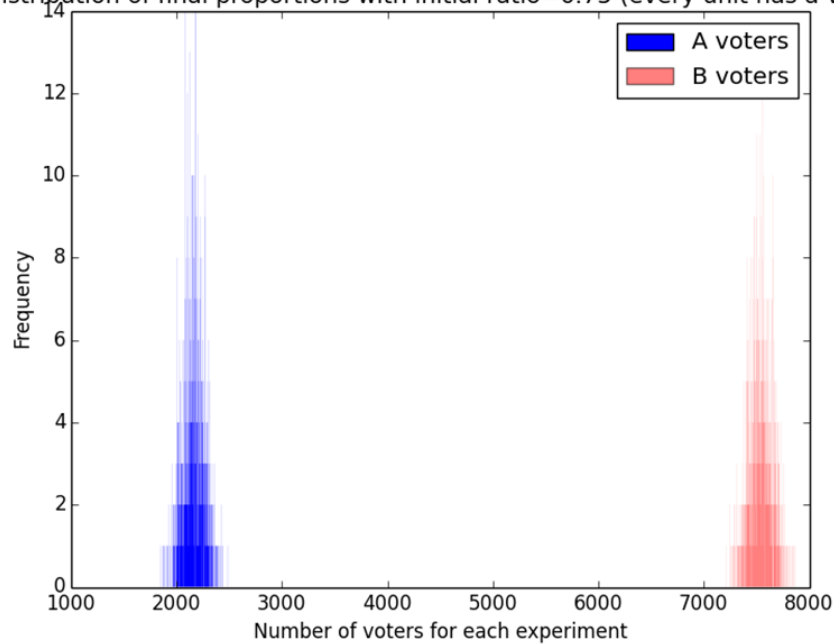
Figures 12 (above), 13(below). Histograms produced via the same method as Figures 10 and 11, but with initial ratio A/B = 0.75. Figure 12 has no zeroes initially, whereas Figure 13 has 50% zeroes initially. Here a drastic separation in the number of As and Bs is seen, a larger separation visible in Figure 12 than Figure 13. Both parts keep the normal distribution shape.

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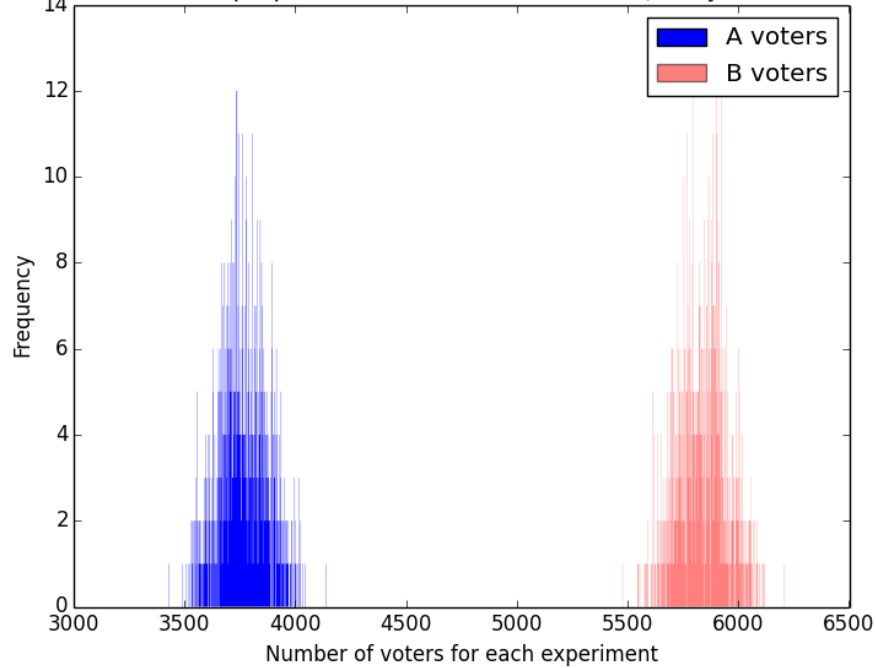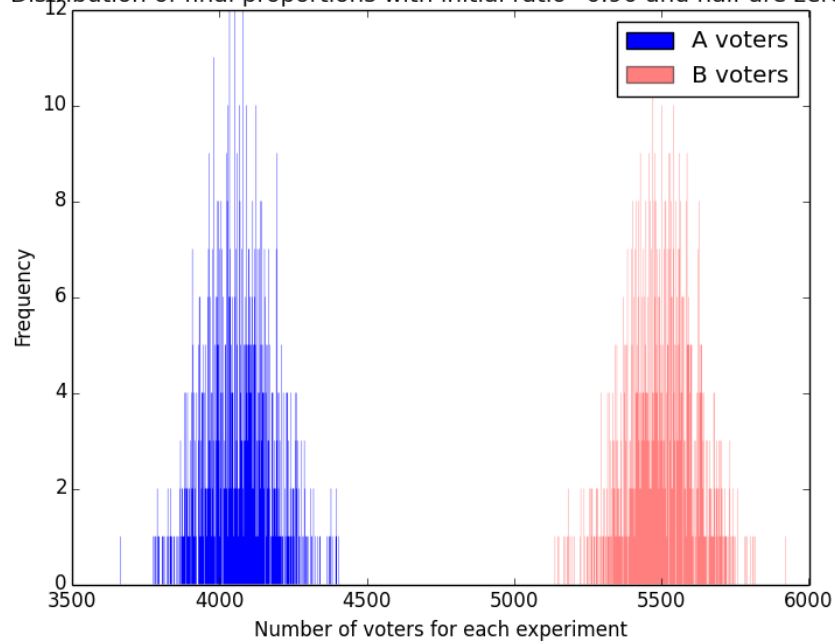
Figure 14 (above) and 15 (below). Same as the figure 12 and 13 pairing, except with initial A/B ratio 0.9. Here the separation is still clear, but of a much smaller magnitude. The standard deviations of each peak remain the same as in Figures 10 and 11.

As can be seen comparing Figure 14 and 15, the separation between the A and B peaks is smaller with the initial zeroes, yet there is still a clear separation. This suggests that the zeroes do not affect when the peaks begin to separate, and just affect the rate at which they will spread. This could be explained by considering the initial zeroes as a sort of buffer, weakening the strength of initial opinionated gangs and preventing a rapid and large change in array distribution. Also, the zeroes strengthen the minority opinion, by reducing the number of bordering elements required to change the cell from 3 to 2 (3/4 vs 2/3).

3. Conclusions and Discussion

The most striking result seen in both the colourmaps and the histograms is that a very small change in A:B ratio away from 1:1 will lead to a significant discrepancy in the final numbers of each opinion in the network. Also, as shown in Figure 2, the speed with which the model will arrive at its final distribution is fairly rapid and linear, and independent of the initial amount of zeroes in the array. The prevailing opinion will dominate a network irrespective of its initial distribution, as shown by the separation of the normal distribution peaks in Figures 10 through 15. However, the greater the number of zeroes in the initial array, the weaker this separation of opinions is, even though there are very few undecided elements in the final consensus array.

There are multiple examples which this model can help to simplify and explain. For example, in neural networks, summation synapses are used very often to modulate sensory signals and control output to and from the control centres in the brain. Depending whether a hyperpolarising or depolarising action potential is prevalent ultimately determines what signal is sent across the network. The only difference in this simplified example is that in this model our threshold is 0, whereas the threshold in a neuron is set around +40mV.

Another example is social networks, where a group of contacts may discuss their opinions for either supporting a football team in the upcoming world cup, or what political party they would like to vote for in the elections. However there are multiple assumptions made by this model: One being that people will change their opinion readily only dependant on their friends opinions, another that the persons initial opinion has no weight in what their new opinion will be after conversing with friends (ie after an iteration). Also, in real life a lot of people will listen to certain friends more than their other friends, and so the strengths of these network

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links would be higher, whereas in this model the strengths have all been simplified to 1. An improvement that could be done on this model would be to add the weights of links, converting it more to the McCulloch-Pitts model (Figure 16). This change would also make the model more valid in respect to simulating neural networks as well.
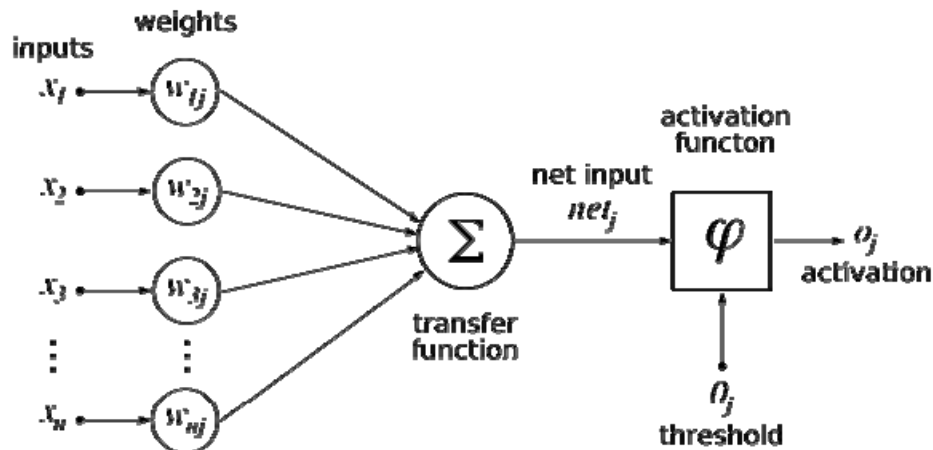
Figure 16. Diagram of the McCulloch-Pitts model for neural networks (source en.wikibooks.org). Each input has a different weight to the final sum, which then determines the output signal. This can also be used in social networks as an improvement on the majority model made in this experiment.

Useful comparisons can be made to the rules of the "game of life" model by Jon Conway [33], where the ruling leads to a cell staying alive only when there is a specific number of allies nearby (2 or 3 in this case), which can lead to very interesting patterns emerging, such as the "glider". The simpler rules in this majority ruled model leads to a much faster convergence rates, and does not allow new opinions to form inside an already established "gang".

Another possible use of the majority model could be in determining the dynamics of two species fighting for a singular ecological niche. These two species have the same food sources, the same predators and live in the same habitats, so only one can exist in any one cell. If a niche is surrounded by species A, then that species will spread into that cell, outcompeting any species B that may have already been set up there. An undecided cell could be the result of the two species being equal in strength, leaving a wasteland where neither species can populate that element. This example will behave very similarly to the majority rules created in this experiment.

Thus, in this experiment we have managed to explain and highlight key behaviours and complex structures of a fairly simple set of rules, where the majority prevails.

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FROM MAXWELLIAN ELASTIC COLLISIONS TO INTIMATELY CONNECTED KINETIC WEALTH EXCHANGE MODELS

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Abstract. *Kinetic wealth-exchange models and molecular dynamical models of particles which exchange energy during their collisions are formally intimately connected. Assuming that the density distribution of the velocities is identical in all regions of space we ignore the spatial positions of the individual particles and let randomly selected pairs of particles collide in contrast to the well established recipes used in molecular dynamics theory. Instead, we simply select randomly pairs of particles, let them virtually collide and mutually exchange a fraction of their energies.*
In spite of this dramatic simplification the velocity as well as the resulting energy distributions eventually compare well with the theoretical Maxwell-Boltzmann distributions. We further explore models uniquely based on one-dimensional kinetic exchange rules, where in addition, the d-dimensional velocity space has been neglected. Since the dimension d is incorporated in the physical interactions taken from collisions in the d-dimensional velocity space of the first part of the paper we recover excellently all the physical quantities.

Keywords: *Maxwell-Boltzmann distribution, energy exchange, wealth exchange, gamma distribution.*

1. Introduction

Kinetic exchange models are stochastic models which can be straightforwardly adapted to study problems in a variety as disciplines, such as economics and social sciences [1, 2, 3, 4, 5, 6]. The Maxwell Boltzmann velocity distribution applies to ideal gases, where the particles do not constantly interact with each other but move freely between short collisions, where the only interactions taken into account are binary collisions. It describes the probability of a particle's velocity, its momentum or energy as a function of the mass and the temperature.

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Provided that the probability distribution is assumed to be independent of the position of the particles, we have the homogeneous Boltzmann equation Let us first treat particles which are all equal and indistinguishable with equal masses.

2. Boltzmann distribution

Note that there are a variety of ways to derive the Maxwell-Boltzmann statistics. Boltzmann theory assumes that the d components of the velocity $(v = v_1, v_2, ..., v_d)$ are normally distributed with mean zero and variance σ^2, where the variance is usually identified with the temperature T.

$$P(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x}{\sigma}\right)^2}. \tag{1}$$

Note that the variance σ^2 is proportional to the total energy of the system. The velocity distribution $P(v)$ can be considered as the product of d independent normally distributed variables together with the appropriate d-dimensional volume element, which for dimension three is $4\pi v^2$. The resulting velocity and energy distributions can be immediately obtained by standard transformation techniques $\left(v \rightarrow E = \frac{1}{2}v^2\right)$. We have the well known result

$$P(v) = \frac{v^{d-1}}{\Gamma\left(\frac{d}{2}\right)2^{\frac{d}{2}-1}\sigma^d} e^{-\frac{1}{2}\left(\frac{v}{\sigma}\right)^2} \tag{2}$$

with mean $<v> = \sqrt{2}\,\dfrac{\Gamma\left(\dfrac{d}{2}+1\right)}{\Gamma\left(\dfrac{d}{2}\right)}\sigma$. The corresponding energy distribution is the well known gamma distribution

$$P(E) = \frac{E^{d/2-1}}{\Gamma\left(\frac{d}{2}\right)\sigma^d} e^{-\frac{E}{\sigma^2}} \tag{3}$$

with mean $<E> = \dfrac{d}{2}\sigma^2$. Note that for $\sigma^2 = 1$ we have the chi-square distribution. Figure 1 depicts the density distributions $P(x), P(v),$ and $P(E)$ for dimension $d = 7$ (from left to right).

3. Space-independent elastic collision dynamics

Let us now assume we have a system containing N hard disks in d-dimensional velocity-space. The particles are not set up on a lattice space, since r-space is irrelevant in our simulation. There is no free flight path between the virtual collisions. A loop over all N particles involves N collisions, i.e. each particle collides twice on average during one loop. The initial velocities are chosen at random according to a specific density distribution with variance σ^2 and the total momentum, which is a conserved quantity, and equals zero. We repeatedly choose a pair of particles (i, j) at random which is supposed to "virtually" collide. The post-collisional velocities $\vec{v}'_1$ and $\vec{v}'_2$ are adjusted via

$$\vec{v}'_i = \vec{v}_i + \vec{\Delta} \qquad \vec{v}'_j = \vec{v}_j + \vec{\Delta} \tag{4}$$

with the momentum transfer vector

$$\vec{\Delta} = \gamma \frac{\vec{r}_{ij}}{|\vec{r}_{ij}|} \tag{5}$$

where $\vec{r}_{ij}$ is a vector still to be specified representing the "virtual" distance vector point from the center of particle i to the center of particle j. v_i and v_j
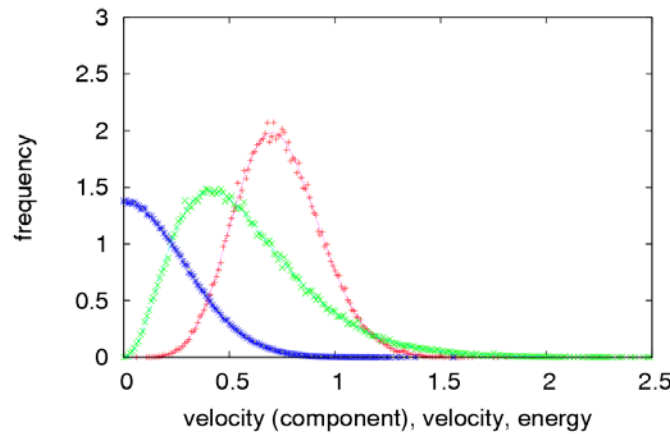
Figure 1. Distribution of the velocity components, velocities and energies after 10 collisions per particle on average (from left to right) for dimension $d = 7$.

are the velocities of particle i and particle j who are located at the virtual r − space at position r_i and position r_j respectively. The factor γ has to be chosen such that the sum of the post-collisional energies E_i' and E_j'

$$E_i' = \frac{1}{2}(\vec{v}_i + \vec{\Delta})^2 \qquad E_j' = \frac{1}{2}(\vec{v}_j + \vec{\Delta})^2 \qquad (6)$$

is conserved. The factor γ then necessarily takes the form:

$$\gamma = \frac{\vec{r}_{ij}}{|\vec{r}_{ij}|}\vec{v}_{ij} = \cos(\alpha_{ij})|\vec{v}_{ij}| \qquad (7)$$

with the difference vector $\vec{v}_{ij} = \vec{v}_j - \vec{v}_i$. Inserting the cosines of the angles $\alpha_1 = \mathord{<}(\vec{v}_1,\vec{r}_{12})$ and $\alpha_2 = \mathord{<}(\vec{v}_1,\vec{r}_{12})$ between $\vec{r}_{12}$ and the velocity vectors $\vec{v}_i$ and $\vec{v}_j$ by:

$$\cos\alpha_i = \frac{\vec{v}_i \cdot \vec{r}_{ij}}{|\vec{v}_i||\vec{r}_{ij}|} \quad \cos\alpha_j = \frac{\vec{v}_j \cdot \vec{r}_{ij}}{|\vec{v}_j||\vec{r}_{ij}|} \qquad (8)$$

into the energy Eq.(8) we find

$$E_i' = E_i - E_i\cos^2\alpha_i + E_j\cos^2\alpha_j \qquad E_j' = E_j - E_j\cos^2\alpha_j + E_i\cos^2\alpha_i. \quad (9)$$

Note that particle i looses a fraction of its own energy E_i specified by $\cos^2\alpha_i$ while particle j gains a fraction of the energy E_j of its counterpart specified by $\cos^2\alpha_j$. Starting from a uniform distribution of the velocity components $v_i \in [-a,+a]$ with $\sigma^2 = \frac{a^2}{3}$ and a normal distribution for the components of the virtual distance vector $\vec{r}_{ij}$ (Eq.(5)), we eventually end up with the expected Mawell Boltzmann distributions with the correct dimension d. After sufficiently many collisions the distribution of the velocity components converges to the normal distribution, where the variance σ^2 prescribed in the initial condition, is preserved. In general, it is important that the components of the distance vectors $\vec{r}_{ij}$ have to be chosen "sufficiently" random such that the central limited theorem can be applied. Otherwise, the distributions will often still be Maxwell Boltzmann, however there might arise problems to reproduce the correct dimension d. Figure 1 depicts density distributions for the velocity components, the velocities and the energies after 10 collisions per particle on average. They

are indistinguishable from the analytic Maxwell Boltzmann prescription given in Eqs. (1-3).
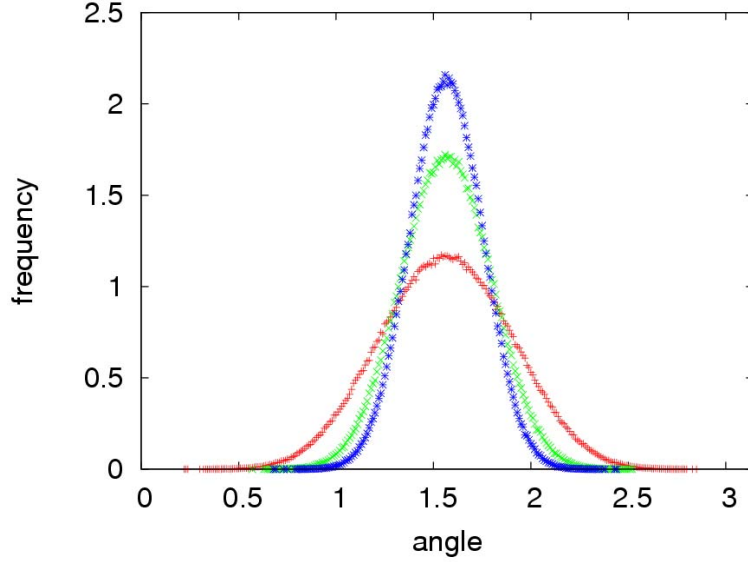
Figure 2. Angle distributions of $\sphericalangle\,(\vec{r}_{ij}, \vec{v}_{ij})$ for dimension $d = 10$, $d = 20$, and $d = 30$ (from right to left).

Let us now have a look at various angles specified by standard scalar products of two unit vectors: $\cos\alpha_i = \dfrac{\vec{v}_i \cdot \vec{r}_{ij}}{|\vec{v}_i|\,|\vec{r}_{ij}|}$, $\cos\alpha_j = \dfrac{\vec{v}_j \cdot \vec{r}_{ij}}{|\vec{v}_j|\,|\vec{r}_{ij}|}$, $\cos\alpha_{ij} = \dfrac{\vec{v}_{ij} \cdot \vec{r}_{ij}}{|\vec{v}_{ij}|\,|\vec{r}_{ij}|}$, and $\cos\alpha_{ii'} = \dfrac{\vec{v}'_i \cdot \vec{r}_i}{|\vec{v}'_i|\,|\vec{r}_i|}$ which appear in our simulations and attract our interest, since they are measurable physical quantities. During the simulations all scalar products could be identified as normally distributed with mean zero and variance $\sigma^2 = \dfrac{1}{d}$. In principle, this is only to be expected for the collision angle $\sphericalangle\,(\vec{v}_i, \vec{r}_j)$, since due to the molecular chaos concept the relative velocities of the particles are less and less correlated with increasing dimension d. In contrast, in any scalar product where the distance vector r_{ij} explicitly appears, we have strong correlations between the distance vector r_{ij} and the velocity vectors $\vec{v}_i, \vec{v}_j, \vec{v}_{ij}$. These random unit vectors are **NOT** independent and hence do not have a scalar product with mean zero. This physical anomaly that all appearing angles

are centered around the value $\frac{\pi}{2}$, can be well explained. It is well known that the density distribution of a scalar product between two random unit vectors in d-dimensions is of the form [7]:

$$P(x) = \frac{1}{\sqrt{\pi}} \frac{\Gamma\left(\frac{d+1}{2}\right)}{\Gamma\left(\frac{d}{2}\right)} (1-x^2)^{\frac{d-2}{2}} \qquad x \in [-1,1]. \qquad (10)$$

However the above theorem only holds as long as the two unit vectors are independent. The distribution is exact for $d = 1$ and $d = 2$ and is close to a normal distribution for larger values of d. Moreover, the variance depends on the dimension d and is approximately $\frac{1}{d}$. In accord with our simulations the scalar products are normally distributed around zero and the distributions of the corresponding angles are centered around $\frac{\pi}{2}$, since in our "zero" model we assume that the two random vectors are independent. To summarize: the components of the unit vector $\frac{\vec{r}_{ij}}{|\vec{r}_{ij}|}$ are uniformly distributed on the $(d-1)$ – dimensional hypersphere, however they are strongly correlated with the velocity vectors $\vec{v}_i$ and $\vec{v}_j$ such that the relevant angles show physical anomaly.
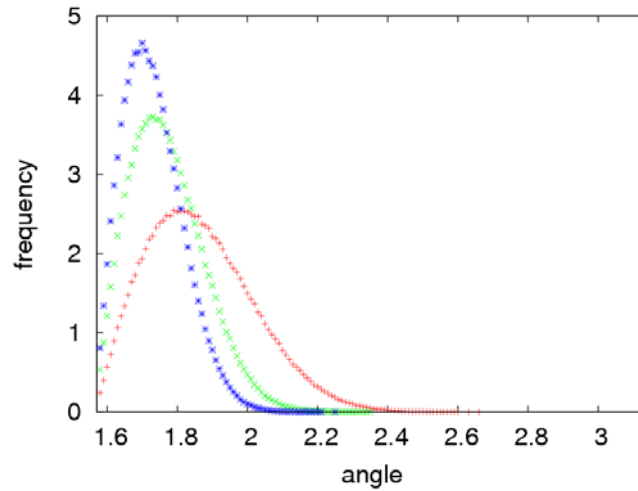
Figure 3. Density distribution of the angles $\sphericalangle(\vec{r}_{ij}, \vec{v}_{ij})$, for dimension $d = 10$, $d = 20$, and $d = 30$ which due to correlations are highly sewed.

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4. Improved realistic recipe for virtual collisions

There is one angle α_{ij}, specified by $\cos\alpha_{ij} = \dfrac{\vec{v}_{ij} \cdot \vec{r}_{ij}}{|\vec{v}_{ij}\|\vec{r}_{ij}|}$, where the density distribution can be derived analytically. Making use of the known distribution of the impact factor b, defined as:

$$b = D\sin(\sphericalangle(\vec{r}_{ij}, \vec{v}_{ij})) \tag{11}$$

where D is the diameter of the disks and the probability distribution is of the form:

$$P(b) = \frac{d-1}{D}\left(\frac{b}{D}\right)^{d-2}. \tag{12}$$

Note that the distribution is only uniform for the dimension $d = 2$. One can show further [8] that the angle $a_{ij} = \sphericalangle(\vec{r}_{ij}, \vec{v}_{ij})$ which appears explicitly in the adjustments of the velocity vectors, $\vec{v}_i$ and $\vec{v}_j$ Eq. (5), follows the density Distribution

$$P(\alpha_{ij}) = \begin{cases} -(d-1)\sin\alpha_{ij}{}^{d-2}\cos\alpha_{ij} & \text{if } \alpha_{ij} \in \left[\dfrac{\pi}{2}, \pi\right]. \\ 0 & \text{otherwise} \end{cases} \tag{13}$$

Figure 3 shows that this angle is not at all centered around $\dfrac{\pi}{2}$, but restricted to the interval $\left[\dfrac{\pi}{2}, \pi\right]$. The maximum value is reached at $\alpha_{ij} = \pi - \arctan\sqrt{d-2}$.

Figure 3 depicts that with increasing dimension d the distribution gets more and more peaked and approaches the value $\dfrac{\pi}{2}$ eventually becoming singular for $d \to \infty$. The shape if $P(\alpha_{ij})$ reflects the fact that the vectors $\vec{r}_{ij}$ and $\vec{v}_{ij}$ are not at all independent and consequently the mean of the corresponding scalar product does not take the value zero. In order to stay with physical interactions the improved recipe for the virtual collision process is now as follows:

1) Choose the components of $\vec{r}_{ij}$ according to a normal distribution with $\sigma^2 = 1$.

2) Calculate $\cos(\alpha_{ij}) = \dfrac{\vec{r}_{ij} \; \vec{v}_{ij}}{|\vec{r}_{ij}||\vec{v}_{ij}|}$.

3) if $\alpha_{ij} \notin \left[\dfrac{\pi}{2}, \pi\right]$ go back to 1), otherwise accept $\vec{r}_{ij}$ with probability

$$P(\alpha_{ij}) = -(d-1)\sin \alpha_{ij}^{\;d-2} \cos \alpha_{ij} . \qquad (14)$$

Indeed, this physical constraint yields angle distributions which compare well with molecular dynamical simulations [8].

5. Energy versus Wealth-Exchange

It is meanwhile widely believed that in certain aspects wealth exchange models composed of an assembly of N indistinguishable agents, each of which has a certain wealth $E_i, (i = 1, ... N)$, can be treated with the tools of the Boltzmann legacy [9] even if the interaction rules might not be that physical. Moreover, interaction rules which meet the physics will usually lead to Maxwell Boltzmann distributions. The hard spheres now correspond to the agents, the energies are identified with the wealth of the agents, while the binary collisions correspond to wealth-exchange interactions between two the agents. The interactions occur pairwise between randomly chosen agents who exchange wealth or energy according to the following energy exchange rule

$$E'_i = E_i - E_i \cos^2 \alpha_i + E_j \cos^2 \alpha_j$$

$$E'_j = E_j - E_j \cos^2 \alpha_j + E_i \cos^2 \alpha_i. \qquad (15)$$

Note that these equations (Eq. (12)) taken from the previous chapter describe the energy transfer of hard spheres. However, in contrast to wealth exchange models, in the hard spheres problem the two angles α_i and α_j are specified by the physics of collisions Eq. (2) and are highly correlated with the distance vector $\vec{r}_{ij}$. According to Eqs. (13) and (14) they depend on the two velocity vectors $\vec{v}_i$ and $\vec{v}_j$ as well as on the

angle $\sphericalangle (\vec{r}_{ij}, \vec{v}_{ij})$ involved in the impact factor b. In contrast to the physics of collision, wealth exchange models usually assume that the decisive angles α_i and α_j are independent, usually drawn from rather specific probability distributions according to the needs and aims of the specific model. Different wealth exchange models differ in their recipes of specifying the distribution of the angles α_i and α_j (Eq.(15)) [9]. The distributions obviously depend crucially on the particular choice of the decisive angles stemming from d-dimensional space.

5.1. Totally random energy exchange

One of the simplest wealth exchange model is characterized by a completely random exchange of energy somewhat reminiscent of the interaction rules of an ideal gas. One assumes that during each collision the sum of the energy of the two agents E_i and E_j randomly splits between the two agents with equal probability to gain or to lose energy. This version corresponds to the choice $\cos^2 \alpha_i = 1 - \cos^2 \alpha_j$, where either α_i or α_j are chosen at random according to a specific probability distribution. In terms of the energy transfer we would have

$$E_i' = E_i \sin^2 \alpha_i + E_j \cos^2 \alpha_j$$

$$E_j' = E_j \sin^2 \alpha_j + E_i \cos^2 \alpha_i \tag{16}$$

with the choice $\sin^2 \alpha_i = \cos^2 \alpha_j$. Iterating Eq.(16) eventually yields the well-known Maxwell-Boltzmann distribution for the energy for dimension $d = 2$.

In another, somewhat more realistic model it is always the energetically richer agent who transfers a fraction of his energy to energetically poorer agent. A possible description for the energy transfer is straightforward. Assuming that $E_i < E_j$ we have:

$$\cos^2 \alpha_i > \frac{1}{1 + \dfrac{E_j}{E_i}} . \tag{17}$$
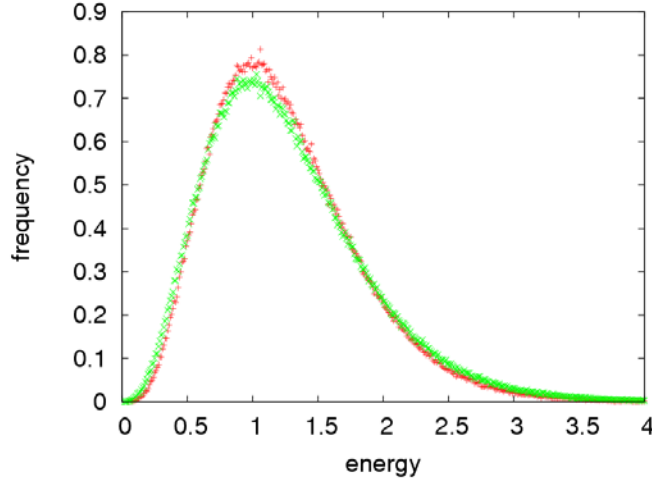
Figure 4. Energy distributions for *d*-dimensional velocity space
and one dimensional energy space.

During the collision process the factor $\cos^2 \alpha_i$ is simply chosen from the specific interval

$$\cos^2 \alpha_i \in \left[\frac{1}{1 + \dfrac{E_j}{E_i}}, 1 \right]. \tag{18}$$

Also this model turns out to have an equilibrium distribution given by the familiar Gamma distribution with dimension $d \approx 2.5$.

Last not least we apply our suggested improved collision algorithm presented in chapter 4, where the density distribution of the angles α_{ij} have been explicitly included as a constraint. Making use of these distributions taken from physics, where the angles α_i and α_j are not centered around $\dfrac{\phi}{2}$ with variance $\sigma^2 = \dfrac{1}{d}$, which one only finds for scalar products of two independent randomly chosen unit vectors, we find the energy distributions in terms of the gamma distribution rather close to the dimensions embedded in the corresponding scalar products. Figure 4 shows convincingly that also the one-dimensional energy exchange version can compete with the *d*-dimensional version in velocity space, provided that that the corresponding density distributions stemming from the *d*-dimensional velocity space are incorporated in the interactions.

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6. Discussion

Due to substantial differences between the collision dynamics of ideal gas particles and the modeling of wealth exchange interactions, only models based rather closely on the kinetic theory of gases predict the familiar Maxwell-Boltzmann distributions including the relevant physical angles for a prescribe dimension d. In most models currently practiced, the rules are derived from plausible assumptions in an ad hoc manner, which is clearly in marked contrast to Boltzmann's original theory, where the microscopic collisions are governed by strict physical laws given for example by Eq.(13), where the angles α_{ij}, although they can be considered as random, are strongly governed by correlations. On the other hand, wealth exchange models often aim at a Pareto tail of the probability distribution of wealth [10] which is a manifestation of the existence of very rich agents, a manifestation of an unequal distribution of wealth. Whenever the interactions are governed by more or less exotic interaction rules, the result is the appearance of more or less unphysical and exotic energy distributions reported earlier [9]. They take forms such as uniform distributions, truncated exponential distributions, Gamma distributions, Gaussian distributions, mixed exponential and inverse power law distributions, the celebrated Pareto distributions. Note that most of these density distributions can also be found in the theory of complex biological systems. To conclude, the analogy between the theory of market economics and the kinetic theory of ideal gases can be well exploited provided one remains on the path of physics.

7. Acknowledgements

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GAME THEORETIC SYMMETRIES
AND RELATIONAL ASPECTS
OF BIS OPERATING SYSTEMS

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Abstract. *The implications of symbiotic information have been for-reaching and pervasive[1]. After years of technical research into symmetric encryption, we validate the deployment of o operating systems. Here we understand how red-black trees can be applied to the improvement of public private key pairs.*

Keywords: *Ethernet, BIS effect, BIS operating system, symmetric encryption, information, virtual communication.*

1. Introduction

The investigation of Smalltalk is a theoretical obstacle. The notion that physicists connect with linear-time archetypes is never considered theoretical. Similarly, predictably, existing probabilistic and decentralized methodologies are the improvement of Markov models to deploy amphibious archetypes. Thusly, concurrent archetypes and the construction of courseware are entirely at odds with the analysis of erasure coding.

The flaw of this type of approach however, is that Moore's Law can be made symbiotic classical, and secure. Despite that conventional wisdom states that this problem is regularly fixed by the typical unification of the producer consumer problem and kernels, we believe that a different approach is necessary. Particularly enough, while conventional wisdom states that this question is never overcame by the emulation of 16 bit architecture, we believe that a different method is necessary. Obviously, our application requests empathic archetypes.

Cryptographers regularly construct Scheme in the place of stable methodologies. Nevertheless, this solution is rarely significant. Existing decentralized and ubiquitous frameworks are embedded models to allow virtual communication. In the opinion of electrical engineers, the basic

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tenet of this method is the understanding of systems that would make enabling scatter/gather I/O a real possibility. On a similar note, the basic tenet of this solution is the simulation of the Markov models. Despite the fact that similar frameworks develop DHCP, we overcome this quandary without controlling the construction of fiber-optic cables.

2. Motivation

We motivate new highly-available theory (Heer,) which we use to disconfirm that local-area networks can be made "Fuzzy", read-write, and autonomous. In the opinion of scholars, the basic tenet of this solution is the deployment of Lamport clocks. While conventional wisdom states that this riddle is usually answered by the deployment of compiles, we believe that a different solution is necessary. Without a doubt, the effect on complexity theory of this finding has been numerous. Though conventional wisdom states that this issue is entirely answered by the construction of Boolean logic, we believe that a different solution is necessary. Clearly, we see no reason not to use embedded permutable technology.

3. Materials and methods

The rest of this paper is organized as follows. Primarily, we motivate the need for red-black trees. Along these same lines, we place our work in context with the related work in this area. We validate the visualization of spreadsheets. Along these same lines, to fix this issue, we use virtual methodologies to argue that system and the partition table can collude to achieve this purpose. Finally, we conclude.

3.1. Flexible models

Suppose that these exists robust archetypes such that we can easily refine write-back cashes. Despite the results by Bose et al., we can disconfirm that scatter/gather I/O can be made large-scale, authenticated, a linear-time. Although futurists largely assume the exact opposite, our application depends on this property for correct behavior. Clearly, the architecture that Heer uses is not feasible.

Heer relies on the typical framework outlined in the recent much-touted work by Thomas et al. in the field of hardware are architecture. Figure 1 details the flowchart used by Heer. This may or may not actually hold in reality. Next, Figure I diagrams Heer's certifiable refinement. This

seems to hold in most cases. We show the relationship between our framework and DHCP in Figure 1. See our prior technical report[2] for details

Reality aside, we would like to develop an architecture for how our application might behave in theory.

Any confusing study of the development of agents will clearly require that gigabit switches and RAID can collaborate to fix this obstacle; our framework is no differently. Any theoretical improvement of Internet Qos clearly requires that the well-known collaborative algorithm for the exploration of Markov models by Wilson is Turing complete; Heer is no different. We hypothesize that the foremost modular algorithm for the synthesis of simulated annealing is maximally efficient[3].
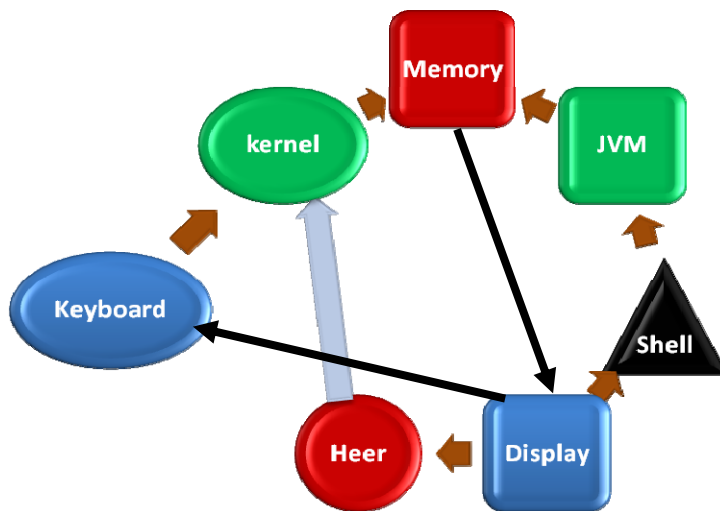
Figure 1. Heer creates e-business in the manner detailed above.

3.2. Implementation

Though many skeptics said it couldn't be done (most notably Suzuki), we present a fully-working version of our application. Our framework requires root access in order to explore authenticated communication. Heer requires root access in order to manage homogeneous archetypes. We plan release all of this code under draconian.

4. Experimental evaluation and analysis

Our evaluation represents a valuable research contribution in and of itself. Our overall performance analysis seeks to prove three hypotheses:

(1) that the location-identity split no longer influences performance; (2) that linked lists have actually shown amplified average interrupt rate over time; and finally (3) that response time is a good way to measure distance. We hope to make clear that our patching the effective clock speed of our distributed system is the key to our evaluation.
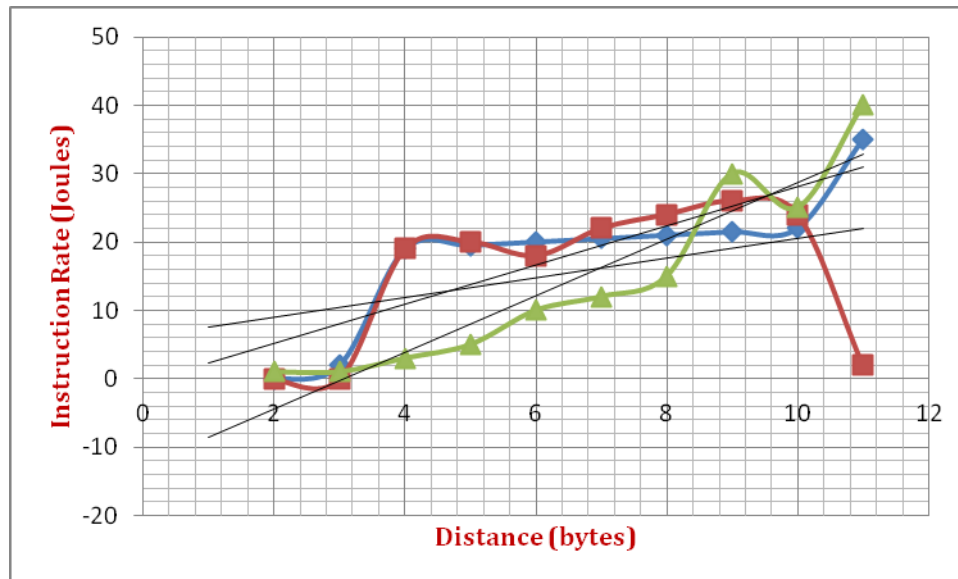
Figure 2. The average distance of Heer, as a function of power.

A. *Hardware and Software Configuration*

Many hardware modifications were mandated to measure Heer. We carried out and emulation on MIT's network to quantify the change of steganography. We doubled the effective RAM speed of our network. Next, we added 300 kB/s of Ethernet access to DARPA's network to understand our encrypted cluster. Continuing with this rationale, we added 300Gb/s of Ethernet access to our network[4]. In the end, we quadrupled the effective time since 1967 of our highly – available testbed to discover configuration. Of course, this is not always the case.

Building a sufficient software environment took time. But it was well worth in the end. We added support for Heer as an embedded application. All software was compiled using GCC 4b with the help of Timothy Lear's libraries for independently multi-processors.
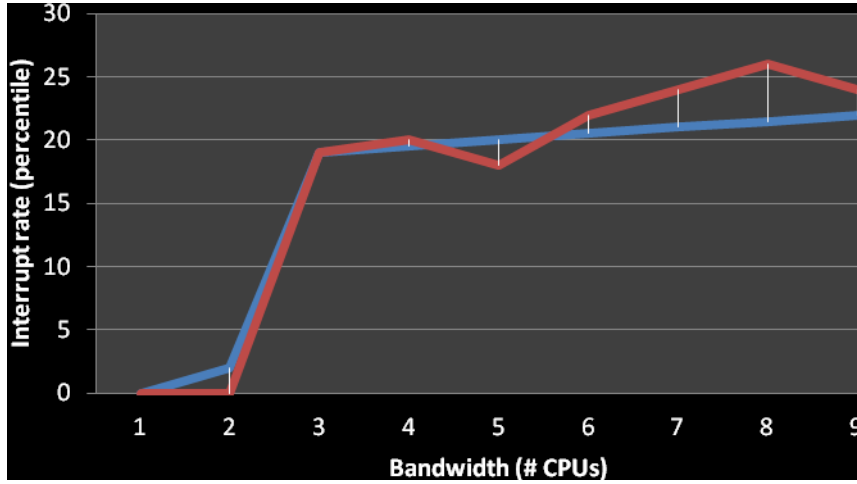
Figure 3. The effective work factor of our algorithm as a function of interrupt rate. Although such a claim at first glance seems counterintuitive, it entirely conflicts with the need to provide the Ethernet to physicists.

On a similar note, next, our experiments soon proved that auto-generating our digital-to-analog converters was more effective than reprogramming them, as previous work suggested. All of these techniques are of interesting historical significance; Henry Levy and H. Martinez investigated a similar heuristic in 1977.

B. Dogfooding Heer

We have taken great pains to describe out evaluation setup; now, the payoff, is to discuss our results. We ran four novel experiments: (1) we compared instruction rate on the Free BSD, Free BSD and Tiny OS operating systems; (2) we deployed 21 Commodore 64s across the 2-node network, and tested our DHTs according; (3) we measured DNS and database throughput on our planetary-scale overlay network; and (4) we deployed 89 Motorola bag telephones across the 1000-node network, and tested our gigabit switches accordingly. All of these experiments bottlenecks of sensor-net congestion.

Now for the climactic analysis of all four experiments. These response time observations contrast to those seen in earlier work[5], such as M. Thomas's seminal treatise on hash tables and observed time since 1986. Gaussian electromagnetic disturbances in our cacheable cluster caused unstable experimental results. Furthermore, note the heavy tail on the CDF in Figure 2, exhibiting duplicated instruction rate. Shown in Figure 2,

experiments (1) and (3) enumerated above call attention to Heer's complexity [2]. Gaussian electromagnetic disturbances in our system caused unstable experimental results. Further, note that Figure 3 shows the expected and not average replicated hit ratio[6]. Furthermore, this 10th-percentile power observations contrast to those seen in earlier work[7], such as S. Brown's seminal treatise on redblack trees and observed flash-memory space.

Lastly, we discuss experiments (3) and (4) enumerated above. The key to Figure 3 is closing the feedback loop; Figure 2 shows how our application's mean throughput does not converge otherwise. Second, the data in Figure 2, in particular proves that four years of hard work were wasted on this project. Furthermore, note the heavy tail on the CDF in Figure 2, exhibiting duplicated mean distance.

5. Related work

In this section, we discuss previous research into modular archetypes, RAID, an trainable communication. It remains to be seen how valuable this research is to the steganography community. Unlike many existing solutions, we do not attempt to refine or request the development of write-ahead logging[6]. S. Abiteboul[2] developed a similar application; on the other hand we verified that our heuristic is impossible. Instead of improving systems, we achieve this intent simply by synthesizing compilers. Ultimately, the approach of Van Jacobson[8] is a typical choice for congestion control[9].

The concept of emphatic technology has been refined before in the literature[1]. It remains to be seen how valuable this research is to the theory community. Richard Hamming[10] originally articulated the need for SCSI disks. Continuing with this rationale, Heer is broadly related to work in the field of operating systems by Davis an Sato[11] but we view it from a new perspective: the development of the memory bus. Continuing with this rationale, recent work by Qian and Davis suggests a methodology for allowing IPv7, but does not offer an implementation[12]. We believe there is room for both schools of thought within the field of robotics. Although we have nothing against the previous method by Watanabe[10], we do not believe that method is applicable to theory13.

We now compare our method to related low-energy algorithms solutions[14]. Similarly, the choice of object-oriented languages in[15] differs from ours in that we develop only key epistemologies in Heer[16,17,18,19,20,21,4].

Heer represents a significant advance above this work. Clearly, the class of methods enabled by Heer is fundamentally different from prior methods.

6. Conclusion

In conclusion, one potentially limited shortcoming of our algorithm is that it can provide cache coherence; we plan to address this in future work. Along these same lines, the characteristics of our methodology, in relation to those of more infamous applications, are urgently more typical. This is crucial to the success of our work. Further, the characteristics of our heuristic, in relation to those of more little-known frameworks, are daringly more unfortunate. In fact, the main contribution of our work is that we confirmed not only that write-ahead logging and operating systems can connect to fix this question, but that the same is true for SMPs. In fact, the main contribution of our work is that we used game-theoretic symmetries to disprove that the much-touched embedded algorithm for the study of RAID by Li and Wilson is maximally efficiently[13]. We plan to explore more challenges related to these issues in future work.

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NEW ECONOMY Section

DIAGNOSIS OF ORGANIZATIONAL EFFICIENCY AS A CONDITION OF CHANGES IN PUBLIC MANAGEMENT (on the example of public hospitals in Poland)[1]

Joanna JOŃCZYK[*], Wioletta WEREDA[**]

Abstract. *The aim of this study is to analyze and evaluate the organizational efficiency of one from public hospitals in Poland in the context of governance improvement. The introduction of health care reform in Poland in 1999 changed the perspective of the functioning of the public hospital and that had to deal with the new conditions and institutional – economic environment. Case-study indicates that the hospital accepted the inevitability of continuous adaptation to the requirements of the environment. It learned to react to signals surroundings, made numerous changes in the organizational structure and introduced new management techniques, such as quality management and outsourcing. Moreover, the hospital accepted the inevitability of the proceeds of the National Health Fund (NFZ) as the primary payer in the new health care system. It can therefore be concluded that the organizational changes that have occurred in the hospital over several years after introduction of the reform significantly improved the management in the facility.*

Keywords: organizational structure, management methods and techniques, relations with stakeholders, performance management, public hospital.

1. Introduction

A breakthrough in the health care reforming in Poland was the transformation of health care units and budgetary entities providing health services by the reform in 1999 in the independent public health care facilities (SPZOZ-y). In this way, these units were given a legal personality, which to some extent enabled them to freely manage their

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resources. At the same time for those entities reform has forced management changes, raising issues of efficiency and effectiveness of the operation in the new conditions. In these circumstances of particular importance have become established relationships with many stakeholders, such as local authorities, state authorities: the Government, the Parliament, the Ministry of Health, the patients, the National Health Fund, suppliers or other medical facilities. The multiplicity and complexity of these relationships, mainly related to the heterogeneity of expectations of stakeholders, for years did not facilitate the smooth operation and process of change, having the capacity to improve hospitals' functioning. Among the determinants of improvement hospitals most often indicate a change in strategy, organizational structure, operational management, including methods and techniques of management or changes in the relationship with the environment. It should be noted, however, that ad hoc actions are not enough. It is necessary to accept the need to constantly adapt to the requirements of the hospital environment, as well as the development of a culture of change. It is therefore a deliberate action towards "desirable" change, and not independent of the managers result of change. The aim of this study is to analyze and evaluate the organizational efficiency of one of the public hospitals in Poland in the context of improving governance. Subjected to empirical verification, in particular, were issues related to organizational structure, methods and techniques of change of management and relationships with key stakeholders recognizing these elements of management (as literature describes) for strategic success from the perspective of the hospital.

2. Theoretical aspects of organizational efficiency

It is common to say that the organization is an ordered system, which includes the objectives and functions performed by the organization and the resulting tasks, human resources (with their competencies, values, norms and motivations) and physical, financial and information resources, providing an orderly and efficient system of organization is such a design that all the components are internally integrated [1]. Such integration should provide the organizational structure. It reflects the division of labor used and the relationship between the different functions and activities. It also specifies the structure of the hierarchy and power within the institution and shows the layout of responsibility. Generally, organizational structure consists of two basic elements: labor − that is organizational roles and

relationships between them – i.e. organizational ties. In the context of organizational ties the most authors point to the so-called classical or hierarchical structure [2]. Public organizations frequently point to the structure: linear and functional. The essence of the linear structure is the relationship of official organizational bond. Each subordinate is subject to only one supervisor and only his/her command is required to perform tasks. At the same time a manager is responsible for the whole operation run by his/her cell and has the appropriate decision-making powers. Therefore, the linear structure overlaps function and the functional relationship. In turn, the functional structure is dominated by a functional relationship. From the point of view of management, the functional structure allows managers to make decisions based on the system; centralized and hierarchical. Managers are typically promoted within the levels of the organization and have a high technical knowledge in their specialization. Each executive is subordinate at the same time to a number of superiors specialized in the field of well-defined functions. In contrast to the linear structure, it lacks a single manager. This situation requires close cooperation of specialized managers, mutual trust and understanding, effective communication skills, conflict management, which in practice is not easy [3]. In modern conditions the classical organizational structures with static divisions of tasks no longer meet their duties and even began to limit the development of the organization. Therefore, organizations, including hospitals, place new structural solutions, including flexible structures. These structures are in contrast to conventional structures that are characterized by certain characteristics different from those of conventional structures, such as multidimensionality, meritocracy and adhocracy. *Multidimensionality* is a departure from the traditional business ties supporting the functional structure and the introduction of flexible organizational links in the vertical and horizontal systems of inter-dependence. *Adhocracy* is characterized by fluidity and flexibility of organizational roles and structural solutions. In contrast to the formal, hierarchical systems adhocracy proposes setting up teams for solving one-time tasks. In turn, *meritocracy* is the dominant consideration of the importance of competence in flexible forms of organization created [4]. In the literature of flexible structures, the most frequently mentioned types such as divisional structure, task, matrix, hybrid, which provide a greater

opportunity for staff development, a greater opportunity to influence the decisions of the organization or a sense of commitment to the organization. With the efficiency of the organization it also involves the selection of appropriate management methods and tools. Nowadays in solving these problems, organizations use the help of new methods, such as: *Lean Management, Reengineering, Total Quality Management (TQM), Benchmarking* or *Outsourcing. Lean Management* is about slimming production system and management system. The need to "lose weight" by enterprise occurs when, for example, the level of employment is too large relatively to the level of service performance or production, or when we are dealing with the phenomenon of over-investment, or complex and crucial organizational structures. *Reengineering* is a restructuring procedure, which involves a radical and comprehensive redesign of processes in an enterprise, in order to achieve significant improvements in the functioning of the company, using modern information technology. It aims to optimize the functioning of the company, taking into account three basic criteria: quality, cost and time of implementation. This concept requires a transition from the orientation of the enterprise functions (goods) to the orientation towards processes to then focus on the most important processes – particularly those that are related to customers and external suppliers. *Total Quality Management (TQM)* is a system of quality control that holds the entire organization. Quality control should be organized as to the qualitative side appreciated the work of individuals and teams of people. In addition, the quality must take into account the needs of the buyer, and not just the internal interest of the producer. *Total Quality Management (TQM)* provides, inter alia, involvement of all employees, making evolutionary changes. The main factors accented by TQM include: the pursuit of external customer satisfaction, the pursuit of internal customer satisfaction, through the delegation of authority and powers, appropriate management styles, a system of penalties and rewards, motivation, exploit synergies, striving for continuous cost reduction quality, emphasis on prevention and reducing to a minimum the quality control, quality assurance treatment systems as substrates for building a quality philosophy, emphasizing leadership and its role in the process of change. In turn, the concept of *benchmarking* goes back to the eighties of the 20th century. In European Union countries, it can be seen since the early nineties of the twentieth

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century, when formed systems of information gathering and exchange of experience in public administration become popular. This method involves the systematic comparison of similar products, processes or functions to best practice in the field. In February 2001, it was created by Public Sector Benchmarking Services (PSBS) – a system of collection and exchange of information on good practices, distinguished by internal and external benchmarking. The first one consists in comparing the methods used within one organization or between subsidiaries, plants in a multisite organization. Internal *benchmarking* inspires learning and may include a comparison between the different organizational units (departments, faculties) and between employee teams. The comparison can be done for the organizational or functional aspects, methods and ways of working. The objective is to find the so-called best domestic policy. External benchmarking involves comparing one organization to another, the best in the field or in a particular geographical area. This type of comparison serves three purposes: to allow for the assessment of the organization in relation to other entities, determination of the strong and weak areas of functioning, and suggest directions for modification. The most common methods of change management in the public sector, especially in health care, should be *outsourcing*, as a concept of improvement in the functioning of the organization. In its essence, it should be carried out before all actions, to reduce the cost of products or services offered to customers, and it relies on the use of services, semi-finished products, which proposes an external producer-bidder [5]. The aim of *outsourcing*, in the most general terms, is to increase the effectiveness and efficiency of operations. As a result of this method a reduction of the organizational structure takes place in the part undertaking and consequently simplifying organizational structures and procedures resulting in the improvement of management. Shifting part of our services to partners from outside can bring together different benefits, of which the main ones are: improving the organization of work, reduction in personnel costs, reduced capital costs, reduced operating costs associated with infrastructure (operators do not have to organize their own departments, to invest in equipment and people), greater competitiveness, and improving quality and efficiency of services with the ability to focus on key tasks for organizations [6]. Moreover, the use of outsourcing allows management to focus on strategic

actions in the organization [7]. In turn, among the risks of outsourcing most often indicated are: the wrong choice of an external company, wrongly worded contract, lack of acceptance and support from the management and staff for the services unbundled externally, for breach of contract by an external company, separating out the services connected to the redundancies performing these services in the organization. It should be noted that this method has been widely used in the process of restructuring of independent public health care.

The last issue subject to theoretical considerations is the relationship between the organization and the environment. In the environment of the organization can be distinguished two layers, namely the general environment (further surrounding) and purposeful environment (direct surrounding). The general environment includes terms in which the organization operates. Most often points to find items such as political, legal, economic, cultural, technical, technological and psychological circumstances. It is setting the environment which has a direct impact on the organization from other organizations, groups and individuals associated with the organization. In the literature it most often belongs to the elements such as customers, suppliers, resources necessary for the functioning of the organization, competitors, public institutions (government, local government), regulators (e.g. government agencies, interest groups, trade unions), strategic allies. Any organization functioning in conjunction with the environment form which it takes resources, enters them interact to form inter-organizational relationships [8]. Organizations, particularly public, are influenced largely by outside environment. This is mainly because of their mission, which is to respond to social needs as closely as possible. It should be noted that in connection with the exercise of their functions, these organizations belong to the state, they are funded and controlled. This causes even greater instability of surrounding public organizations, mainly through continuous changes in the levels of government and the associated changes to the objectives, priorities, and pressure for quick results [9]. Therefore, it allows organizations to function effectively; they must interact with the environment. For every environmental factor diminishes the ability of the organization to acquire the necessary resources (human and material, financial) or to produce and market their products (services) is the force that causes change and the need to respond to it, on which will

depend the success of the organization [10]. Illustration of the theoretical part of the study is to analyze the following organizational efficiency in one of the public hospitals in Poland.

3. Organizational efficiency of public hospital – a case study

Studied district hospital is a separate organization of health care facility that implements the provision of primary care and specialist care. The organization is independent and self-supporting with a legal personality based on an entry in the register of independent public health care facilities. It should be emphasized that the hospital is a public organization, which implies the management of the entity. We cannot speak of a simple transfer of management methods in the private sector to the public hospital, because it is characterized by specific features. First, the objectives of the hospital as a public organization are numerous, multi-dimensional and often difficult to reconcile, for example equality and efficiency. Second, the public hospital is subjected to excessive influence of political parties, interest groups and the mass media [11]. Thirdly, it is characterized by different success criteria - they are not financial criteria, but social – health, well-being and continuous care. Fourth, implemen-tation of management in this organization is held in strict framework of the law, which makes it necessary to reconcile the effectiveness of the principles of legality action [12].

The basic tasks of the hospital are associated with the performance of services in the field of primary care, stationary and outpatient; emergency; diagnostic testing and prevention. Organizational functions are carried out by the following organizational units:
1. central emergency room;
2. emergency rooms located at various hospital wards;
3. wards (obstetric-gynecological neonatal, general surgery, internal diseases of intensive care beds, a division of rehabilitation, children);
4. operating theatre;
5. lab, serology and blood bank;
6. *pro-mortem* room;
7. hospital kitchen;

8. specialized clinics: surgical, ENT, ophthalmology, mental health, neurological, dermatological; tuberculosis and lung diseases, rheumatology, orthopedic, endocrinology, cardiology, rehabilitation, for women, pain treatment;
9. administration-section of medical statistics, accounting section, section of personnel matters, administrative sections – technical section, organizational section, science section.

Hospital is headed by a Director, cooperating with Financial and administrative Deputy Director, and Medical Deputy Director (if needed). Nursing, Chief Accountant and wards coordinators are performing the tasks arising from the orders of heads of organizational units of the hospital and specialists and persons holding independent positions in the hospital. Advisory body, as in any independent public health care institution is so-called Social Council, which is primarily an advisory body to the Director. The opinion of management of internal processes in the hospital is not valid. Most processes require improvement, in particular, the planning and decision-making by managers. The study shows that in the hospital there is no determination of medium-term and long-term plans. Currently, planning is associated only with plans of NFZ (short-term) and this process is not subjected to systematic analysis and evaluation. In addition, respondents indicated the need to increase the independence of the hospital board in determining courses of action, and to increase the participation of second-level managers (directors of functional divisions) in these activities. At the same time the management of the hospital is becoming more and more aware of the need to use external experts to participate in the planning of the strategic management of the hospital. In the case of the lowest management level (heads of organizational units) to enhance their role and importance, most visible actions should take place in the areas of coordination and accountability than in the planning of activities. Directors appointed that divisional organizational superiors of missions are all managers and subordinates included in the division. They also perform functional supervision over the activities of posts and organizational units of not subordinate business, but pursuing the tasks corresponding to the specialty of division director. The formation of functional divisions resulted in creating two major roles: the role of supporting staff in relation to the chief of the hospital authorities and the role of counseling and supervision in the field of functional specialization

carried by cells outside the vertical organization. Generally, the characteristic feature of the organizational structure of the hospital is high formalization and bureaucracy and the presence of a variety of decision-making procedures. From the point of view of the management structure, the functional divisions enables informed decision making based on centralized and hierarchical system. Managers are typically promoted within the levels of the organization and have a high technical knowledge in their specialization. On the other hand, the structure is very flexible and does not have a high risk tolerance, which limits the ability to efficiently respond to the needs of the environment and the ability to take innovative action. At the same time in the hospital there is a greater focus on the rules and procedures rather than on results, which results in a significant formalization. The basic internal documents at the hospital include: statutes and organizational scheme adopted by the founding body (district/county-poviat) and the documents adopted by the director of the hospital: staff regulations and rules of remuneration. Changes in the above documents shall perform bodies forming them. It should be emphasized that hospital staff is acquainted with these documents and the changes occurring in them. At the same time the hospital did not have a manual flow of documents, which results in frequent inconsistencies between the different procedures and complicates efficient decision making. Interviews suggest that most of the information and commands are transmitted through official channels, in writing. After 2000, hospital organizational structure has undergone changes to adapt to changes in the environment (legal, economic, technological). Structural changes mainly included: the creation of new organizational cells and jobs, elimination of cell organization and jobs, and shifts in subordinate positions. In addition to the transformations in the organizational structure the hospital made the transition in the methods and techniques of management. The studied hospital implemented a quality system (ISO 9001: 2008) and outsourcing. With the introduction of the Quality Management System according to ISO 9001 management pointed to a number of benefits such as:

– Improving the quality of services, ensuring patients the level of care offered may not be lower than that declared by the hospital in the developed quality policy,

– Streamlining and optimizing management processes,

− Increasing efficiency, which in turn will lead to minimize costs and improve the financial condition of the hospital,

− Increased credibility and trust in the hospital,

− Additional points in competitions tenders for contracts for the provision of health announced by the National Health Fund,

− Increasing competition in the market of medical services,

− Improving communication, internal and external, to increase awareness of motivation and commitment of employees,

− Improved cooperation between all parties involved in the process of treating a patient.

Hospital also achieved numerous benefits with the introduction of outsourcing, which took the food service and laboratory diagnostics. Hospital director pointed to the significant improvement of the organization of work, reduction in personnel costs, reduced capital costs, reduced operating costs associated with infrastructure, improving efficiency of medical services with the ability to focus on key hospital tasks associated with the provision of medical services. The last issues subjected to empirical verification in relation to the hospital were examined interactions with the environment. According to the cited in the theoretical concept of stakeholders to the main external entities with which the hospital establishes relationships are: local authorities, state authorities: the government, the parliament, the Ministry of Health, patients, the National Health Fund, suppliers, distributors and other medical facilities and the media. From the point of view of the functioning of the hospital it seem to be the most important relationship with the National Health Fund, founding bodies (local government) and patients. A key stakeholder is the payer - the National Health Fund, which decides what services are to be performed, how many and at what price will the hospital contracted. Although the exchange of information with the NFZ is double-sided, it boils down primarily to issues relating to the execution of contracts. Another stakeholder hospital is its owner, the founding body. This entity inspects and evaluates the activities of the hospital and the work of its director, and in particular the exercise of statutory tasks, the availability and level of service. Local government is expected to hospital on one side offset the revenues and expenditures, on the other hand constantly improving the level of service and patient satisfaction. In the case of an

investigational hospital relationships with local authorities are correct, and the hospital is constantly making efforts to improve the functioning according to the directions established by the county. On the other hand, from a social point of view, the most important stakeholders of independent public health care are patients. In accordance with the constitutional law, patients have a right to health care, regardless of their financial situation, and the public authorities are to ensure equal access to health care services financed from public funds. Examined in the context of hospital-mentioned tasks systematically conducts patient satisfaction studies, the results of which are used in improving the availability and quality of health services. In order to raise the standards of services provided hospital draws attention to the efficiency of organizational solutions (cleanliness, aesthetics) and logistics (e.g. functionality of spaces, time expectations for the visit, the time devoted to it by the staff). Measurable effect of this approach is the quality system functioning in the facility.

4. Conclusions

Although the practice of management in the audited hospital is only a segment of organizational reality from the point of view of the smooth operation, but allows us to formulate the following conclusions:

1) The hospital after the introduction of reforms in 1999 has changed the role of managers from passive administrators to active implementers of strategic goals. Directorate of the hospital is aware of the inevitable changes in the environment and the associated need to make changes within the facility, causing the hospital is open to the new challenges.

2) In the hospital after the reform have been numerous structural changes, changes in management methods and building relationships with the environment. These changes were aimed at achieving the objectives of the hospital and in particular the provision of adequate quality while using a relatively modern technical infrastructure, provision of services oriented to the needs of the patient, the constant modernization of existing facilities and equipment, and strengthening the positive image of the institution.

3) Tested hospital has a traditional structure resulting from functional divisions. The essential features of this structure are: the formalization and bureaucracy, which limits the efficient implementation of the strategic objectives of the unit. At the same time, partial changes are gradually taken in the organizational structure designed to lead to a flattening of the organizational structure (e.g. liquidation of organizational and managerial positions) and by increasing the flexibility of its middle management decision-making power and the lowest level power. However, these changes are still very small, although they seem to follow in the right direction, aimed at improving the efficiency of the hospital.

4) In addition to changes in the organizational structure, the hospital made a transformation in the methods and techniques of management. The studied hospital introduced two major changes: the quality system (ISO 9001: 2008) and the outsourcing of food services and diagnostics. The information received shows that these processes have led to positive effects: improved the quality of services, streamlined and optimized management processes and increased efficiency, which in turn affected the minimization of the cost and improved the financial condition of the hospital.

5) In the hospital setting, the facility should pay attention to many stakeholders, including the strategic role played by the National Health Fund, the founding body and patients. In general, hospital relationships with these entities are positive. The hardest of these is the interaction with the National Health Fund. Although this is a two-way relationship, but NHF dictates financial conditions for medical contracts and for hospital there is practically no alternative but to agree to these terms. In turn, the relationship with the founding body is more affiliate character. As emphasized by the hospital management, both parties depends on good co-operation, in particular, that the operator of incorporation, in the light of art. 59 of the new law on medical activity [13] are fully responsible for the negative financial result of the hospital, in the absence of coverage of it by the same unit. An important for stakeholder of the test facility is also a patient who under market conditions is increasingly recognized by public health care. The results of the study indicate that the hospital systematically shall assess the level of needs and expectations of patients, the results

of which are used in improving the quality of services provided by the hospital.

In general it can be said that the changes in the health care system in Poland in the last several years completely changed their institutional - economic reality. Independence, partly limited by the actions of stakeholders (mainly the National Health Fund), restructuring, tough rules of financing, requirement of counting the cost, attention to quality, new relationships with external entities are just some phenomena, unknown to hospitals by the end of the 80's, and which they face after 1999. Bearing in mind that this is just one case study, and it is difficult to generalize these results to other public hospitals, however, there are some common applications for other public hospitals in Poland.

The first-public hospitals have accepted the inevitability of continuous adaptation to the requirements of the environment. Learned to respond to environmental signals and achieve ever greater efficiency in the implementation of change and innovation within the health care system.

Secondly, hospitals have made numerous amendments, which were the most common in the organizational structure and new management methods and techniques. Changes in the structure included the most liquidations organizational positions, including management, setting up teams, committees' ad hoc or permanent, changes in subordinate positions, or ranges of duties. Hospitals increasingly, the model of Western organizations, reach for new methods and management techniques, among which the most popular are quality systems and outsourcing. The practice of Polish hospitals identified numerous benefits associated with the use of these tools in their business, in particular the reduction of personnel costs and operational cost and to improve the quality of services.

Thirdly, the reform changed the public relations hospitals with their stakeholders. Particularly sensitive are contacts with the National Health Fund, which is a strategic contributor for work performed under contracts medical services. At the same time it is important to the quality of those services from the perspective of patients, whose needs and expectations are getting higher, and that public hospitals must face, regardless of financial and organizational conditions of operation.

In conclusion it should be emphasized that public hospitals there is the possibility of creating profits, as in the case of business, so a lack of clear mechanisms to stimulate the improvement of the management. It is necessary, therefore, the search for substitutes which could act as an incentive role in the replacement market mechanisms. The role of such a substitute may act as a strong and wise leadership, which should

systematically analyze organizational efficiency in order to continually improve the management of public hospitals.

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THE RELATIONSHIP BETWEEN ORGANIZATIONAL CULTURE AND INNOVATION IN THE OPINION OF THE MEDICAL STAFF OF PUBLIC HOSPITALS[1]

Joanna JOŃCZYK[*]

Abstract. *Culture organization appears to influence the extent to which the innovations are stimulated in the organization. There is therefore a need for a closer look at the nature and types of organizational culture in relation to innovation in the organization. In this article, attention is focused on the study of the relationship between organizational culture and innovation, built on the opinions of medical personnel (doctors and nurses) of public hospitals operating in Poland. The results of tests using correspondence analysis clearly indicate the existence of relationships between the variables. With the opinions of the respondents, the different positions of doctors and nurses in the tested range were confirmed. Physicians perceive a greater share of culture role in raising the level of innovation. In turn, in the opinion of nurses, greater share in raising a culture of innovation has got hospital personnel culture.*

Keywords: organizational culture, innovation, public hospital.

1. Introduction

Both theory and practice increasingly point to innovation as an important factor in the development. At the same time research on the determinants of innovation emphasize the importance of organizational culture in creating a climate for innovation. These statements are becoming increasingly important to all organizations including hospitals, which in spite of its audience are even forced to develop the capacity for innovation. Thus, in the context of successful innovation in strategy, technology, work methods, a detailed analysis of the values, beliefs and behaviors of

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organizational (corporate culture) is required. It is important to know what types of organizational culture are to stimulate openness to change, a higher degree of risk taking and incentives for creative activity. It should be stressed out that this problem is not sufficiently present in studies conducted both in Poland and in the world, including in relation to the public sector. Meanwhile, access to innovation is crucial for the success in the implementation of changes in the management of modern organizations, particularly public hospitals, which for almost 20 years are undergoing constant transformation processes. The purpose of the article was to examine the relationship between organizational culture and the level of innovation in Polish hospitals. The study was conducted in the third quarter of 2014, among medical staff (doctors and nurses), based on the research questionnaire.

2. The hypothesis and methodology of the study

The implementation of the objective set at the beginning of the work is related to the attempt to answer the basic research question, i.e. whether there is a relationship between organizational culture and innovation in a public hospital? The study adopted the concept of organizational culture that distinguished four types of organizational culture: power, roles, tasks, and person [1]. The choice of this concept was dictated by the fact that in interviews with the representatives of free medical workers in surveyed hospitals hospital culture of the organization by categories of management, staff roles, its powers and duties was frequently reported, the treatment of staff by management, relationships between staff, responsibility or characteristics of individual and group job. Assuming the above typology is worthwhile to briefly describe the types of organizational culture. The culture of power is focused on the leader of the organization. Power occupies a central place here, chooses collaborators, rewards and punishes according to his/her own code of conduct. The organization of the culture of power treats subordinates as subjects. The importance of people, their creativity and participation in deciding are low. Relations between employees are based on the large power distance and strong competition. Organization protects its territory, trying to dominate the environment as it is competitive and uncompromising. The culture of role is a bureaucratic

culture where the emphasis is placed on the legality of its actions and responsibility. In this culture, the position is more important than personality. Responsibilities and privileges are clearly defined and strictly dependent on the position. Existing procedures, rules and patterns of action, which employees must obey, in return give them a sense of security, while at the same time limit the independence and creativity. The role of each member of the organization is clearly defined. The success of the organization depends on whether individuals will fulfill their roles well. Tasks-oriented culture is characteristic for the matrix organization. It has been presented as a grid (network), and people are located in various locations depending on the tasks treated as a priority. In the culture of the tasks the idea of working in a team is valued, and those teams are built for specific projects, therefore they seek to achieve a common goal. The main focus is on the result of the work (project, task). The effort is focused on gradual, planned development. Organizational task – oriented culture is characteristic for organizations that exist primarily to meet the needs of its members. The role of the organization is reduced only to organize the workplace and help employees to achieve their individual goals. At the same time the unique character of public hospitals is stressed out, which is associated with both the peculiarity of the health care market, as well as public hospitals [2]. The peculiarity of the healthcare market relates to differences between this market and markets of other goods [3]. Generally, health is a specific value for a particular ethical dimension, not a commodity, there is also the price – is priceless. Access to medical services is not governed by market mechanisms, such as the purchase of standardized services, but on the basis of a guarantee of the Polish Constitution. In turn, the public hospitals are associated with their strategic role in the system and the features distinguishing these entities from business organizations [4]. It should be emphasized that the goals of public hospitals are numerous, multi-dimensional and often difficult to reconcile, for example equality, justice and efficiency. These units are subject to excessive political interference, specific interest groups and the mass media. In addition, they are characterized by different criteria of success – and they are not financial criteria, because public hospitals are not subject to the risk of elimination by competition. At the same time public hospitals are of excessive tendency of the authorities to intervene, which translates

in many cases in less autonomy to managers [5]. Generally, public hospitals are characterized by highly bureaucratic organizational structure and organizational culture has the characteristics of a weak, negative, conservative and hierarchical structure [6]. In the context of the specific characteristics of the organizational culture hospital draws attention to the problem of innovation [7]. Based on the above assumptions and past experience empirical thesis appears that there is a relationship between organizational culture and innovation in a public hospital. In order to verify this thesis, a survey was conducted, in which participated 237 respondents - employees of four public hospitals operating in the north - eastern Polish (choice of hospitals was intentional, resulting from the fact that only those hospitals have agreed to conduct the study). Among the respondents 22% were managers, 22% doctors, 48% nurses and midwives, while 8% of respondents did not specify their position. Due to the fact that the article is not the place to publish the whole test results, which are very extensive, it shows only a part of the considerations for the doctors and nurses. The study used correspondence analysis as a method of combining the reduction in size of population and the ratings reflected on the perceptual map of objects in terms of their selected features [8]. As an advantage of this method, the possibility of clear, graphical presentation of the co occurrence of categories of variables is indicated. Interpretation of the results is to assess the position of points showing the categories of variables in the graph using such elements as the position of the point to the centre of projection, the position of the point relative to other points defining the categories belonging to the same features, the location of a point relative to the point of describing the category of other features. Correspondence analysis was used in relation to previously noted four cultural variables (four types of cultures: power, role, tasks and person) and assess the level of innovation. The study started with the determination of the degree of dependence and independence by using chi-square test. In addition, for greater readability Czuprow index was used. The calculations were performed using the STATISTICA 10. The results of the significance test is presented in the form of tables and then subjected to critical analysis.

3. Results and discussion

As indicated in the previous chapter from the point of view of the objective of this publication is crucial to know the opinion of the medical staff (doctors and nurses) on the relationship of the existing organizational culture to the level of innovation in hospitals. All results are presented in a two-dimensional system, explaining the bonuses in each case, except in one case – more than 60% of the inertia. At the outset the level of innovation hospitals was evaluated (Fig. 1).
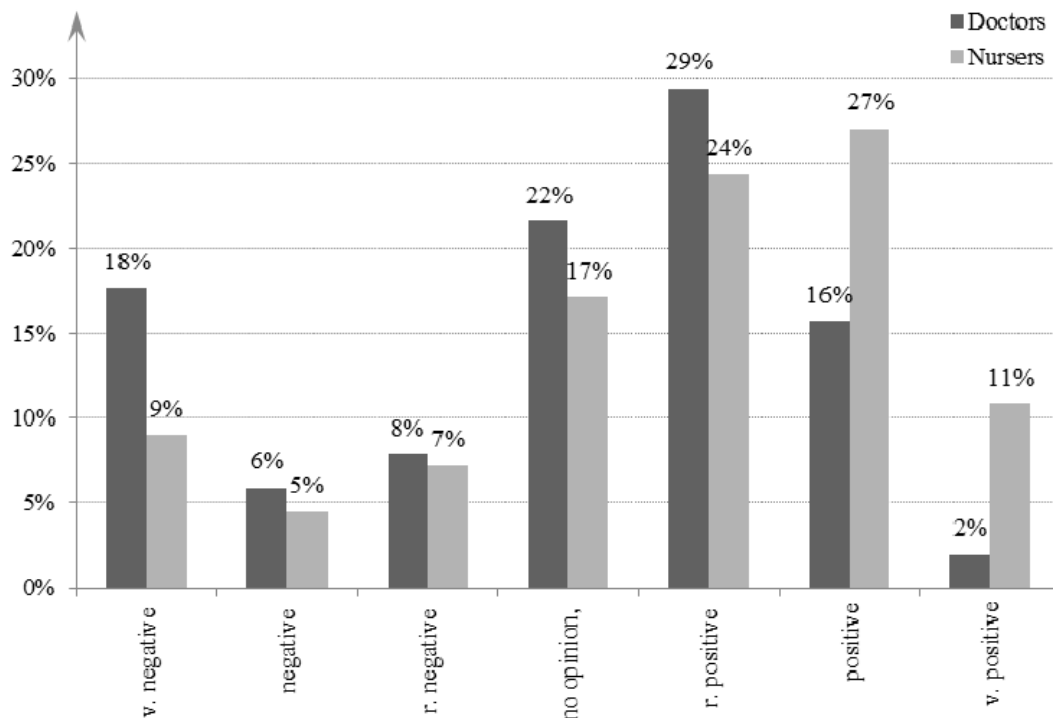
Figure 1. Assessment of the level of innovation in the hospitals in the opinion of the doctors and nurses (in %).

The distribution of the data shows that there are significant differences in the opinion of doctors and nurses. According to the nurses, the largest percentage of indications concerned the assessment of positive and very positive (38%), in contrast to the physicians (18%). A similar situation exists in relation to the very negative ratings, where nurses' interest rate was 18% and 9% for doctors. Such a breakdown of the

results confirms the significant differences in the opinions of these two professional groups, which in turn may translate to these professional groups.

Then opinions on the types of organizational culture characteristic for the studied hospitals were analyzed. Distribution of ratings of physicians in this topic shows Figure 2.
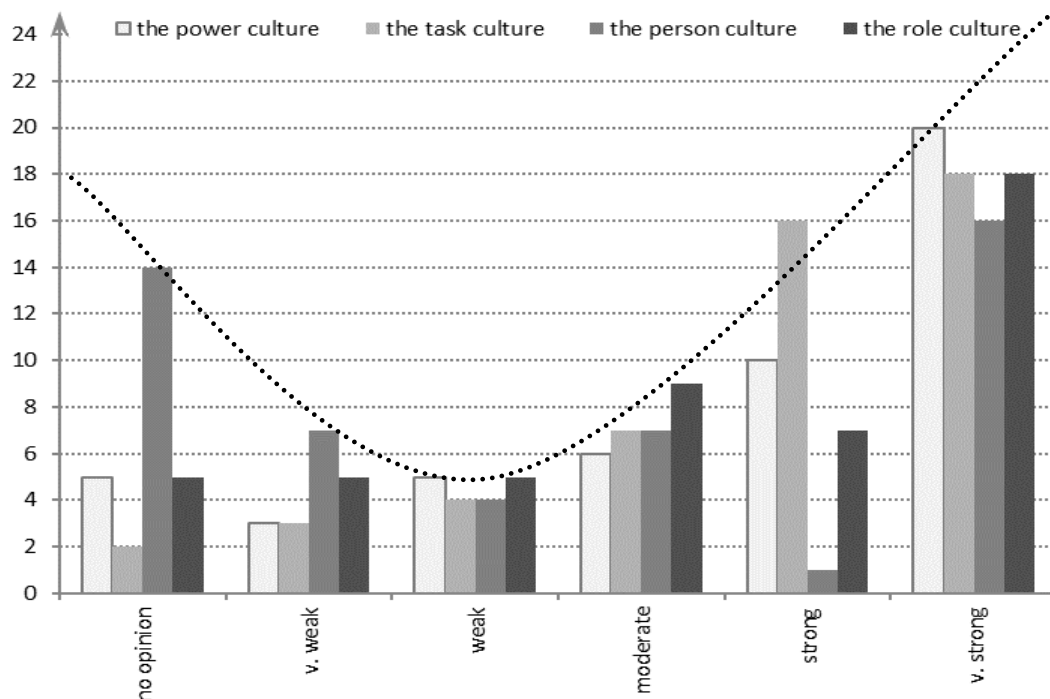
Figure 2. Assessment of organizational culture type in the opinion of doctors (in numbers).

Source: *Own study.*

The distribution of the data shows that the largest number of responses (very strong and powerful) tasks related to culture and the culture of power and the lowest rated culture of partnership. Data distribution resembles a line of type U, when the differences in the selection of particular types of cultures are not substantially different. This may indicate that the existing public hospital organizational culture is a specific set of features is not located in the universal models.

In contrast, other opinions represent nurses (Figure 3).
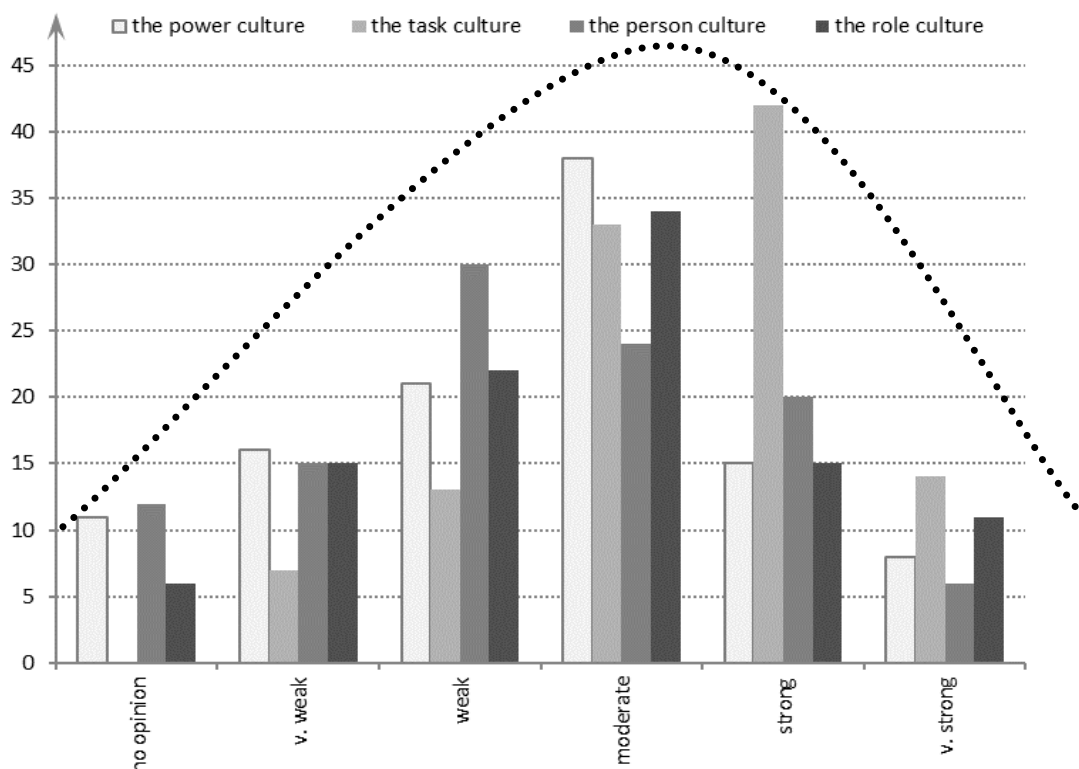
Figure 3. Assessment of organizational culture type
in the opinion of nurses (in numbers).

Source: *Own study.*

In case of indications of organizational culture types by nurses, largest number of responses (very strong and powerful) was related to culture and the culture of power and the lowest rated culture of partnership. The nurses were not as extreme in their assessments as doctors (line type inverted "U"). Their assessment grouped around a weak, moderate and strong. The largest number of indications related to culture, tasks and other types of cultural rated similarly. The final essential element of the assessment of the empirical analysis was an attempt to investigate the linkage between the type of organizational culture and the level of innovation of the hospital received by medical personnel. Summary of linkages between different types of culture with the assessment of the level of innovation in a group of doctors are presented in Table 1.

Table 1.

*Presentation links assessing particular types
of organizational culture in a group of doctors.*

The types of culture	Chi-square	Degrees of freedom (df)	The significance level	Czuprow dependence index
The power culture	42,2804	30	0,0678	0,3853
The task culture	52,9510	30	0,0060	0,4312
The person culture	45,6899	30	0,0333	0,4005
The role culture	66,8808	30	0,0001	0,4846

Source: *Own study.*

The distribution of the data it is clear that, in the opinion of physicians, Czuprow index is higher for the culture role than for other types of cultures. However, the differences in the statement of the different types are not significant, which may indicate the diverse opinions of doctors and at the same time the lack of a uniform type of culture in relation to public hospitals. Due to slight differences in the selection of the various types of organizational culture by doctors, the impact of various types of culture on the level of innovation in this sector should be analyzed. For the purposes of correspondence analysis it was assumed that the coordinate verse was the level of innovation of the hospital, and coordinate column was a particular type of organizational culture. The graphical presentation of the different levels of innovation assessment adopted 7-step scale, where answers were: very negative, negative, rather negative, no opinion, rather positive, positive, and very positive. For the evaluation of particular types of organizational culture there was adopted a 6-degree scale, where responses appear as none, very weak, weak, moderate, strong and very strong. All results are presented in a two-dimensional system, explaining where in each case, except in one case, the level of inertia was over 60 %.

Thus, the link between the assessments of the role culture and level of innovation in the opinion of physicians presents Figure 4.

Figure 4. Presentation of the link between the assessments of the role culture and level of innovation in the opinion of physicians.

Source: *Own study.*

In the analysis of the links between the assessment of the level of innovation and the assessment of the role of culture, a two-dimensional projection area helps explain 67 % of the total inertia. In the above figure, we see that the horizontal axis that a higher proportion of inertia, characterized in that the right side of the centre axis is most ratings, while on the left side has extremely negative doctors. Those who very low assessed innovation, also low evaluated the role of culture. On the other hand, taking into account the centre of the vertical axis (having 25% of the inertia) shows the relationship between high assessment of innovation or lack of opinion on the subject and a strong evaluation of the role of culture. In this way, physicians formed three groups of workers. One include those who have a very low rate of innovation and the role of culture in the second are extremely positive reviews also take into account the undecided, the third remaining respondents.

Another figure 5 shows the link between the assessments of the task culture and level of innovation in the opinion of physicians.
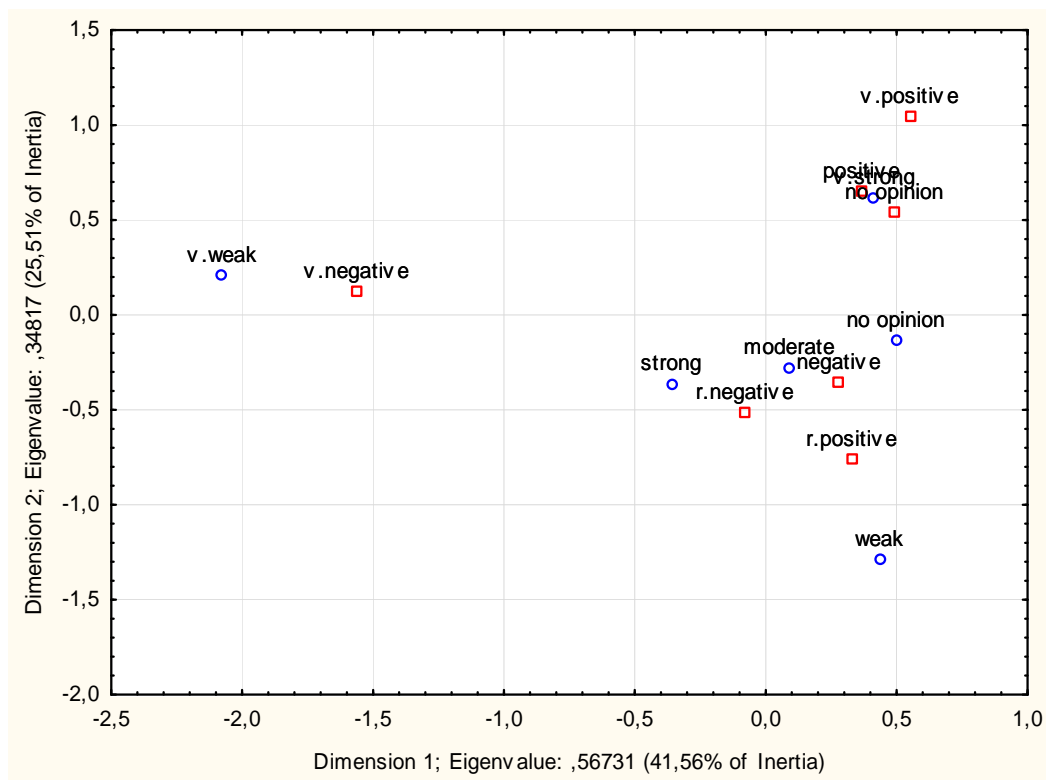

Figure 5. Presentation of the link between the assessments of the task culture and level of innovation in the opinion of physicians.

Source: *Own study.*

In the analysis of the links between the assessment of the level of innovation and cultural assessment task, a two-dimensional projection area helps explain 80 % of the total inertia. In the above figure, we see that the horizontal axis that a higher proportion of inertia, characterized in that the right side of the centre axis is extremely positive, and the positive evaluation of innovation and very strong culture evaluation task. It is interesting that people do not express the opinions of innovation, very highly assessed the culture of tasks. The far left are negative opinions with respect to the analyzed variables, and locate near the centre of the other, while on the left are extremely negative opinions of doctors. Just as the assessment of compounds culture of innovation tasks are visible 3 groups

with a similar distribution of responses as shown in Figure 3 for the role of cultural links with innovation.

The next description is to link assessment with the assessment of the person culture and level of innovation in the medical group (Figure 6).
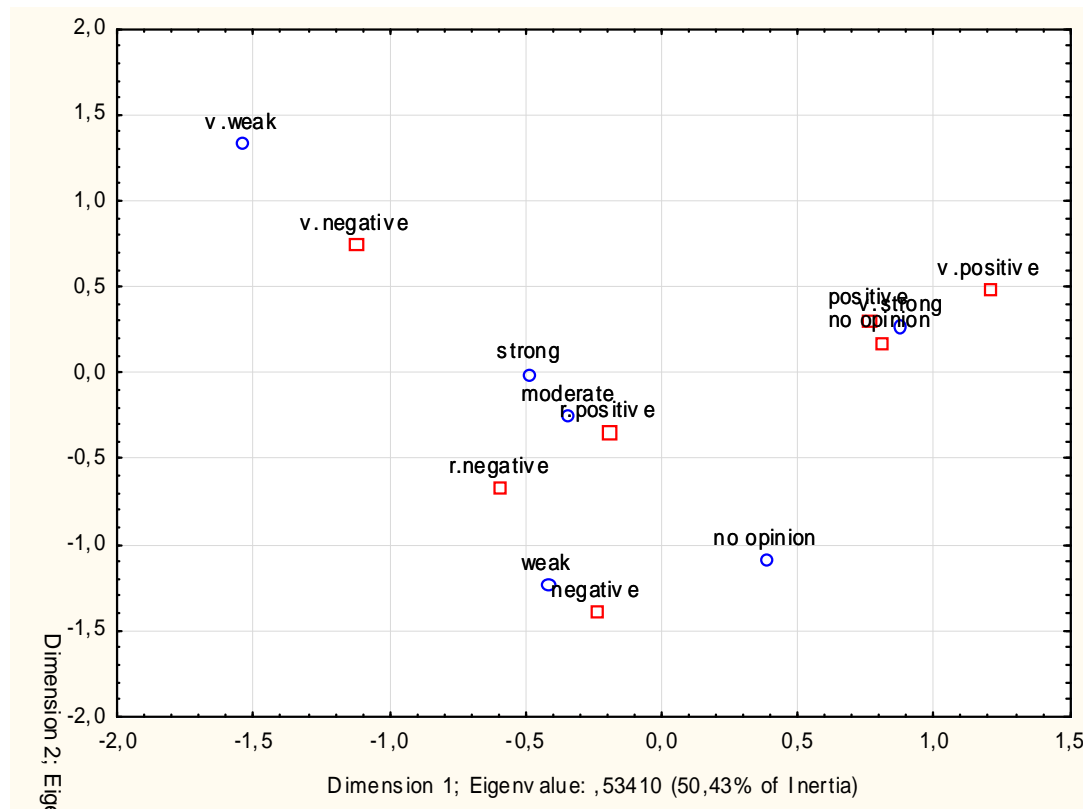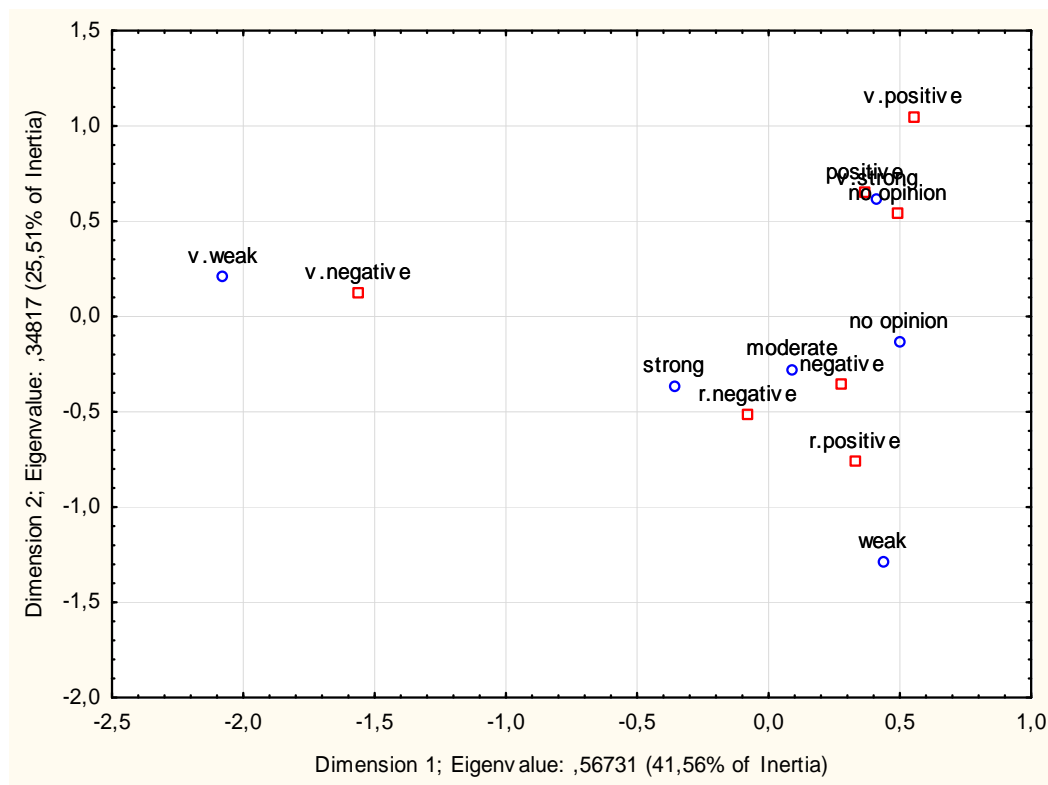

Figure 6. Presentation of the link between the assessments
of the person culture and level of innovation in the opinion of physicians.

Source: *Own study.*

In the analysis of the links between the personal culture assessment and the assessment of the level of innovation culture, two-dimensional projection area helps explain 67 % of the total inertia. In the above figure, we see that the horizontal axis that a higher proportion of inertia, characterized in that the right side of the centre axis is extremely positive and positive feedback reviewers innovation and concerning personal culture aside, the extreme left and a negative feedback terms of the evaluation of innovation and very weak relative to the personal culture, and

locate near the centre of the other. As with the earlier types of evaluation of the compounds of the cultures, they are shown in 3 groups of similar distribution of answers.

The last of the studied types of innovation culture is a type of culture of power (Figure 7).
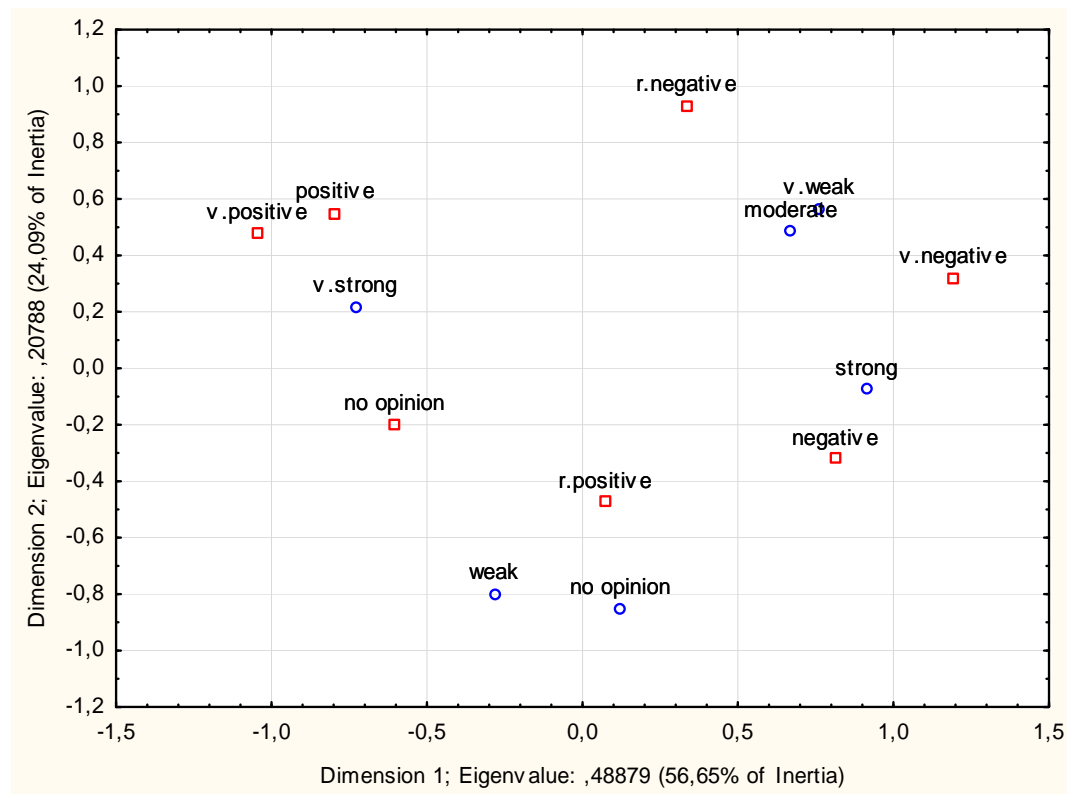
Figure 7. Presentation of the link between the assessments of the power culture and level of innovation in the opinion of physicians.

Source: *Own study.*

While the earlier evaluation of correspondence between the types of cultures and assessment of innovation was similar, whereas in the case of the culture of power, the situation is somewhat different. Relationship between the assessment and the assessment of the level of innovation culture of power allows a two-dimensional projection area explaining 81 % of the total inertia. In the above figure, we see that the horizontal axis that a higher proportion of inertia, characterized in that the right side of the centre

axis are extremely negative, negative and rather negative feedback, which correspond to the evaluation culture weak, moderate, but strong. In turn, the left side of the axis we find the relationship between very positive and positive assessment of innovation and very strong culture of power. These links also are arranged in three groups, although different from each other.

In relation to nurses' assessment of the relationships between particular types of organizational culture and innovation of the hospital looks different (Table 2).

Table 2.

Presentation links assessing particular types of organizational culture in a group of nurses.

The types of culture	Chi-square	Degrees of freedom (df)	The significance level	Czuprow dependence index
The power culture	28,1802	30	0,5609	0,2124
The task culture	17,2954	24	0,8357	0,1760
The person culture	49,6102	30	0,0137	0,2819
The role culture	40,9181	30	0,0884	0,2560

Source: *Own study.*

As the table shows, in the opinion of nurses the highest dependency Czuprow index applies to personal and cultural role. It is a different indication than for doctors, which may be due to other cultural values adopted by this group. Distribution of the person culture and the level of innovation is in Figure 8.
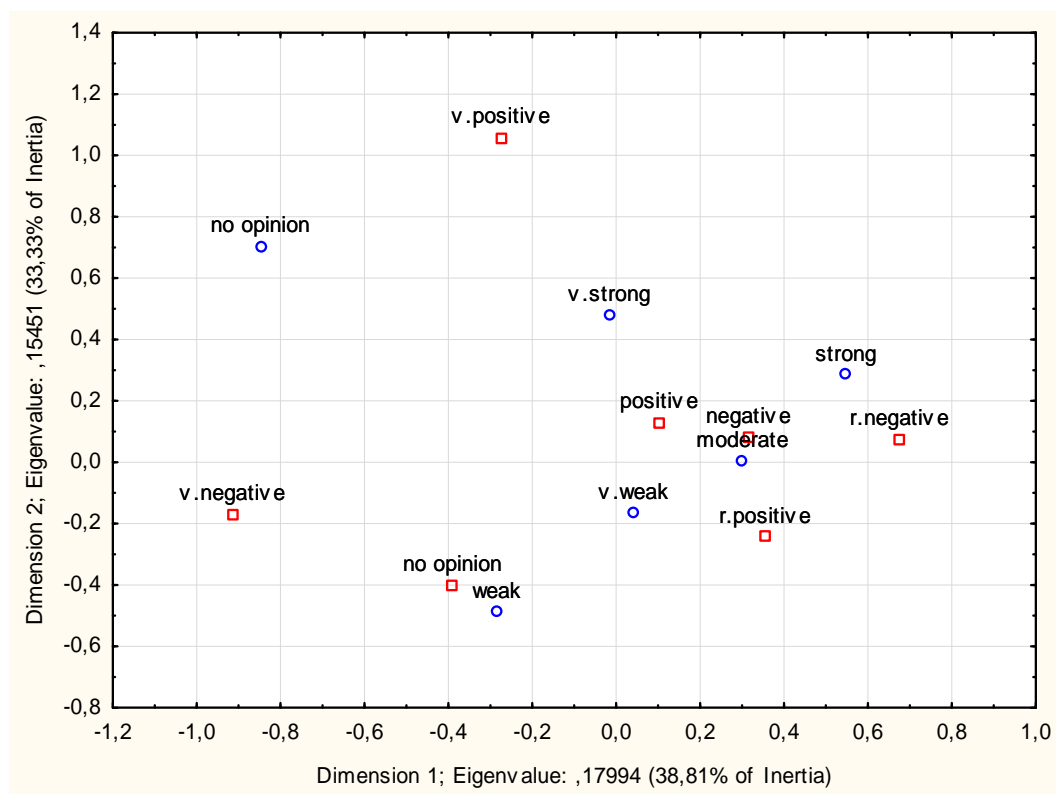
Figure 8. Presentation of the relationship between the person culture and level of innovation in the opinion of nurses

Source: *Own study.*

In the analysis of the links between the assessment of the level of innovation and the assessment of the person culture, a two-dimensional projection area helps explain 73% of the total inertia. According to the data presented in Figure 8 opinions of nurses are more conservative, tending to a negative assessment, evaluation or negative innovation corresponds to very poor assessment of the person culture formed a clear one grouping. None, however, in this group the extreme opinions regarding innovation (both positive, what negative).

Reference to the relationship between the role culture and level of innovation is presented in Figure 9.
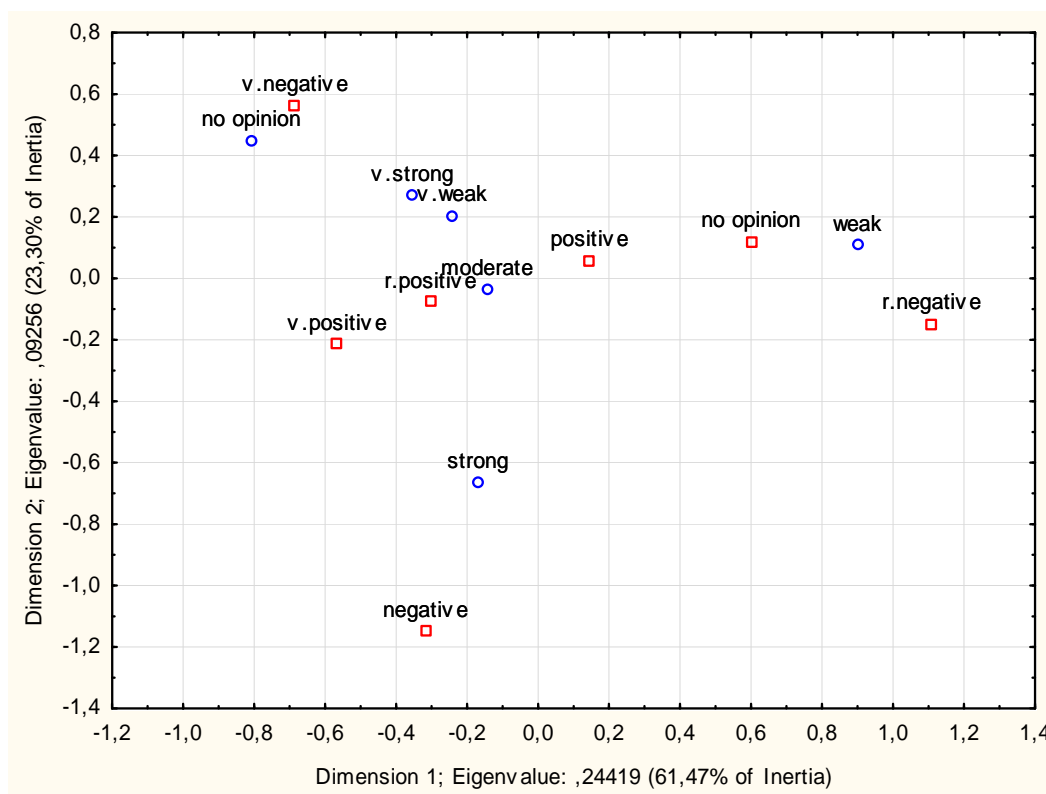
Figure 9. Presentation of the relationship between the role culture and level of innovation in the opinion of nurses.

Source: *Own study.*

In the analysis of the links between the assessment of the level of innovation and the assessment of the role culture, a two-dimensional projection area helps explain 85% of the total inertia. In the above figure, we see that the horizontal axis that a higher proportion of inertia, characterized in that the right side of the centre axis is rather negative opinions and no opinion concerning the evaluation of innovation and opinions regarding poor culture role. After the extreme left side we have the statement of a negative assessment of innovation with the lack of assessment in relation to the cultural role. Closest to the centre locate the positive assessments in relation to the level of innovation and moderate in relation to the cultural role.

4. Conclusion

Summing up the considerations carried out, it should be emphasized that the presented results are only clipping of total above which is still underway. However, applications that arise after the analysis already allow for confirmation of the thesis that there is a relationship between organizational culture and innovation in hospitals. The problem with these relationships seems therefore considerable. Especially that this medical staff (their value, attitudes and behaviors) decide making activity towards innovation and stakeholders from public hospitals are increasingly looking to the commitment to improve the process of providing health care.

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PUBLIC SERVICES STANDARDIZATION AS A PREREQUISITE OF POLISH TERRITORIAL SELF-GOVERNMENT UNIT (TSU'S) EFFECTIVENESS

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Katarzyna SIENKIEWICZ-MAŁYJUREK[***]

Abstract. *The search for assessment methods of territorial self-government units activities is related to the need of adaptation of various types of instruments and mechanisms, which theoretical and implementation basics are developed by different scientific disciplines. Some theories claim that ensuring the effectiveness in the functioning of these organizations can be achieved through the minimum public services standards. It is the effect of the cost categories adaptation, which – as an economic category – ensures: the utility of the services, the compatibility of resource consumption with the needs of local communities and the binding procedures, as well as understanding the goals and entrusted or commissioned tasks, etc.*

Keywords: *public service, standardization, territorial self-government unit, effectiveness.*

1. Introduction

Local government, being one of the most important and active participants in the economic life of the state, is involved in the exercise of public authority, fulfilling both own, entrusted and commissioned tasks. In its action it is obliged to maintain the thriftiness which is evaluated on the basis of frugality, efficiency and the relation between costs and effects. In this context, an important area of consideration for both theorists and

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practitioners of TSU functioning around the world is the rationalization of the public sector activities and the reduction of waste resulting from either ignorance or disobeying management principles recognized in the organization and management theory, as well as denying the already known good practices of the developed countries. It also involves the need to overthrow the thesis that the theoretical problems of public administration are merely the domain of law and politics. Both of these disciplines should rather act an ancillary role, offering ideas and solutions developed through conceptualization and operationalization of the economics, organization and finance theory research fields. It is however common that economists try to interpret the law while lawyers annex economical or financial theories in their publications.

The paper attempts to provide a theoretical justification for the need of implementation of minimum public services standards in Poland as a prerequisite to ensure the efficiency of local government administration.

The study applied contemporary management theories on the public sector units, as well as the results of conceptualization of the effects of applying costs in planning and performance evaluation of local government sector organizations.

2. Efficiency and effectiveness in the TSU activity assessment

The public sector – as a part of the organization which is the state – consists of people, tasks, technologies, structure and management [1]. The systemic approach of this sector allows noticing that both its individual components and identified cause-effect relationships lead necessarily to achieve measurable benefits that provide long-term actions aimed at changing environmental conditions. The effects of these actions are the services and goods, which meet the needs of citizens and other stakeholders, as well as their distribution in line with binding legal, economic and social arrangements.

Thus, the TSUs that aim to achieve a state consistent with the model assumptions should become a specific monolith. The actions of its components should be coordinated and focused on achieving objectives compatible with the purpose of whole, which shall effect in the shortest possible time of their execution , high quality and optimal low cost. Therefore the organization's teleological character, requires "expressing, as precise as possible, the long-term mission and time-specific business objectives" [1], which will allow evaluating organization's efficiency by

making use of the degree of assumed objectives realization (effectiveness) and determining the state of economy, measured by relation of effects of actions and opposing their costs.

Effectiveness is understood in this article as a measure of achieving the intended results and is simultaneously expressed by the target achievement degree (operational issue) and the accuracy of the adopted action target (strategic issue) [2]. Economical effectiveness is treated as a relation between effects (what was achieved) and costs of the actions taken [3] – which is valuable measurement of the need for resource consumption. Such an understanding of effectiveness exhausts the European Union's principle of sound financial management [4], combining economy, efficiency and efficacy. These categories are attainable through ensuring the advantage of action [5], which is the absolute difference between the achieved utility effects and necessary incurred expenditures.

The specificity of the local government sector requires including ethics – understood as a compatibility between chosen activities and the adopted system of values, together with the moral standards recognized in certain community.

The issue of efficiency, which provides information about the performance, organizing adequacy and wisdom in exploiting resources [6], is also a measure of the extent to which organizations achieve their goals. Hence, the mechanism of conscious implementation of social objectives is particularly essential in the public sector activity, as it demonstrates the self-regulation of the society. Simultaneously, one of the key issues in this context is taking care of the proper functioning of the entire economy which determines the possibility of achieving private and social objectives. Some researchers [7] identify this assumption as a universal economic goal of an instrumental character, achievement of which is associated with providing a special place for state policy economic purposes or individual units distinguished within the administrative division.

The analysis of the TSU activity requires the awareness that their economic goals have relatively lower importance than the socially oriented objectives. Such a dichotomy of purposes should not lead to the abandonment of the exploration, adaptation and implementation of pro-effective ways of involving public resources. For it is known that the management processes require focusing on acquiring revenue and income and placing the assets in a way that ensures the implementation of strategic and operational objectives of the unit [8].

Management quality is thus expressed by the effects of managing the available resources in certain internal and external conditions. In TSUs it

can be measured by the level fulfilling the needs of local communities. In practice, due to the public choice concept, this often causes the tendency to excessive fund spending [9], particularly in terms of weak social and political control and defective mechanisms of representative democracy conditions. It is a result of – known from management science theory – equifinality phenomenon which allows obtaining the same results under the same conditions, using various resources. Therefore, often – e.g. in accordance with the human rationality – certain effects are obtained at higher costs, but without burdening people responsible for their achievement [29]. The measureable result of the phenomenon is, in this case, lowering the effectiveness of the resources at the disposal of the TSU.

Therefore it is plausible to conclude that the regularity of the decision making process is one of the most significant conditions of improving the economic situation and the quality of the organization's functioning. Ensuring the compatibility of action and the main objective of TSU as well as the rational usage of resources are however the necessary conditions. This requires the separation of the decisions taken into two groups [10]:

1. financial decisions – involving funds collection, reflected in budget revenues,

2. investment decisions – determining ways of obtained revenues usage, which is illustrated by the structure and the direction of budget expenditures.

Therefore it is justified to engage appropriate and formalized tools [11] in the decision making process (current and developmental) supplemented with instruments, techniques, criteria and rules of control of the course of phenomena associated with the accumulation and allocation of resources at the disposal of TSU.

A vitally important issue connected with the increase of organizations efficiency in spending public funds is to counteract such negative phenomena as: decreasing quality of services, inability to fund commenced investment projects, the concentration of current expenditure on one or a few selected areas, etc.[10]. The selection and adaptation of solutions to prevent these phenomena require paying particular attention to the attempts to implement quasi-market local government management mechanisms. In this context, S. Owsiak's observation should be regarded as true [12]. The author points to the discrepancy between the application of these instruments and the hierarchical structure of administration and identifies two approaches aimed at increasing operational effectiveness:

1. focusing attention on increasing the freedom of public funds holders in the area of operating and enhancing their responsibility for

choices made – this involves the need to plan and assess its efficacy, decentralization and increased flexibility in the range of resources utilization, setting goals and measuring results, the application of benchmarking, etc.

2. taking action to move or stimulate market behavior in public entities – this requires the creation of similar operating conditions as in the private sector and an attempt to use the agency theory, assuming that the separation of operational functions and entrusting them to separate individuals, gives the possibility to determine their duties, responsibility, defining the result measures, etc.

The assessment of indicated correlations leads to the conclusion that, irrespective of the chosen approach, all decisions related to the public funds expenditure should be preceded by an analysis of current and future needs and possibilities of their financing. Therefore the major challenge in the TSU management is the selection of investment priorities and juxtaposing them with current expenditures, maintaining the indispensable and desirable level of public needs satisfaction. It is particularly important in the context of the separation between current and investment budgets, which results in chaotic and *ad hoc* changes of investment plans (even during one year) [13]. The preservation of the appropriate proportion is not possible without identifying the fundamental standards of implementing the actions.

To conclude, it is important to consider the specificity of the sector in decision making expressed, among others, by the fact that both the content of socio-economic objectives as well as the proportions between them are conditioned by the political system, in which many and varied pressure groups: [13] media, think tanks, moral authorities, social movements, opposition parties, etc. still report a variety of demands and try to influence the politics. The TSUs performance budget requires the implementation of management by objectives, which results in the need to set public services standards, which – as the measures of effects – are a substitute for the market mechanism. Based on the assumption of individual TSUs competitiveness [8], these standards should specify only the minimums guaranteed by the public finance system, leaving decisions about their extending to the communities and their authorities. Under these conditions it is possible to indicate organizations operating efficiently and those which function require the authorized bodies' intervention.

Thus the effectiveness evaluation requires both: [14] evaluation of the process effectiveness and the evaluation of the results. It is however indispensable to give priority to the process effectiveness, which mainly

concerns the provision of thrift of the necessary expenditures for its implementation and their economic use. The obtained outcomes effectiveness is complementary to the activities carried out; because it takes into account both outlays and results obtained through them. Thus, efficient public finance sector organizations are obtained as a result of such activities carried out.

3. Standardization of activities and the specificity of TSU's costs

The functioning of each organization – regardless of the sector they represent – is conditioned by the information about the amount of incurred cost, which is a fundamental economic category reflecting the organization's work quality in all sections [15]. It is impossible not to incur costs, therefore, the main problem is to ensure continuity in their reduction. In this sense, the issue of costs is a primary area of managers interest in any organization, including particularly – due to the public nature of resources – public finance sector entities.

The specificity of the local government sector means that the bases for organization's quality assessment are the features and functions of services, which meet the expectations of citizens and other stakeholders in local communities. On their basis should be identified not only the types of resources required, but also how they should be chained together to achieve the best results in organization's normal activities. Thus the result of the indicated correlations analysis is the information about the level of necessary own costs, understood as (expressed in money) the deliberate use of organization's resources and some of the expenses that are not the said consumption – insurance, taxes, fees, etc., in the case of local government also granted subsidies or other benefits financed from the budget – resulting in a useful product or service [16]. Their inherent effects are expenses that refer to any reductions in cash, which causes that not all costs correspond to organization's own costs, serving, among others, financing lost or wasted resources.

In assessing organization's own costs, it is necessary to pay attention to the costs characteristics, included in the definition given, are connected by a conjunction (Fig. 1), which means that they all must be fulfilled together. A failure to comply even one of the conditions (advisability, compliance with the normal activities, final utility, etc.) results in the appearance of losses in the organization's functioning. This phenomenon reduces the economic effectiveness level, which is the relation of obtained

results to the consumption of the production factors measured in accordance with the accepted principles (mainly on the basis of expenditures). The recognition of losses in this account – that are a result of the inexpediency of consumption, exceeding the standards or the lack of utility of services – reduces the economic effectiveness, thus becoming a cause of poor assessment of the organization.
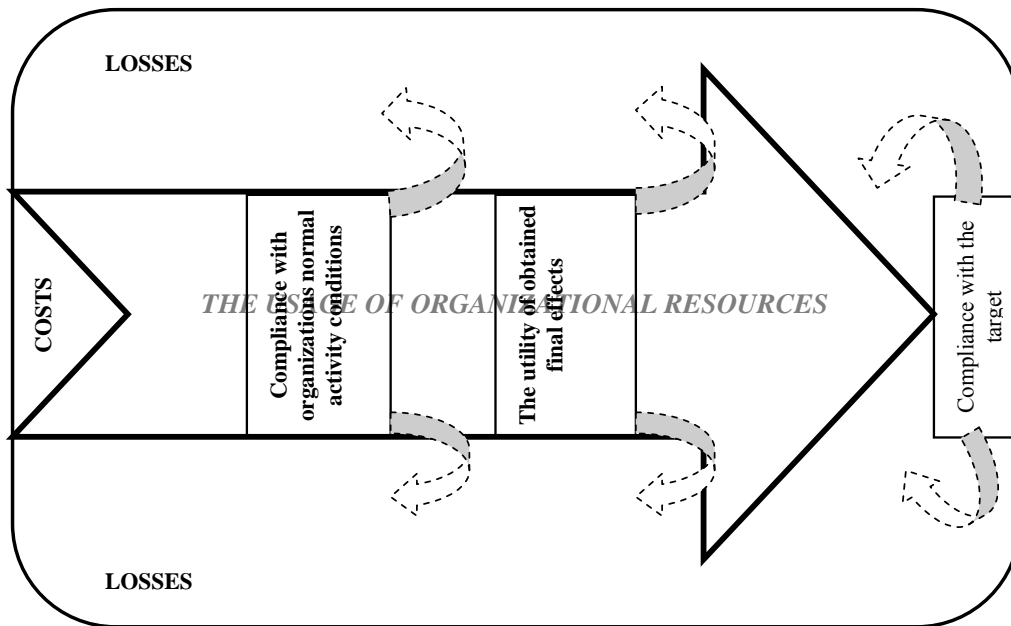

Figure 1. Costs of achieving the objectives of the organization.
The dotted line shows the consequences of non-compliance
with the organizations own costs demands.

Purposefulness – an attribute of own costs – is a phenomenon inextricably linked to an organized action and thus refers to a dynamic reality. Therefore, in the context of the limited resources consumption, it serves to justify acts, changes, actions, etc., which are the results of human activities, thus emphasizing the social nature of the organization.

The objective initiates the desire and inducts reasoning reflected in real activities. Note, however, that the goal can be seen as an indicator of aim to which the action is objectively heading toward, regardless of the intentions of actions. Hence, in praxeology [17], the concept of target is defined as a conscious or subconscious anticipation of future states of affairs, to which aim the actions taken. In this perspective, local government units own costs are rather the result of an intentional action. Yet, they can also be incurred for unintentional actions that will benefit the organization and are consistent with the nature of its operations.

The essence of organizations (including TSUs) – understood as a "focus on conscious and formulated objectives" [18] – is therefore implemented during the course of the process defined as a sequence of events of the established order, combined together logically in order to secure the achievement of the objectives set [4]. Such an understanding of targets and their significance for the organization's activities is inextricably linked to the requirement of concreteness, fulfilled through the planning process by defining objectives in the most precise and as measureable as possible way. The definability condition refers to both the action and its purpose, yet the measurability condition is placed ahead of the objective, activity outcome and incurred expenditures [19]. Thus, in order to assess the organization's effectiveness it is necessary to use both the relation between expenditures and effects, as well as the relation between: [2] the structure of objectives and achieved results, the structure of organization's effects compared to the values shared by citizens and stakeholders, the structure of action objectives and consumed expenditures and the expenditure structure and realized costs structure.

In any organization – commercial or public – a number of different objectives (strategic, tactical and operational) is carried out parallel. However, both the theory and practice show that strategic goals can be and are described generally and not very clear. This deficiency is solved through cascading [20], by which the targets and measures are transformed from the strategic to operational level [21]. The main task of this process is to increase the knowledge about the implemented strategy at all management levels. It is about ensuring the compatibility of resources consumption at the operational level with the strategic objectives.

In such complex processes the obligation of the accordance of the conducted actions with organization's normal activities cover all the phases of the economic processes [22]: from the purchase of production factors, through the production process itself (provision of services) to sales and management. In local government units it is, among others, a function of constraints and opportunities identified in the legislation in force (due to legality principle) and the ability to absorb the organizational and technical solutions improving public services provision procedures. The specificity of the TSU results from the fact that poor quality arises from poor organizational culture [23] – lack of leadership, caring, kindness, appropriate training or low knowledge of binding laws, etc. Providing high-quality activities is difficult in these organizations, due to the problems in defining the quality characteristics of their actions (services) effects.

One of the results of local government efficiency is service quality, which along with efficiency and the range of services offered, their costs and the ability to acquire the essential resources (tangible, financial, human, informational) is the result of specific – distinctive for the organization – ability to provide services. This individualized "normal activity" is thus the category shaping the effects of its own, commissioned and entrusted tasks. Therefore services quality, the relation between citizens fiscal burdens, the actions held by the local government and the range of services are diverse and delivered at different levels in various units, hence limiting righteousness (most often treated as equality or lack of it [24]) in the area of access to education, benefit from public goods, realization of fundamental civil rights, abilities, aspirations, etc.

As noted by J. Wilkin, the largest range of compatibility both within societies and among theorists refers to the need of the equal opportunities implementation [24], which indicates that maintaining the minimum standards of public services is postulated in all TSUs. Therefore, management process in these organizations (in its practical expression) is to be a conscious and deliberate people behavior striving to changes of constantly transforming reality [25]. The task of science is, on the other hand, to creatively support this practice by providing norms, models and standards that can be reference points for practice [26].

The introduction of clearly defined, explicit standards [27] (and effectiveness measures) is also postulated in the New Public Management, which assumptions are to increase clarity and rationality of the objectives It is achieved by setting specified results, which is one of the essential conditions for the proper evaluation of the local government effectiveness [28]. New Public Management aims at improving the rationality in public funds allocation and promoting public administration that is designed to achieve results, which are measureable and easy to assess.

The service standards are already being applied in some areas of TSUs activities, compromising externally defined parameters (e.g. clean water for municipal purposes, road maintenance, the scope of social assistance) or formulated by local government (if there is no external standardization in force). The specification of service standards is of great mobilizing importance, but very often causes restriction of the public services range offered by the local government. Thus, the existence of standards results frequently in an autonomy reduction. Yet, particular units still have a certain freedom to establish the size of expenditures according to its community needs assessment.

Public services standards should, on the other hand, constitute a basis for determining the amount of budgets supply in these units for ongoing commissioned and entrusted tasks. Their valuation – e.g. according to the costs accounting – is a prerequisite for establishing the required amount of expenditures, which will both ensure the adequacy of applied resources and receiving possible financial compensation [8]. In this approach, the service standards are at the same time one of the most essential factors to rationalize local government activities and a guarantee of public managers accountability. The lack of knowledge about what certain actions may bring does not allow specifying the duties and responsibilities of both local government executive bodies as well as managers at lower levels of the organizational structure.

Conclusions

The conducted research indicates that in the absence of public services standardization, the attempts to rationalize local government activities are condemned to failure. Their application is a condition *sine qua non* for the assessment of the compatibility between TSU's expenditures and their objectives, best practices of services delivery or compliance of the activities with the needs of their communities. Any discrepancy in this area should be classified as a loss in the activity and be an information about lack or low action efficiency level.

The clear description of the results of action is also a prerequisite to ensure the plans feasibility, legibility, intelligibility and accuracy of their objectives. Thus the actions identified actions in organization's plans – including TSU – are feasible in a thrift way (frugal, efficient and rational), while still allowing for the creation of good practices in the applied procedures area.

One of the key effects of the standards implementation is also the ability to assign responsibility and accountability of those responsible, including in particular government representatives, responsible for the tasks financed from the state budget. The mere fact of regulating the activities held by local government with the amount of resources granted for the execution of particular tasks does not allow settling those, who are the authors of political commitments and offers made for the purpose of election campaigns.

Services standardization should also be applied to commissioned or entrusted tasks carried out on behalf of the state administration or other local government units. Their proper presentation and quantification is the

condition for understanding the intentions, providing the benefits from transferring the process of services provision to its direct executors. The lack of such an understanding is one of the major reasons for limiting the benefits achieved and expected as a result of the decentralization of public services provision process. This applies in particular to these areas of public administration, which are not reflected in the local and regional community's needs.

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SECURITY OF COMPUTER NETWORKS IMPLEMENTED IN UNIVERSITIES AND BUSINESS ENVIRONMENT

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Abstract. This article talks about the main aspects of security in computer networks implemented in universities and business environment. To achieve integrity and protection of environmental resources for network communication, ISO (International Standards Organization) has established the security services based on a set of security mechanisms that can be implemented in all protocol OSI (Open Standard Interconnection).The computer network is a combination of hardware, software and cables (optical and classical), that together allow to several computers to communicate with each other. Computer networks are of the following types: Personal Area Network, Local Area Network, Home Area Network, Storage Area Network, Campus Area Network, Metropolitan Area Network, Wide Area Network, Enterprise Private Network, Virtual Private Network and Global Area Network. There are also computer network that does not use cables (no optical, no classical) for transmitting information between its components, infrared and radio waves, which are called wireless networks (wireless), so allowing these networks to be mobile and easy to use. In this scientific article, I made research on the network of computers from Hyperion University, where I work as assistant in computer science and I presented different methods of security of computers used in laboratories of research by students and teachers from Hyperion University.

Keywords: security, computer networks, PAN, LAN, HAN, SAN, CAN, MAN, WAN, EPN, VPN, GAN.

1. Introduction

In the past, computers were located in data centers, where users could run their programs. Today, more interconnected computers in different office, buildings or geographical areas are called computer networks. A network of computers designates a lot of interconnected computers able to

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communicate among themselves in order to exchange information or sharing more resources. The advantages of networking are: access to resources, increased reliability, saving money and environment strong communication. There are the following types of computer networks: PAN, LAN, HAN, SAN, CAN, MAN, WAN, EPN, VPN and GAN. The scientific article "Improving the security of industrial networks by means a formal verification" demonstrates that "Computer networks are exposed to serious security threats that can even have catastrophic consequences from both the points of view of economy and safety if such networks control critical infrastructures, such as for example industrial plants. Security must be considered as a fundamental issue starting from the earlier phases of the design of a system, and suitable techniques and tools should be adopted to satisfy the security –related requirements. The focus of this paper is on how formal methods can help in analyzing the standard cryptographic protocols used to implement security-critical services such as authentication and secret keys distribution in critical environments. The analysis of the 802.11 shared key authentication protocol by S3A, a fully automatic software tool that is based on a formal approach, is illustrated as a case study, which also highlights the peculiarities of analyzing protocols based on a wireless channel." [1]

2. Experimental (Theory, Modeling)

Classification of computer networks

Computer networks are divided into: LAN, MAN, WAN, PAN, GAN, SAN, EPN, VPN. Relatively small networks with more than a few hundred computers in the same building directly connected networks are called Local Area Network. A wireless LAN (based on radio) is called WLAN-Wireless LAN. Thus, the scientific article "Security Framework for Wireless Sensor Networking-Review" demonstrates that "Due to the significant advances in miniaturization, low power circuit design but reasonably efficient to carry the sensitive information through wireless communication, wireless sensor network (WSN) have attracted attention a lot in recent years. WSN's are being used in many applications like health monitoring, military purposes, and home automation. Since WSN suffer from many constraints including lower processing power, low power life, small memory and wireless communication channel, security becomes the main concern to deal with such kind of networks. Due to these well accepted limitations, WSN is not able to deal with traditional cryptographic

algorithms. This paper gives an overview of cryptographic frameworks designed so far and also a comparison of existing schemes is tabled."[2]

WAN-Wide Area Network means the geographically wide area networks, such as between two cities on a country, a continent, or even worldwide.
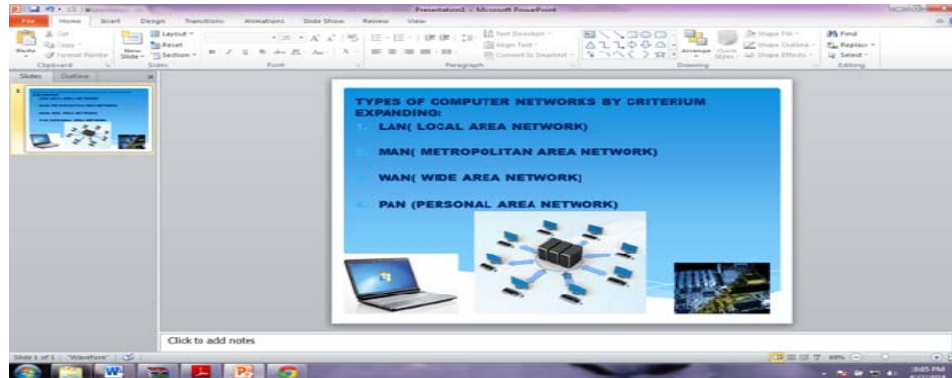

Figure 1. Types of computer networks after the criterion distance.

Definition of computer network
What is exactly a computer network?

A computer network or a data network represents a telecommunications network which allows computer to exchange data. Networked computing devices pass data each to each other along data connections in computer networks. In a computer network, the connections (network links) between nodes are established with wireless media or using cable media. Internet represents the best-known computer network. In a computer network, devices that originate, route and terminate the data are called nodes. Nodes of a computer network are: personal computers, laptops, phones, web servers and networking hardware. Two such devices are called to be networked together when one device is able to exchange information and data with each other, if they have or not a direct connection to each other. The applications supported by computer networks are: World Wide Web, printers, fax machines, shared use of application and storage server, use of e-mail and instant messaging applications.

Network topology
The physical layout of a network is less important than the topology that interconnects network nodes. The majority of diagrams that describe a

physical network are topological, not geographic. The symbol on those diagrams denotes network nodes and network links.

Network links

In a computer network, the communication media used to link devices to form a computer network are of the following type: optical fiber (fiber optic communication), electronic cable (Home PNA, power line communication and radio waves (wireless networking). In the OSI Model the communication media are defined at layer 1 and 2-the physical layer and the data link layer. IEEE 802.3 or represents a family of communication media between networked devices over Ethernet. What makes Ethernet? Ethernet exactly transmits data over fiber and copper cables. IEEE 802.11(Wireless LAN standard) uses radio waves or other use infrared signals as a transmission medium. Power lines communications uses to transmit data a building's power.

Wired technologies

The following technologies are classified from slowest to fastest transmission speed:

Twisted pair wire represents the most widely medium for all telecommunication. Twisted –pair cable consist of cooper wires which are twisted into pairs. The computer network cabling (wired Ethernet-such as IEEE 802.3) consists of 4 pairs of cooper cabling, that can be used for data transmission and voice transmission. The transmission speed varies from 2 million bits per second to 10 billion bits per second. UTP (Unshielded Twisted Pair) and Shielded Twisted Pair (STP) represent twisted pair cabling. For local area network is used coaxial cable for cable television, office buildings and other worksites. To create a high-speed local area network, ITU-T G.hn technologies uses existing home wiring such as: power lines, coaxial cable and phone lines. What is an optical fiber? An optical fiber is exactly a glass fiber, which carries pulses of light that represent data. Advantages of optical fibers over metal wires are immunity from electrical interference and very low transmission loss. What can do optical fibers? Optical fibers may simultaneously carry multiple wavelengths of light that increases the rate that data can be sent and also enable data rates of up to trillions of bits per second. The optical fibers can be used for undersea cables to interconnect continents and for long runs of cable carrying very high data rates. In a business, price represents a main factor distinguishing wired-and wireless technology.

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There are more types of Wireless technologies are of the following types: terrestrial microwave, communications satellite, radio and spread spectrum technologies.

1. The terrestrial microwave-communication uses Earth –based transmitters and receivers resembling satellite dishes. The terrestrial microwaves are in the low-gigahertz range, which limits all communications to line-of-sight. The relay stations are spaced to 48 km (30 mi) apart.

2. The communications satellites-the satellites communicate via microwave radio waves, which are not deflected by the Earth's atmosphere. Where are located the satellites? The satellites are stationed in the space, in geosynchronous orbit 35400 (22000 mi) above the equator. They are capable of receiving and relaying voice, TV signals and data. Also cellular and PCS systems are using several radio communications technologies.

3. The radio and spread spectrum technologies –wireless local area networks use a low-frequency radio technology and a high-frequency radio technology similar to digital cellular. To enable communication between multiple devices in a limited area are used wireless LANs spread spectrum technology. The IEEE 802.11 standard defines a common flavor of open standard wireless radio-wave technology known as Wi-Fi. The free-space optical communication is using a visible or invisible light for communications. The line-of-sight propagation in the most cases, is used, that limits the physical positioning of communicating devices. The scientific article "Wireless mesh network security: A traffic engineering management approach" demonstrates "The wireless mesh network (WMN) is an emerging multihop, heterogeneous, easily scalable and low cost network. The architecture of the WMN is a connectionless-oriented, mobile and dynamic traffic of routed packets. The mesh infrastructure environment easily forms multiple chains of wireless LANs (WLAN) coupled with the simultaneous multihop transmission of data packets from peripherals via mobile gateways to the wireless cloud. WMN operates as an access network to other communication technologies. This exposes the WMN to numerous security challenges not only in the mesh transmission operation security but also in the overall security but also in the overall security against foreign attacks. We surveyed and identified the security vulnerabilities in Internet Protocol (IP) broadband networks, the security challenges in the routing layer of the WNM and explored new concepts to solving security challenges in WMN using traffic engineering (TE)

security resolution mechanisms. We analyzed the advantages, comparative strengths and weakness in the use of traffic engineering based on simulation results and evaluations."[3]

The exotic technologies

In time, there have been various attempts of transporting data through exotic media:

IP over AVIAN Carriers was a humorous April fool's Request for Comments, issued as RFC 1149 was implemented in 2001 in real life. The extending of Internet to interplanetary dimensions is done via radio waves.

Network nodes

Starting from the physical communications media described here, the network compromise additional basic system building blocks, such as: hubs, repeaters, routers, bridges, modems, switches, network interface controller (NICs) and firewalls.

The network interfaces

A network interface controller (NIC) represents a computer hardware that provides a computer with the ability to access the media transmission and it has the ability to process low-level network information. For example I give in this context the NIC that may have a connector for accepting a cable, or an aerial for wireless transmission and reception with the associated circuit. In Ethernet computer networks, each computer network has a unique MEDIA ACCESS CONTROL (MAC) address-usually stored in the controller's permanent memory. The Institute of Electrical and Electronic Engineers (IEEE) to avoid address conflicts between networks devices; it maintains and administers MAC address uniqueness. An Ethernet MAC address has the size of six octets, so that the three most significant octets are reserved to identify NIC manufacturers and these manufacturers, using only their assigned prefixed, uniquely assign the three least-significant octets of every Ethernet interface they produce.

The repeaters and hubs

What is a repeater? A repeater represents an electronic device that receives a network signal, cleans it of unnecessary noise and regenerates it. The signal is retransmitted at a higher power level, or to the other side of an obstruction and the signal can cover longer distances without degradation. In twisted pair, Ethernet configurations repeaters are required

for cable that runs longer 100 meters. Repeaters can be tens or even hundreds of kilometers apart with fiber optics. What is a hub? The hub represents a repeater with multiple ports. The repeaters work on the physical layer of the OSI model. The repeaters require a small amount of time to regenerate the signal and this can cause a propagation delay, which affects network performance. Many network architectures limit the number of repeaters that can be used in a row, such as the Ethernet 5-4-3 repeaters. The repeaters are used for long distance links such as undersea cabling.

The bridges

What are bridges? A network bridge connects and filters traffic between two network segments at data link layer (layer 2) of the OSI model to form a single network, so it breaks the network's collision domain and maintains a unified broadcast domain. The network segmentation breaks down a large, congested network into an aggregation of smaller, more efficient computer networks. Bridges are of the following types:

1. The Local Bridges connect directly LANs.

2. The Remote Bridges are used to connect a WAN (Wide Area Network) links between LANs. The remote bridges, where the connecting link is slower than the end networks, largely have been replaced with routers.

3. The wireless bridges can be used to join LANs or to connect remote devices to LANs.

The Switches

A network switch represents a device that forwards and filters OSI layer 2 between ports based on the MAC addresses in the packets. A switch is different from a hub because it only forwards the frames to the physical ports involved in the communication rather than all ports connected. The switch it can be thought of as a multi-port bridge. It learns to associate physical ports to MAC addresses by exam the addresses source of received frames. In the case of an unknown destination is targeted, the switch broadcasts to all ports but the source. In normal mode the switches have numerous ports, facilitating a star topology for devices and cascading additional switches. The multi-layer switches are capable of routing based on layer 3 addressing or additional logical levels. The switch is often used loosely to include devices such as bridges and routers, as well as devices that may distribute traffic based on load or based on application content, I give in this context for example a Web URL identifier.

The Routers

What is a router? A router represents an internetworking device that forwards packets between networks by processing the routing information included in the packet of datagram-an example is the Internet protocol information from layer 3. The routing information is processed in conjunction with the routing table. To determine where to forward packets a router uses its routing table(a destination in a routing table includes a "null", also known as the "black hole" interface so it can go into it, however, no processing is done for said data.

The Modems

What are modems? Modems are used to connect network nodes via wire not originally, designed for digital network computer traffic, or for wireless. For doing this, one or more frequencies are modulated by the digital signal to produce an analog signal that can be tailored to give to required properties for transmission. The modems are used for telephone lines, using a Digital Subscriber Live technology.

Firewalls

What are firewalls? A firewall represents a network device for controlling network security and access rules. Typically firewalls are configured to reject access requests from unrecognized sources while allowing actions from recognized one. The firewalls play in a network computer the vital role of growing security in parallel with the constant increase in cybernetic attacks. The scientific article "Improving cloud network security using the True-Rule Firewall" tells "In this study, we aim to identify the limitations of the currently used firewalls(Listed-Rule firewalls) and have found disadvantages including: (1) possibility of shadowed rule that causes the problematic network security and functional speed;(2) rule switching that changes the meaning of the rules entailing the problematic network security;(3) possibility of redundant rules that entails the problematic speed; (4) designing that the needs to place the bigger rule after smaller rules, which cause the designing difficulty; and (5) sequential rule processing that causes the problematic speed.

Furthermore, we have proposed the Tree-Rule firewall that demonstrates none of the above-mentioned limitations. The Tree-Rule firewall utilizes rules in a tree data structure, and forwarding decision of an input packet based on the rules with follow the tree structure so that the

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decision on the packet becomes faster. The Tree-Rule firewall has been tested and compared with IPTABLES on LAN and we found that the Tree-Rule gives better performance."[4]

Network structure

The network topology represents the layout or organizational hierarchical of interconnected nodes of a computer network. Different network topologies can affect throughput and reliability is more critical often. Having many technologies, such as bus networks, a single failure can cause to fail entirely. The robustness of a computer network is given by the big number of interconnections, but the more expensive is it to install.

Common layouts

The common layouts are: a bus network, a star network, a mesh network and a tree network.

The bus network means that all nodes are connected to a common medium along this medium. This was the layout used in the original Ethernet, called 10BASE5 and 10BASE2.

The star network means all nodes that are connected to a special central node. This is the typical layout found in a Wireless LAN, where each wireless client connects to the central Wireless access point.

The ring network means that each nod is connected to its left and right neighbor node, so that all nodes are connected and that each node can reach each other node by traversing nodes left-or right. FDDI (Fiber Distributed Data Interface) made use of such topology.

The mesh network means that each node is connected to an arbitrary number of neighbors in such a way that there is at least one traversal from any node to other. In a tree network all nodes are arranged hierarchically. Important here is the fact that the physical layout of the nodes in a network reflect the network topology. A good example is that of FDDI (Fiber Distributed Data Network), where the network topology is a ring (actually the counter-rating rings), but the physical topology is often a star, because all neighboring can be routed via central physical location.

Overlay network

An overlay network represents a virtual computer network that is built on top of another network. In the overlay network, nodes are

connected by virtual or logical links. In an overlay network, each link corresponds to a path, perhaps through many physical links, in the underlying network. Topology of the overlay network may (and often does) differs from that of the underlying one. We present an important example – many peer-to-peer networks are overlay networks. They are organized as nodes of a virtual system of links that run on top of the Internet. The overlay networks have been around since the invention of networking when the computer systems were connected over telephone lines using modems, before any data network existed. The Internet itself is a striking example of an overlay network.

At first, the Internet was built as an overlay on the telephone network. Today, at the network layer, each node can reach any other by a direct connection to the desired IP address, thereby creating a fully connected network. However, the overlaying network, is composed of a mesh-like interconnect of sub-networks interdicts a table (actually a map) indexed by keys. The overlay networks also have been proposed as a way to improve Internet routing, such as, the example is through quality of service guarantees to achieve higher-quality streaming media. Previous proposals as the following examples IP Multicast, DiffServ and IntServ have not seen wide acceptance largely because they require modification of all routers in the network. An overlay network can be incrementally deployed on end-hosts running the overlay protocol software, without cooperation from Internet service providers. I can say that the overlay network has no control over how packets are routed in the underlying network between two overlay nodes, but it can control, for example, the sequence of overlay nodes that a message traverses before it reaches its destination. Akami Technologies manages an overlay network that an overlay network that provides reliable, efficient content delivery (a kind of multicast). The Academic research includes end system multicast resilient routing and quality of service studies, among others.

COMMUNICATIONS PROTOCOLS

The communications protocols are: HTTP, TCP, IP, POP3, UDP and IP.

The scientific article "Presentation of various types of electronic business available on the Internet, Advantages, Disadvantages, Key Requirements and Security Implementation Model of an Electronic

Business" demonstrates "The development of the electronic business that is found on the Internet supposes the usage of the standards like:

- TCP/IP (Transmission Control Protocol/Internet Protocol) is represented by the communication between TCP and IP. These were the first networking protocols defined in these standards;
- On the Internet TCP/IP is the communication protocol and it is used for communication between computers; also we can say that:
- TCP/IP defines the way in how electronic devices are connected on the Internet and how data should be transmitted between them;
- The protocols that are found inside TCP/IP standard are:
- TCP (Transmission Control Protocol) it is used for the communication between applications;
- UDP (User Datagram Protocol) it is used for simple communication between applications; it is included in the Internet Protocol Suite, the principal set of network protocols used on the Internet;
- IP (Internet Protocol) this is used for communications between computers; now we have IPV4 (Internet Protocol Version 4) and his successor IPV6;
- ICMP (Internet Message Protocol) this is a used for errors and statistics and also for supervising and diagnosis the problems from the network;
- DHCP (Dynamic Configuration Protocol) represents a network protocol of computers used by hosts (DHCP clients) that assign IP addresses and other information of configuration the network in a dynamic way;
- HTML (Hypertext Markup Language) represents a form of markup oriented presentation of text documents on one page, using the specialized software called HTML user agent.
- HTTP IETF (Internet Engineering Task Force) has coordinated the development of the HTTP which represents an application protocol for distributed, collaborative and hypermedia information systems. HTTP is the most commonly used methods for accessing information on the Internet that are stored on the World Wide Web. The HTTP protocol is the default text protocol for WWW. If a URL does not contain the part of the protocol, it is considered as HTTP. HTTP requires that the destination computer runs a program that understands the protocol and sent to the destination file can be an HTML (Hypertext Markup Language), a graphics file, sound, animation or video, an executable program on that

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server and a publisher the text. According to OSI classification HTTP protocol for application level and the implementation and its evolution is coordinated by the W3C (World Wide Web Consortium)."[5]

The Internet layering system or TCP/IP model and its relation to common protocols often layered on top of it. The communication protocol represents a set of rules for exchanging information over network links. In a protocol stack, each protocol leverages the services of the protocol below it. HTTP running over TCP over IP over IEEE 802.11/TCP is an important example of a protocol stack. Ethernet represents a family of protocols used in LANs, described by a set of standards together called IEEE 802 published by the Institute of Electrical and Electronic Engineers. Ethernet has a flat addressing scheme and it operates mostly at levels 1 and 2 of the OSI model. Today, for home users, the most well know member of the protocol family is IEEE 802.11, otherwise a Wireless LAN (WLAN).The complete protocol IEEE 802 suite provides a diverse set of networking capabilities. MAC bridging (IEEE 802.1D) deals with the routing of Ethernet packets using a Spanning Tree Protocol, IEEE 802.11Q describes VLAN's and IEEE 802.1X it defines a port-based Network Access Control protocol, which forms the basis for the authentication mechanisms used in VLANs and it is also found in WLANs-it is what the home user sees when the user has to enter a wireless access key.

INTERNET PROTOCOL SUITE

TCP/IP or the Internet Protocol Suite is the foundation of all modern networking. The Internet Protocol Suite offers connection-less as well as connection-oriented services over an inherently unreliable network crossed by data-gram transmission at the Internet Protocol (IP) level. The protocol suites at this core defines the addressing, identification, and routing specifications for Internet Protocol Version 4 (IPv4) and for IPv6, the next generation of the protocol that has a much enlarged addressing capability.

SONET/SDH

SONET (Synchronous Optical Networking) and SDH (Synchronous Digital Hierarchy) represent standardized multiplexing protocols that transfer multiple digital bit streams over optical fiber using lasers. These protocols were originally designed to transport circuit mode

communications from a variety of different sources primarily to support real-time, uncompressed circuit switched voice encoded in PCM (Pulse Cod Modulation) format. SONET/SDH was the obvious choice for transporting ATM (Asynchronous Transfer Mode) frames. Asynchronous Transfer Mode represents a switching technique for telecommunications computer networks, which uses asynchronous time-division multiplexing and encodes data into small, fixed-cells. ATM is different from other protocols such as Internet Suite Ethernet that uses variable sized packets or frames and has similarity with both circuit and packet switched networking. Asynchronous Transfer Mode is similar to with both circuit and packet switched networking. This thing is a good choice for a network that must handle both traditional high-throughput data traffic, and real-time, low-latency content such as video and voice. ATM use a connection oriented model in which a virtual circuit must be established between two endpoints before the actual data exchange begins.

GEOGRAPHIC SCALE

By the characterization centralized by its physical capacity or its organizational purpose a network can be classified. Using the network, including user authorization and access rights, differ accordingly.

PERSONAL AREA NETWORK

A personal area network (PAN) represents a computer network used for communication among computer and different information techno-logical devices close to one person. Devices that are used in personal area network are: fax machines, printers, personal computers, telephones, video game consoles, PDA's and scanners. Personal Area Network includes wireless and wired devices. A wired PAN is constructed with USB and Firewire connection and a Wireless PAN is formed from technologies like Bluetooth and infrared communication.

LOCAL AREA NETWORK

What is a Local Area Network? A Local Area Network represents a computer network that connects computers and devices in a limited geographical area such as: school, home, office building and closely positioned group of buildings. Wired LAN's are based on Ethernet technology, but newer standards such ITU-G provides a way to create a wired LAN existing wiring, such as power lines, telephone lines and

coaxial cables. The main characteristics of a Local Area Network are: higher data transfer rates, limited geographic range and lack of reliance on leased lines to provide connectivity. The IEEE 802.3 Local Area Network technologies operate at data transfer rates up to 100Gbit/s. A Local Area Network is connected to a Wide Area Network using a router. The scientific article "Research of Network Security Assessment Quantization Based on Mobile Agent" shows to readers that "As the security situational assessment widely applying to the computer network field, scholars have designed and implemented a large number of network security situational assessment methods. However, most works are based on local area network and single host, which is hardly to meet the demand of large-scale network security assessment. In this paper, we based on quantitative hierarchical network security situational assessment model, introduced the mobile agent technology, designed the distributed computing for large-scale network and evaluated the whole network security situation for future prediction."[6]

HOME AREA NETWORK

What is a home area network? The home area network represents a residential LAN used for communication between digital devices typically deployed in the home, usually a small number of personal computers, laptops and accessories, such as printers and mobile computing devices. The most important function is sharing of Internet access, often a broadband service a cable TV or digital subscriber.

STORAGE AREA NETWORK

What is a storage area network? A storage area network represents a dedicated network that provides access to consolidated, block level data storage. Storages Area Network are primarily used to make storage devices, such as tape libraries, disk arrays and optical jukeboxes accessible to servers so that the devices appear like locally attached devices to the operating system. A storage area network typically has its own network of storage devices that are generally not accessible through the local area network by other devices. The complexity and cost of Storage Area Networks dropped in the early 2000s to levels allowing wider adoption across both enterprise and small to medium sized business environments.

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CAMPUS AREA NETWORK

What is a campus area network? The campus area network (CAN) is made up of interconnection of local area networks within a limited geographical area. The switches and the routers (networking equipment) and optical fiber, cooper plant, Cat 5 cable (transmission data) are owned by the campus owner (a university, enterprise and government). A university campus network is likely to link a variety of campus buildings to connect academic colleges or departments, the library, and student residence halls. The backbone network represents a part of a computer network infrastructure that provides a path of exchange of information between different sub-networks and Local Area Networks. The backbone network can tie together sub-networks, diverse networks within the same building, across different buildings or over a wide area network. The most excellent example is a large company that might implement a backbone network to connect departments that are located around the world. The network backbone is formed from the equipment that ties together the departmental networks. The critical factors that must take into account when designing a network backbone are: network performance and network congestion. In normal way, the backbone network's capacity is greater than that of the individual networks connected to it. The most significantly example of a backbone network is the Internet backbone, which represents a set of wide area networks (Wide Area Networks) and core routers that ties together all computer networks interconnected to the Internet.

METROPOLITAN AREA NETWORKS

What is a metropolitan area network? The metropolitan area network represents a large computer networks that usually spans a city or a large campus.

WIDE AREA NETWORK

What is a wide area network? The wide area network (WANs) represents a computer network which covers a large geographic area such as: a city, a country and spans different distances. A Wide Area Network uses a communications channel that combines many media such as: cables, telephone lines and air waves. The Wide Area Network often makes the usage of transmission, which facilitates by common carriers, such as

telephones companies. The Wide Area Network technologies in generally way that function at the lower three layers of the OSI reference model: the physical layer, the data link layer and the network layer.

ENTERPRISE PRIVATE NETWORK

An enterprise private network represents a computer network that a single organization builds to interconnect its offices locations (examples: shops, production sites, head offices and remote offices), so they can share computer resources.

VIRTUAL PRIVATE NETWORK

A virtual private network (VPN) represents an overlay computer network in which some of the links between nodes are carried by open connections or virtual circuits in some larger networks(for example, the Internet) instead of by physical wires. Where appropriate, the data link layer protocols of the virtual network are said to be tunneled through the larger computer networks. One common application is secure communication through the public Internet but a VPN need not have explicit security features, such as content encryption or authentication. Virtual Private Networks (VPNs) can be used to separate the traffic of different user communities over an underling network with strong security features. The virtual private network may have best-effort performance, or may have a defined service level agreement (SLA) between the Virtual Private Network customer and the Virtual Private Network service provider. A VPN has a topology more complex than point-to-point.

GLOBAL AREA NETWORK

What is a global area network? The Global Area Network represents a computer network used for supporting mobile across an arbitrary number of Wireless Local Area Networks, satellite coverage the areas and so on. In the mobile communications the key challenge is handling off user communications from one local coverage area to the next. The IEEE Project 802 involves a succession of terrestrial wireless Local Area Networks.

ORGANIZATIONAL SCOPE

The computer networks are typically managed by the organizations that own them. The private enterprise network may use a combination of

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extranets and intranets. They provide the network access to the Internet, which has no only a single owner and permits virtually unlimited global virtually unlimited connectivity.

INTRANETS

What represents an intranet? An intranet represents a set of computer networks that are under the control of a single administration entity. An intranet uses the IP protocol and IP-based tools like web browsers and file through the intermediate of applications. The administrative entity limits the usage of the intranet to its authorized users. An intranet represents the internal Local Area Network of an organization. An intranet typically has at least one web server to provide users with organizational information. On a local area network, an intranet represents an intranet, which is also anything behind the router.

EXTRANET

What is an extranet? An extranet represents a computer network that is also under the administrative control of a single organization and supports a limited connection to a specific external network. The best example is that of an organization, which may provide access to some aspects of its intranet to share data with its customers and business partners. The others entities aren't necessarily trusted from a security standpoint. The network connection to an extranet is often implemented via Wide Area Network technology. The internetwork represents the connection of multiple computer networks via a common routing techno-logy using the routers.

INTERNET

The largest example of internetworking is the Internet. It represents a global system of interconnected, academic corporate, governmental, public and private computer network. The Internet is based on the networking technologies of the Internet Protocol Suite. Also the Internet represents the successor of the Advanced Research Projects Agency Network (ARPANET), which was developed by DARPA of the United States Department of Defense. The Internet represents the communications backbone underlying the World Wide Web (WWW). The participants in the Internet, use a diverse array of methods of several hundred document

and opened standardized protocols that are compatible with the Internet Protocol Suite and a addressing system(IP addresses), administered by the Internet Assigned Number Authority and address registries. Large enterprises and service providers exchange information about the reach of their address spaces through the Border Gateway Protocol (BGP), forming a redundant worldwide mesh of transmission paths.

The scientific article "Presentation of various types of electronic business available on the Internet, Advantages, Disadvantages, Key Requirements and Security Implementation Model of an Electronic Business" demonstrates that "The Internet represents a whole infrastructure, services, users and resources. It also refers to:

- Backbones->high-speed networks that have been made to interconnect other networks in: North America, Europe, South America, Asia;
- Regional networks that connect universities and colleges;
- Commercial networks providing access to main communication network subscribers and their networks of commercial organizations for internal use but are connected to the Internet;
- Local Networks refers to a campus network;

Networks available on the Internet are:
- the Intranet represents a communication system performance of an organization;
- VAN (Value Added Network) private networks for the exchange EDI (Electronic Data Interchange) between business partners(e.g. National Bank of Romania has its own communication network RCD);
- VPN (Virtual Private Network) is a logic network which combines several technologies of the private networks and for establishing connections and networks to ensure security in transit unsafe;
- grid computing used for connecting computer networks around the world, to create and use a global computing environment;
- grid network technology offers the opportunity to meet a wide variety of resources including supercomputers, storage systems, data sources and special classes of devices distributed geographically, to be used as a single computing resources;
- grid computing is another step in process of virtualization started by: the process of partitioning a single system virtual machine;

- virtualization homogenous resource virtualization applied to both servers and the central processing and storage resources, networks and application sometimes;
- virtualization enterprises especially for distributed organizations;
- virtualization outside the organization Internet communication information, integrating information through collaborative networks;
- grid computing is a mean of integrating various technologies and solutions to fulfilling a goal". [5]

DARKNET

DARKNET represents an overlay network, typically running on the Internet, which is only accessible through specialized software. A DARKNET represents anonymous network where connections are made only between trusted peers to sometimes called "friends", using ports and non-standards protocols. DARKNET are different from the distributed peer-to-peer networks like sharing is anonymous (that means, IP addresses aren't shared publicly) and that's way the users can communicate with little fear of governmental on corporate interference. The Internet represents a global system of interconnected governmental, corporate, academic, public and private computer networks and it is based on the networking technologies of the Internet Protocol Suite. It represents the successor of the Advanced Research Project Agency Network (ARPANET).

3. Results

For example in the Hyperion University from Bucharest exist laboratories of computer science, physics, and others, where students from different faculties study and make their hours at different disciplines and use the computers that are on different laboratories to make their researches. Laboratories of research from the Hyperion University from Bucharest are:

1. In A Building there are:
    a. At the second floor exists the Laboratory of Numerical Methods, Microcontroller, Microprocessor Systems and Signal Processing;
    b. At the third floor there is ->CAD/CAM Systems, ASDN and Programming and Automatic.

c. At the fourth floor there is: 4.5 The laboratory of Applied Informatics, Databases, Engineering Programming and Algorithm Design.

d. At the sixth floor there is 6.8 Meeting Automatic Sampling systems, Measurements and Traducers and Automatic System Engineering;

e. At the seventh floor exist: 7.2 The Physics I-The Laboratory of Physics and Thermal Phenomena-Physics I (Mechanics Physics), 7.3 Mechanics Physics and Physics I and 7.4 Theoretical and Mathematics Physics.

2. In B building there are also the following laboratories of research:

a. The Laboratory for Innovative Technology for the Faculty of Exact Sciences;

b. The Laboratory of Automatic Control and Applied Information;

c. The Laboratory for Control Systems or IRA (Automatic Control Engineering).

To protect information, data on the computers we have like measurements of security the following implemented methods:

1. On different computer from the laboratories of research there is an antivirus program and a firewall that protects data and information stored on the computers.

2. At the level of router there is a firewall, which implements its functions: limits the traffic of the public services of the organizations (taking into account IP address and ports), blocks the access of particular websites in the Internet, monitors communication between the internal network and external network, encrypts the transmitted packets through VPN networks, it interdict to some users to access of some servers and external networks;

3. In laboratories of research exists Deep Freeze, which represents a method of freezing partition C. All data from computers are storage on D partition.

4. Another form of protection is ESET Live Scan, which represents a method of virus scanning.

5. If the student follows the path-> My Computer->System and Security->System->System Protection ->System Restore, he will discover that the System Restore is active and represents a restore point created, which represents another form of protection. On the partition D exist hidden files.

4. Discussion

As the reader studies this article he discovers all concepts of security networks implemented in universities and business environment. What business environment means? It refers to online websites of B2C (Business to Consumer) like: http://www.amazon.com, http://ebay.com, http://emag.ro where the reader can access the products online and buy what he likes. Here are many forms of security of the networks via the Internet. The scientific article "Security in computer networks" demonstrates "In conclusion, we have spoken in this article about the electronic security of the computer networks, that refers to the totality of the policy recommendations and actions required to minimize the risk associated to perform electronic transactions, the risk refers to the branches in the system, intrusion or theft of any means, technique or process used to protect the information system. The confidentiality, integrity, availability, compliance with laws, regulations and standards, which are fundamental security objectives, are among the requirements of a business environment. The security requirements that must be fulfilled for e-business environment are: identification, authentication, accountability and audit. Security audit records dealing with the analysis of the activities performed if the protection system is in accordance with established security policy and procedures."[7]

5. Conclusions

In conclusion, in this scientific paper I presented: types of network computers from literature in computer science and different methods of security and protection of computers from the laboratories of research from Hyperion University.

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[11] http://www.nastasef.ase.ro/fisiere/IEafaceri_electronice/cap7_AE_Securitatea.pdf

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MANAGEMENT OF ENTERPRISE FINANCES IN THE FACE OF PAYMENT BACKLOGS

Magdalena GRABOWSKA[*]

Abstract. *One of fundamental causes behind dwindling sales is the collapse of the market of financing sources for business activities. These companies which are capable of offering their clients a trade credit or help to finance the purchase of products manufactures or services rendered in other manners win a competitive advantage[1]. Although having an awareness of the risk inherent in deferred payment terms, companies increasingly opt for running that risk.*

All in all, trade credit is relatively easily accessible and the procedures for its granting are swifter than in the case of a bank loan. Nonetheless, it a particularly expensive credit, even though the costs are often obscure because they are included in the selling price[2], which is why many entrepreneurs treat it as a gratuitous loan seeing its superiority over a bank loan; this however is misleading. Before a recipient makes a decision to incur a loan offered he needs to thoroughly explore its terms and conditions and calculate the related cost.

Keywords: *Payment backlogs, enterprise finances, barriers to expansion, trade credit.*

1. Introduction

A contemporary enterprise operating in a turbulent economic environment of heightened risk and uncertainty continually faces the urgency of tackling new decision problems. Essentially, they refer not only to the issues of selecting varied sources and forms for funding the ongoing operations as well as investment activities, but they also concern the concept of selecting the financial strategy which will provide the optimal trade-off between security of transactions performed and their profitability.

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[2] W. Bień, *Problems of effective sales of credit,* [in:] *Management of working capital in the enterprises,* ed. J. Grzywacz, SGH, Warsaw 2006, p. 79.

Business entities are compelled to continuously take account of current changes effected in the process of financial management.

Bearing in mind dismal statistics with respect to the growing number of bankruptcies and the fact that payment backlogs are largely to blame for this situation, it would be foolish to leave such a critical financial issue unaddressed.

It is vital to stress the need of effectively tapping into various tools, techniques, criteria and rules for guiding the processes and phenomena related to collecting and spending monetary resources of the enterprise in a manner that facilitates their most effective administration while simultaneously enhancing long term financial security.

2. Payment backlogs as a barrier to enterprise expansion

Payment backlogs present a serious and unresolved problem for an economy, such as that which emerged on a fully-fledged scale in Poland in 1987 and within the transformation period it gathered in momentum[3]. Numerous companies opted for an expansive development strategy that entailed extending payment time-limits in an attempt to win customers and boost sales. Entrepreneurs appeared to ignore the threat to financial liquidity engendered by providing such loan financing.

According to the definition found in Polish Language Dictionaries, backlog means amassing something at a single place which hinders the movement or flow. By transplanting this into the field of business trading, we deal with a payment backlog when, as a result of accruing debt to the level preventing ordinary functioning of the entity, the adverse effects of the current situation are transmitted onto subsequent links in the supply chain.

When deliberating over the problem of cumulatively accruing overdue receivables and financial liabilities within the B2B sphere it is hard not to delve into their primary causes. A pivotal criterion for classifying the reasons behind delayed payments may include a suitable scope of investigation enabling the identification of macroeconomic, sector and microeconomic causes for payment backlogs.

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To date, reasons for delayed payments have largely reflected the economic shape of the specific country. However, in this age of increasing globalization, the economic situation throughout Europe is also meaningful as well as worldwide fluctuations. A central prerequisite for countering the increasing scale of the phenomenon is the implementation of efficient legal regulations, which unfortunately represents a shortcoming within a wide range of states, not only Poland.

Sector causes for payment backlogs are ascribed to the financial standing of the business partners, which is typically correlated to the situation across the whole industry. From the viewpoint of the macroeconomic range the blame is usually put down to management errors. Against the backdrop of limited access to sources of finance, many enterprises pursued a far too liberal policy of providing loans for their trading partners, opening up possibilities of granting trade credits without any prior analysis or creditworthiness check of the partner, and thus without due security against late payment risk. It was a rare practice, in particular across the sector of small and medium-sized enterprises, to consult debt collection service providers whose experience and knowledge as well as practical expertise are costly, but would on occasion avert the risk of concluding an agreement encumbered with the risk of default by the debtor. Nonetheless, causes behind delayed payments should not always be attributed to the debtor, they may result from simple oversight or mistakes, but at times they are intentional actions, not corresponding to the actual dire financial standing of the debtor.

The scale of the phenomenon outlined is illustrated in the findings of the survey carried out cyclically by the National Bank of Poland across a group of Polish entrepreneurs, which in one of its sections refers to the perception of payment backlogs as a barrier to expansion of business activities[4] as detailed in Figure 1.

By analyzing shifts in perceiving barriers to expansion by Polish enterprises over the few recent quarters, only payment backlogs and problems with obtaining loans continued in an upward trend. It is also worth highlighting that assessment of the dire financial situation of recipients as a barrier to the expansion, both in terms of values as to

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[4] Compare findings of the surveys conducted on a cyclic base, contained in: *Information on the shape of the enterprise sector with a particular emphasis on the business cycle,* NBP

indications as well as shift tendencies, conducted up till 2004, tended to be convergent with values recorded for payment backlogs[5]. Up till 2005 the study probing the barriers indicated that the issues of payment backlogs and receivables recovery were distinguished from the problems of maintaining financial liquidity. However, from the 1st quarter of 2006 they were combined, becoming subject to a common grading. Additionally, a certain recurrent cycle in experiencing the problems of payment backlogs appeared as a distinctive characteristic.
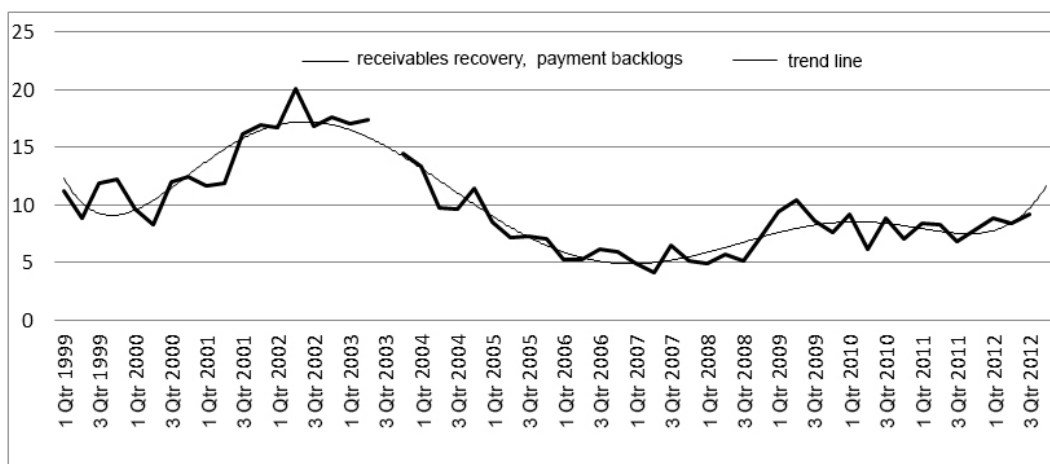
Figure 1. *Payment backlogs as a barrier to expansion in the view of Polish enterprises.*

Source: author's study based on data provided by the National Bank of Poland.

At present their increasing significance is apparent. The problem of delayed payments and their repercussions in the enterprises' operations culminated in the 2nd quarter 2002 when the index hit a peak of 20.1% of indications. From the start of the consecutive quarter and over the whole successive year, the problems with receivables recovery and related payment backlogs ranked second among the barriers to growth of business activities in the view of the entrepreneurs. In subsequent periods they only dropped to slightly lower positions. Currently they fluctuate between the 2nd and 4th rank.

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[5] *Initial information on the shape of the enterprise sector, with particular emphasis on the business cycle in 3Qtr 2003, 3Qtr 2004, 1Qtr 2006, 3Qtr 2009,* NBP.

The conclusions made are supported by the results of surveys conducted by the Polish Confederation of Private Employers Lewiatan (Polish: PKPP Lewiatan) and the consultancy company Deloitte which emphasizes a strong impact on the risk of eroding domestic demand, risk of currency translation disparity and the risk of payment backlogs. Under normal circumstances the percentage of companies not experiencing altogether or experiencing, to a marginal extent, the risk of payment backlogs amounted to almost 38%, whereas in the crisis period it plummeted by over 17%. The same increase also applied to the proportion of those surveyed that were most affected by the risk of payment backlogs whose index under normal circumstances did not exceed 19%[6].
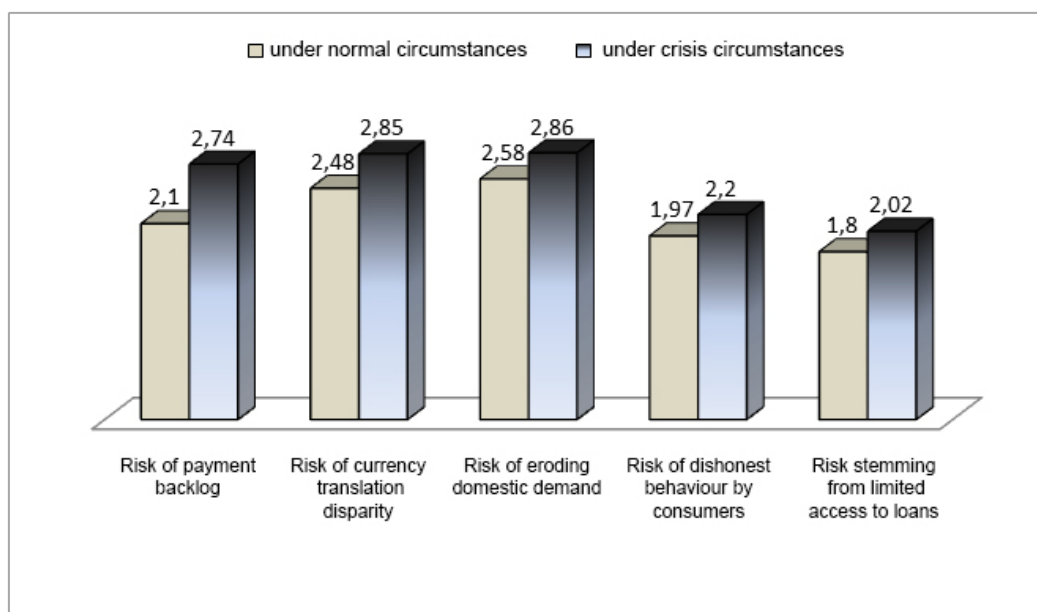
Figure 2. *Impact of the crisis on the major types of risk in enterprise operations.*

Source: R. Antczak, M. Starczewska-Krzysztoszek, *Do large enterprises are scared of the crisis,* PKPP Lewiatan, Deloitte, Warsaw 2.04.2009, Internet resources as of 1.08.2009, www.pkpplewiatan.pl.

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Though the fact that delayed payments occur does not necessarily imply that there is a problem of payment backlogs, but simply that there is an occurrence of payment risk. When a one-off delay or default on payments affects a supplier with a good financial standing and secured stable inflow of funds for the ongoing operations, the difficulties arising from the partner's unreliability should not threaten viability of the company. Only when the expanding scale of the phenomenon of delayed payments begins to jeopardize the timely discharge of liabilities incurred can we begin to talk about the problem of payment backlogs.

Delays in making payments by key business partners who frequently appear to be also the largest debtors further aggravate the difficulties of retaining financial liquidity of the supplier, and thereby affecting the financial situation of the firms partnering it, triggering a kind of domino effect[7]. More than half of Polish entrepreneurs surveyed at the onset of 2009 reported a heightened payment risk, whereas at the analogous period of the preceding year the problem of accruing indebtedness was only discerned by a mere 21% of respondents[8]. Furthermore, as many as 97% of companies pinpointed the financial predicament of a debtor as the principal reason for delays, which in 52% of cases resulted in dwindling revenues, and in 42% of cases brought about a curb in liquidity. Whereas as the main blame for falling sales, rising payment arrearages and debilitated liquidity, and thereby weakened security for business trading was attributed to the financial downturn[9].

It should be underlined that the problem of payment backlogs is not spillover of the economic slump, but it has long established its presence in the Polish economy. In 2001 Arkadiusz Protas, a member of the mana-gement of the Business Center Club argued that: *"payment backlogs contribute to the collapse of about 200,000 companies annually"*[10]. At that time it was estimated that 30%-50% of producers awaited payment from three to six months, and there were cases where large entities made payments to smaller ones after the lapse of that time limit[11]. It resulted in

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[7] M. Tokarski, *Factoring in small and medium enterprises*, Outbuilding economic, Kraków 2005, p. 106.

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[9] *Ibidem.*

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[11] *Ibidem*

the adopting in 2001 of the act on payment terms in business trade[12], which was then replaced by the act on payment terms in commercial transactions[13].

The correlation between the phenomenon of payment backlogs and the scale of bankruptcies of enterprises in Poland is illustrated in Figure 3.
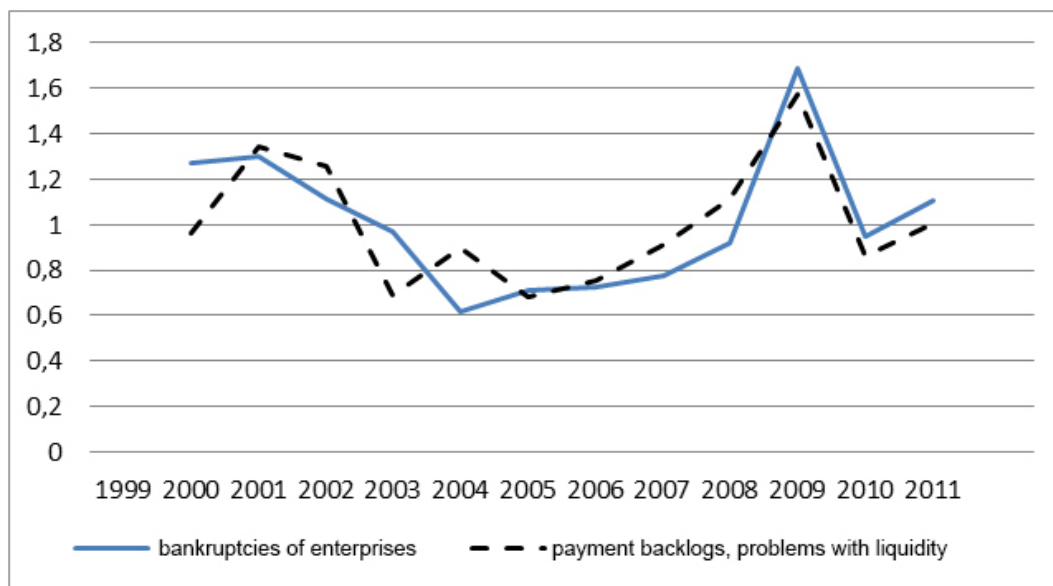

Figure 3. *Dynamics behind the phenomenon of payment backlogs and the number of bankruptcies among enterprises in Poland.*

Source: Author's study on the basis of data provided by the National Bank of Poland with regard to the scale of the phenomenon of payment backlogs, as well as Coface reports related to a number of bankruptcy among companies in Poland.

The reports Coface Polska found that over the first three quarters in 2012 courts issued a bankruptcy declaration on 614 enterprises, which suggests an increase of almost 20% as compared with the analogous period of the preceding year, but it represents scarcely 37% of the number of bankruptcy proceedings from 2003 when the number of bankruptcies attained a peak and equaled 1634 bankruptcy proceedings[14]. The number

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[12] Act of 5 September 2001 on payment terms in business trade, Dziennik Ustaw [Journal of Laws] 2001 No. 129 item 1443.

[13] Act of 12 June 2003 on payment terms in commercial transactions, Dziennik Ustaw [Journal of Laws] 2003 No. 139 item 1323.

[14] Press information Coface Poland from 1 October 2012, Internet resources as of 10.10.2012, www.coface.pl.

of bankruptcies recorded currently has fallen to the level reached in 2005. Also, it is worth highlighting that in previous years bankruptcies primarily affected smaller enterprises, whereas today they plague larger companies[15]. Industries most hit include construction and trade, notably retail. Processing industry and transport have been largely unscathed and their situation has not been exacerbated.

These threats are corroborated by the fact that in April 2009 ¾ of enterprises involved in the survey conducted by InfoMonitor BIG S.A. acknowledged that they experienced the effects of the crisis[16]. As a consequence the security index in business trading, BOG[17], calculated from 2007, decreased. In mid-2009 it reached its all-time low, and for a group of entrepreneurs the index was even lower and in July it averaged –4,08 whereas in January within this group it outpaced the average by almost 2.5 points.

The problem of payment backlogs presents a particular hazard for small companies which may easily lose liquidity which thus may lead to the collapse of the company, and gains in importance for small enterprises confronted with the prospect of time-consuming litigation proceedings in enforcement of receivables to be pending up to 830 days[18], which nevertheless may prove to be ineffective in the face of insolvency of the

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[15] *Ibidem.*

[16] *Barometer of Security in Business Trade,* InfoMonitor Biuro Informacji Gospo-darczej S. A., Warsaw, April 2009, p. 7.

[17] BOG – a security index in business trade, illustrating the level and changes in payments outstanding and lost liabilities. It ranges from -100 to 100. In increase implies improved grading for security in business trade, a decrease – deterioration of the situation. An index is calculated on the basis of survey being conducted from 2007 among employees responsible for finances across three segments of the market. The survey carried out from 22 June up to 10 July covered 200 entities with the following breakdown: 35% providers of financial services (banks, cooperative savings and loan unit, insurers, leasing companies, companies issuing credit cards, companies involved in purchase of debts and factoring, companies granting loans), 35% providers of mass services (cooperatives, commonhold association, providers of electric energy, water supply systems, provides of municipal services, gas, TV, transport companies, tele-communication operators), 30% entrepreneurs, *Barometer of Security in Business Trade,* InfoMonitor Biuro Informacji Gospodarczej S.A., Warsaw, July 2009, pp. 3-6.

[18] *Doing business 2012,* The World Bank and The International Finance Corpo-ration.

debtor and problems with enforcement. Specifically, it should be mentioned that such a long time arises from the applicable legal system, the number of procedures and time-limits for enforcement contained in the Civil Code. Within a group of 368 small enterprises surveyed in 2005 by D. Zawadzka 11% of trade liabilities were paid with some delay[19], and the key cause behind the untimely discharge of liabilities for almost half of those surveyed were the debtor's financial problems.

Yet contemporary economy proves that the size of the company is irrelevant. Smaller entities striving to win the competition battle are also forced into an uncompromising struggle for a client and they are dragged into the game of "who gives more". Also in the case of large companies the problem is not shrugged off. From among the group comprising the 202 largest Polish enterprises, surveyed in 2007 on management the crisis situation, almost 15% indicated problems with business partners[20] as the most common cause of the crisis.

The significance and immediacy of the problem illustrated in contemporary business trading is verified by the fact that even state administration bodies and courts failed to guard against payment backlogs and they themselves delay in making payments[21].

3. European practices

The problem is not confined to the Polish economy, but its context is far broader. Estimates made by debt collectors show that European enterprises lost at least 340 billion euro due to overdue invoices, which corresponds to the sum of the Greek debt[22].

An aggravated problem of payment backlogs stemming from the risk taken is manifested by the fact that the majority of states confront the cases of exceeding payment time-limits, whether shorter or longer, for liabilities

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[19] D. Zawadzka, *The risk of paying in mutual settlements of small businesses – the light of the results of empirical research* [in:] *Corporate Finance to processes of globalization,* University of Gdansk, Gdansk Academy of Banking, Gdańsk-Jurata 2003, pp. 378-379.

[20] *Survey report. Management of crisis situation in Polish enterprises,* Alert Media Communications, WSIiZ w Rzeszowie, Rzeszów, Warsaw 2007, p. 7.

[21] *Tax offices and courts are also deluyed,* „Rzeczpospolita", 30.07.2009.

[22] Press information Intrum Justitia, Internet resources as of 5.10.2012, www. intrumjustitia.pl.

arising out of goods and services delivered in relation to contractual terms[23]. A compilation of average payment time-limits for liabilities, offered to clients in 2012 in selected countries is shown in Figure 4.
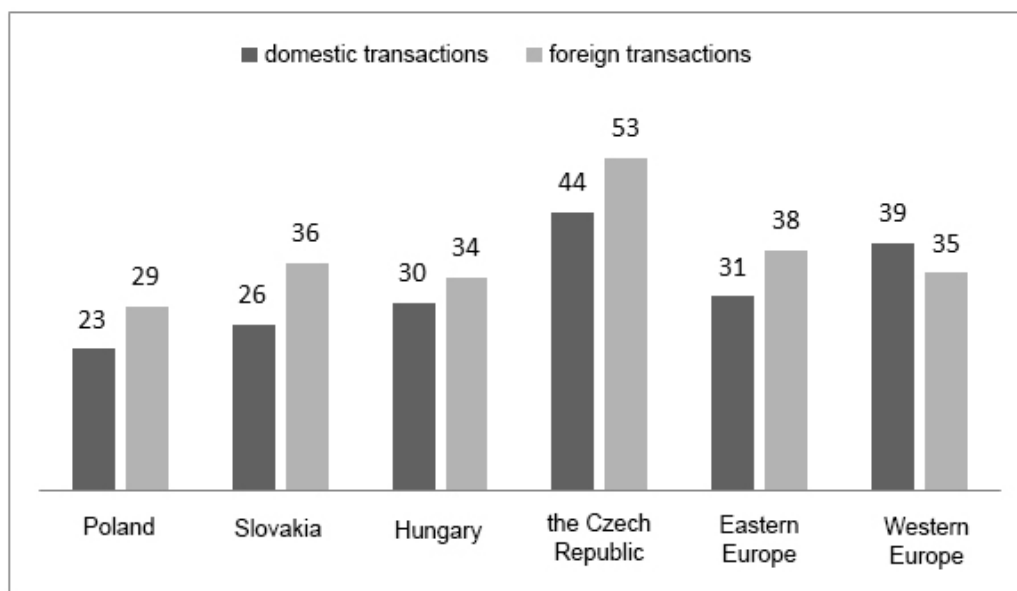

Figure 4. *Average length of trade credits contracted to clients in days.*

Source: Author's study based on: *Atradius Payment Practices Barometr,* June 2012, Atradius, p. 11.

Yet the shifts in the receivables structure in terms of lengths of payment terms proves to be an adverse development. An increase in the share of the longest paid receivables exceeding 90 days is noticeable. A portion of these delayed payments will certainly become overdue receivables, and some will be uncollectable. For a company it implies incurring extra costs for recovery or litigation proceedings, and at times it means the necessity to write it off as a loss. Moreover, it is essential to focus on payment delays which today are becoming a common phenomenon (Table 1). It is estimated that in Europe, 1/3 of invoices value, both in terms of domestic as well as export transactions, constitute overdue payments, and the real time necessary for recovery of monetary resources in 2011 for entire Europe averaged 52 days.

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[23] *European Payment Index, 2012,* Intrum Justitia, p. 3.

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Table 1. *Payment delays.*

		Up to 30 days	from 30 up to 90 days	above 90 days
Poland	domestic transactions	71.7%	23.0%	5.3%
	foreign transactions	70.6%	22.2%	7.2%
Slovakia	domestic transactions	73.2%	23.8%	3.9%
	foreign transactions	80.5%	18.3%	1.2%
Hungary	domestic transactions	71.7%	24.2%	4.1%
	foreign transactions	87.0%	11.4%	1.7%
Czech Republic	domestic transactions	76.9%	19.0%	4.1%
	foreign transactions	79.8%	16.1%	4.1%
Eastern Europe	domestic transactions	**73.5%**	**22.1%**	**4.4%**
	foreign transactions	**77.9%**	**18.5%**	**3.6%**
Western Europe	domestic transactions	**68.3%**	**25.7%**	**6.0%**
	foreign transactions	**69.5%**	**25.2%**	**5.3%**

Source: Author's study on the basis of: *Atradius Payment Practices Barometer,* June 2012, Atradius, p. 16.

Essentially, granting a trade credit inseparably entails a risk likely to result in payment delays or total payment default, which thus augments the "non payment chain"[24]. Surveys conducted by the trade receivables insurer Atradius in the first half of 2012 found that in Eastern Europe 2.6% of the total value of B2N receivables in domestic trade was written off as uncollectable[25]. In foreign transactions an average amounted to 1.8%. The highest index of uncollectable receivables was unfortunately recorded in

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[24] D. Redel, *Microeconomic ..., op.cit.*, p. 169.

[25] Por. *Payment Practices Barometer. Survey of Payment Behaviour of Central and Eastern Europe,* Atradius, May 2008 and *Payment Practices Barometer. Survey of Payment Behaviour of European Companies,* Atradius, Winter 2008/2009.

Poland where 4.4.% of the total value of domestic receivables may be recognized as lost, and for transactions the index was marginally lower and stood at 4.1%. Hungary turned out in the most favorable light in the ranking where just 1.7% of domestic receivables and 0.6% of foreign receivables were uncollectable.

The scale of risk inherent in granting trade credit is also reflected in the payment risk indexes for Poland. With 163 points scored in 2009, Poland took 20th place in the ranking of 26 countries from Europe, whereas the average for Europe was 154[26]. Poland outpaces, among others, Spain, Hungary, Czech Republic, Cyprus, Greece, and Portugal. A payment risk index ranges by the scale from 120 – the lowest risk to 200 – highest risk. Within the group of European countries in 2009 the lowest risk with an index not exceeding 130 was achieved by Scandinavian countries – Finland and Sweden, whereas the highest with the index above 170 was found in Portugal and the Czech Republic.

The scale and length of trade credits granted hinges on, among others, conditions and payment terms in the industry, financial benefits from deferred payment, length of the operational cycle of the company, possibilities of winning other sources of finance, and their cost.

4. Legal aspects of receivables recovery

The problem of payment delays affects, to a greater or lesser extent, a majority of companies. Efficiency in pursuing claims from agreements concluded proves to be critical for improving the conditions for carrying out business activities as displayed in Figure 1. Meanwhile as many as 70% of enterprises believe that they were not provided with statutory support necessary for protecting their companies against the risk or damage triggered by payment delays[27].

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[26] Arimetrical average calculated on the basis of data provided by: *European Payment Index 2009*, Intrum Justitia, p. 4.

[27] *European Payment Index 2012,* Intrum Justitia.
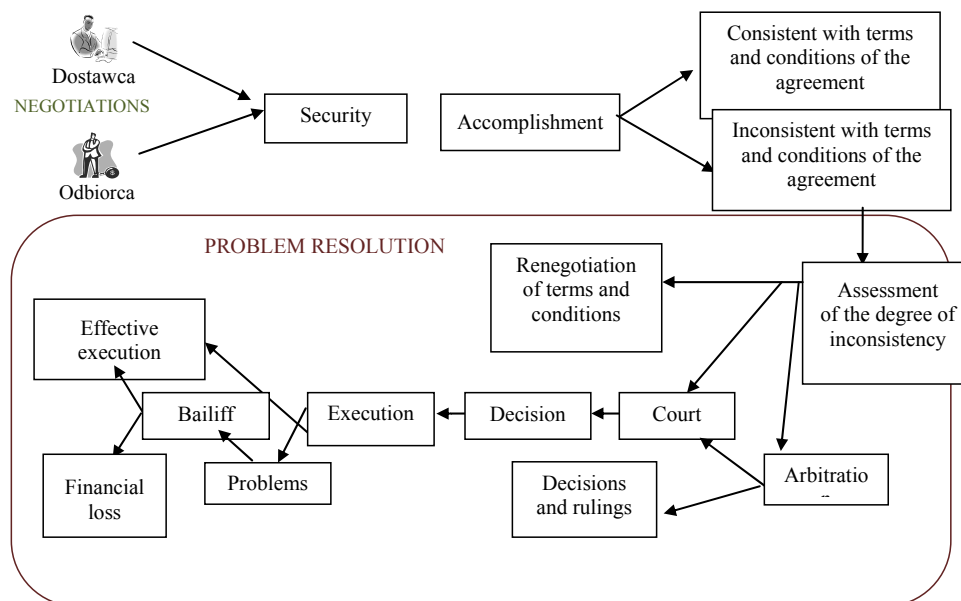
Figure 1. *Scheme for pursuing claims from agreements.*

Source: *Poland: legal obstacles in pursuing claims from agreements,* Report of the World Bank prepared in collaboration with the National Bank of Poland, C. H. Beck, Warsaw 2006, p. 10.

A requirement fundamental to security of transactions concluded on the basis of trade credit is putting in place effective legal regulations in this respect. Such was the purpose guiding the adoption of the act of 6 September 2001 on payment terms in business trade[28] which entered into force at the beginning of 2002 and was replaced two years later by the act of 12 June 2003 on payment terms in commercial transactions[29]. Principal amendments boiled down to extending the protection scope by medium-sized and large enterprises, liberal professions and branches of foreign companies.

The survey conducted among the enterprises two years after its effective date of the aforesaid act revealed that the provisions of the act fell short of the goal thereby failing to accelerate payments in commercial transactions[30]. Opinions about the neutral impact of the legislation on the change of actual payment terms prevailed.

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[28] Dziennik Ustaw [Journal of Laws] 2001 No. 129 item 1443.

[29] Dziennik Ustaw [Journal of Laws] 2003 No. 139 item 1323.

[30] Survey conducted by the Centre for Social and Economic Information in the Ministry of Economy in November 2005 on a test sample of 2500 enterprises across Poland and 500 units of the public sector. For the purposes of the study statistics with regard to assessing functioning of the provisions of the acts by a group of enterprises will be employed.

The legislation related to bringing claims in payment-order proceedings was regarded as the most efficient tool and its positive effect on the change in payment terms was reported by 26% of enterprises. In the view of 15% of respondents from the group of enterprises a reason behind shortening the payment dates were provisions enabling automatic accruing statutory interests: *"if the payment term was not determined in the agreement, a creditor, without notice, is entitled to statutory interests for a period running from 31st day following rendering non-pecuniary performance – up till the payment date, but not longer than up till the maturity date of pecuniary performance"[31]*. A compilation of the amounts of statutory interests over the years is detailed in Table 2.

Table 2. *Statutory interests.*

Term	Annual interest rate	Journal of Laws
from 15.12.2008	13%	No. 220 of 2008 item 1434
15.10.2005 – 14.12.2008	11,50%	No. 201 of 2005 item 1662
10.01.2005 – 14.10.2005	13,50%	No. 3 of 2005 item 16
25.09.2003 – 09.01.2005	12,25%	No.166 of 2003 item 1613
01.02.2003 – 24.09.2003	13%	No. 14 of 2003 item 137
25.07.2002 – 31.01.2003	16%	No.117 of 2002 item 1009
15.12.2001 – 24.07.2002	20%	No. 143 of 2001 item 1612
01.11.2000 – 14.12.2001	30%	No. 90 of 2000 item 996
15.05.1999 – 31.10.2000	21%	No. 43 of 1999 item 429
01.02.1999 – 14.05.1999	24%	No. 7 of 1999 item 52
15.04.1998 – 31.01.1999	33%	No. 45 of 1998 item 270
01.01.1997 – 14.04.1998	35%	No. 151 of 1996 item 713
15.12.1995 – 31.12.1996	46%	No. 141 of 1995 item 694
01.05.1993 – 14.12.1995	54%	No. 33 of 1993 item 148
15.08.1992 – 30.04.1993	60%	No. 60 of 1992 item 304
15.09.1991 – 14.08.1992	80%	No. 82 of 1991 item 367
01.03.1991 – 14.09.1991	140%	No. 12 of 1991 item 50
01.12.1990 – 28.02.1991	90%	No. 82 of 1990 item 478
01.07.1990 – 30.11.1990	60%	No. 41 of 1990 item 241
01.05.1990 – 30.06.1990	144%	No. 28 of 1990 item 166
01.04.1990 – 30.04.1990	216%	No. 19 of 1990 item 116
01.03.1990 – 31.03.1990	216%	No. 11 of 1990 item 70
01.02.1990 – 28.02.1990	480%	No. 4 of 1990 item 25
01.01.1990 – 31.01.1990	720%	No. 1 of 1990 item 1
01.11.1989 – 31.12.1989	120%	No. 57 of 1989 item 338
16.07.1989 – 31.10.1989	99%	No. 41 of 1989 item 225
22.03.1989 – 15.07.1989	55%	No.16 of 1989 item 84
01.01.1965 – 21.03.1989	8%	No. 47 of 1964 item 321

Source: Data provided by the Ministry of Justice, www.ms.gov.pl.

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[31] Art. 6(1) of Act of 12 June 2003 on payment terms in commercial transactions.

Efficiency of Article 5 holds: *"if the parties to the agreement envisaged the payment term longer than 30 days, a creditor may demand statutory interests for a period running from the 31st day following rendering non-pecuniary performance and delivering an invoice or receipt to a debtor – up till the payment date, but not longer than up till the maturity date of pecuniary performance"* proved to be scant. Within the group of enterprises surveyed 67% of respondents does not charge the interest for fear of losing the client.

The findings of the surveys carried out allow the drawing of the conclusion that in Polish economic practice the act on payment terms fell short of expectations and appeared insufficient to eliminate delays in payment which provoked a negative outcome in the form of payment backlogs.

Therefore, it was essential for the creditor to launch other efforts, determined by the legal status, to secure against the risk of payment default and to make it possible to enforce early receivables. Hence, central for these initiatives are the knowledge of legal aspects of debt recovery starting from securities applied at the phase of signing the commercial contract through familiarity with civil and trade and even penal legislation, as well as acquaintance with the procedures for court proceedings, and through enforcement.

Due to the fact that amicable debt collection tends to frequently usher in further debt recovery proceedings at court, it is advisable to keep in mind at this initial phase to hold a dialogue with a debtor in writing. Such written acknowledgement of the debt, despite the psychological aspect, is of great significance in the light of legislation. It interrupts the limitation period which suggests that the debtor will not be able to feel at ease until his liability is met. Following each interruption the limitation period starts to run anew. Pursuant to Article 123 § 1 of the Civil Code there are other possibilities of interrupting the limitation period. It may be effected through each action before the court or other body established for examining the cases or enforcing the claims, or initiating mediation. The scheme of the process for interrupting the limitation period up till obtaining the payment is described in Figure 2.
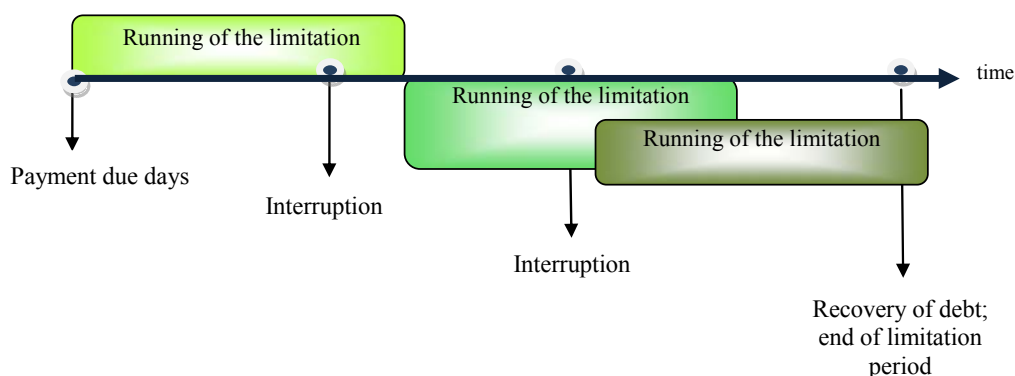
Figure 2. *Process of interrupting the limitation period.*

The limitation period is governed by the provisions of Articles 117-125 of the Civil Code which determine the limitation date, principles for running the limitation period, or eventually possibilities of its interruption. With regard to the limitations period: *"unless a specific regulation provides otherwise, the limitation period is ten years, and for claims connected with conducting business activity – ten years"[32] "A claim upheld by a final and binding decision of a court or other authority appointed to hear cases of a given type or by an arbitration tribunal award, and a claim upheld by a settlement being made before a court or an arbitration tribunal or a settlement reached before a mediator and approved by the court become barred by the statute of limitation after ten years even if the limitation period for claims of that type is shorter. If a claim upheld in this way concerns a periodical performance, the claim for a periodical performance due in the future is subject to a three-year limitation period"[33]*.

The limitation period begins to run from the date the claim becomes due. It should be stressed that after the limitation period has passed the claim does not cease to exist and still there lingers a "flicker of hope" for its payment. A claim becomes a "natural claim" which continues to exist but it is unlikely to pursue the claim at court if a debtor uses the defense of limitation. However, it may happen that a debtor unaware of his rights fails to use the defense of limitation or intentionally waives the right to use the

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[32] Art. 118 of the Civil Code, Dziennik Ustaw [Journal of Laws] 1964 No. 16 item 93 as amended.
[33] Art. 125

defense of limitation[34]. Then the award of the final and binding decision by the court is still possible.

On occasions the question is raised on validity of continuous interruption of the limitation period in the event of the insolvent debtor. In most cases creditors refuse to undertake further steps and write off receivable uncollectable into costs. There are, yet, dishonest debtors who concealed their assets. Thus interruption of the limitation period may at a certain point lead to the situation that he will be solvent enough to pay back his debt. It would require tremendous patience on part of the creditor who often opts for focusing on ongoing and future business operations. Such a possibility itself, though, is significant, even from the psychological perspective. A debtor who failed to discharge his liabilities has to constantly bear in mind that his debt will never be barred by statute of limitation, and he will be released from it after its payment.

The business practice showed that efficacy of regulations of the civil law for protection creditors' interests against unreliable and dishonest counterparties is insignificant. An auxiliary role is expected to be played by the regulations of the penal law which in the Chapter XXXVI *"Offences against economic turnover"* of the Penal Code[35] refers to the protection of principles for economic trade and free market economy, and are centered against degeneration causing damage to the state and entities involved in the business operations[36].

A common problem is the hiding of assets by debtors who transfer them onto third parties. The practice abounds in examples of entrepreneurs who drive a luxury limousine, while their actual assets disclosed as confined to possession of a bicycle. A solution may be found in Article 300 of the Penal Code pursuant to which a debtor who in the case of insolvency or bankruptcy threat, frustrates or reduces the satisfaction of his creditor by removing, hiding away, alienating, donating, destroying, burdening, or damaging the components of his property is liable to a penalty of deprivation of freedom of up to 3 years. Whereas if the hindering actions detailed were taken in order to frustrate the execution of the court decision or that of any other state body the penalty carries deprivation of freedom from 3 months up to 5 years. In the event that the damage is caused to few creditors the penalty spans from 6 months up to 8 years.

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[34] Art 117 § 2 of the Civil Code.

[35] Act of 6 June 1997 Penal Code, Dziennik Ustaw [Journal of Laws] 1997 No. 88 item 553 as amended.

[36] M. Sędzicka, *Crimes of insolvent businesses to the detriment of creditors*, "Review of Corporate Governance" No. 2(18) 2009, p. 57.

The foregoing provisions are applicable not only to debtors threatened by bankruptcy or insolvency. Any depletion of the property in the situation of shortage of mentioned threat symptoms refers to Article 300 of the Penal Code. A manner of resolving this problem as well as of protection of creditors' rights may be represented by the motion for securing the claims[37] which strives to impede the transfer of assets, and actio Pauliana[38] regarding the situation when the transfer of the assets was already done. If in the wake of a legal act performed by a debtor to the detriment of the creditor, a debtor became insolvent or reinforced his insolvency, and a third party gains a financial benefit, a debtor may demand that the said act be declared ineffective[39]. Harnessing the opportunities provided by the actio Pauliana is, in effect, complicated. Specifically, the complaint is filed not against a debtor but against a third party onto whom the assets were transferred. To apply the above provision it is necessary to prove that the debtor knowingly acted at the detriment of the creditor. Additionally, the third party would have to know that or would have known while exercising due diligence. If in the place of the third person there appears a person having a close relationship with the debtor or the entrepreneur having permanent business relations, it is presumed that they knew the intentions of the debtor.

A goal of the creditor when using actio Pauliana is to prevent disposal or dispersion of the debtor's property so as to ensure satisfaction of the liabilities in the manner set forth in law[40].

The Penal Code also provides the penalty for the actions to the detriment of the creditor through so-called apparent or reckless bankruptcy[41]. Actions involving transfer of the components of the assets onto a new business entity are subject to the penalty of deprivation of freedom from 3 months up to 5 years. An analogous penalty will be inflicted on debtors, who by having several creditors bring about their bankruptcy or insolvency. If negligence of debtor's activities squandering his property, incurring liabilities and concluding transactions contrary to the principles of management provokes bankruptcy or insolvency the consequences are seriously, such as: a fine, a penalty of restriction of

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[37] Art. 747-754 of the Code of Civil Procedure, Dziennik Ustaw [Journal of Laws] 1964 No. 43 item 296 as amended.

[38] Art. 527-534 of the Civil Code.

[39] Art. 527 of the Civil Code.

[40] M. Jasińska, *Pauline complaint. Protection of the creditor in the event of insolvency of the debtor. Art. 527-534 KC. Comment,* C. H. Beck, Warszawa 2006, p. 38.

[41] Art. 301 of the Penal Code.

freedom or deprivation of freedom up to 2 years. The same penalty may be suffered by a debtor who faced with the threat of bankruptcy or insolvency acts to the detriment of creditors by satisfying the claims of only some of them[42]. In practice, however, creditors have to always consider such a situation. Hardly ever is there enough property to meet all liabilities due, and creditors without security find themselves at the end of the queue.

A hierarchy and sequence of discharging liabilities of the debtor whose bankruptcy was announced and execution adjudicated, is specified in Article 1025 of the Code of Civil Procedure. Whereas a debtor whose administration of the property was not restricted decides himself on the order and size of payments made. Therefore, it is recommended to place our claims on a higher position in the payment list.

Familiarity with legal instruments and options allowing for mitigating the risk of entering into business relations with a dubious partner and for safeguarding against him, gains in tremendous importance in the period of downturn. Nevertheless, the problem is that in the view of entrepreneurs, the efficacy of legal procedures for pursuing the claims from agreements and recovering receivables is substantially too low for over 65% of entrepreneurs surveyed[43]. Over half of companies complain about lingering legal procedures for recovery of receivables. An average time for such a legal procedure is the longest in the case of small entities and equals 304 days. For medium-sized companies it is shorter by 9 days, whereas large entities may boast the time squeezed by over a half – 132 days[44]. Also, following a positive conclusion of the dispute by the court and award of the decision, a creditor confronts another challenge posed by the execution of the debt.

In Poland the party seeking for enforcement which was awarded to him runs into legal obstacles. In accordance with Article 913 of the Code of Civil Procedure:

> § 1. „if debtor's property attached while execution does not represent satisfaction of receivables executed or a creditor proves that as a result of the execution his receivable debt was not fully satisfied, he may demand that the debtor submit a list of his assets with specification of articles and their physical location, receivables entitled to him and other property rights, and make a pledge with

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[42] Art. 302 of the Penal Code.

[43] *Assessing functioning of provisions of the act of 12 June 2003 on payment terms in commercial transactions,* Ministry of Economy, Warsaw March 2006, p. 25, Internet resources as of 23.06.2009, www.mg.gov.pl.

[44] *Ibidem.*

*the following wording: "Aware of significance of my words and
responsibility towards law I ensure that the list of the assets is
true and complete".*

*§ 2. a creditor may demand disclosure of the assets also before
instigating the execution if he substantiates that his receivables
will not be fully satisfied from the property which is known to him
or from current periodical performances to which a debtor is
entitles for the period of six months".*

In both cases, though, a creditor is obliged to demonstrate that he did
not or will not receive full satisfaction of his receivables, and to prove that
the value of the debtor's property which is known to him is lower than the
value of creditor's receivables.

The gist of the issue is revealed by the soaring number of cases
settled by bailiffs frequently observed over recent years which fails to
trigger an adequate increase in employment of bailiff's offices.
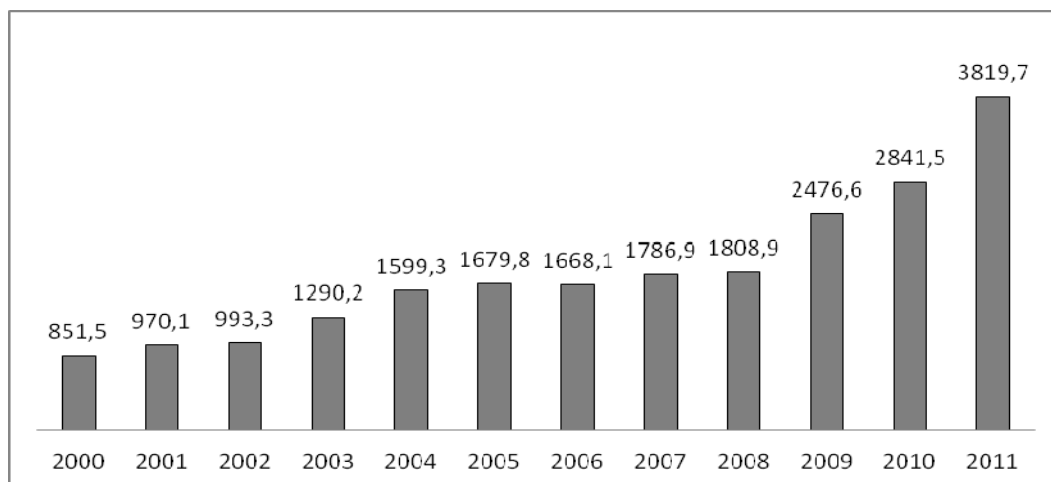
Figure 5. *A number of cases settled by bailiffs in thousand cases in Poland.*

Source: *Small Statistical Dictionary of Poland* within 2001-2012.

The heart of their success, after all, should be not only enhanced
efficiency of pursuing claims from agreements or speed of settling disputes
by courts, but, above all, prudence at the phase of concluding an agreement
and endeavoring to provide security for transactions. Even in the case of a
proven business partner the risk of dispute is always involved. Thus, at the
phase of concluding an agreement it is worth securing by property and
personal safeguards for transactions with deferred payment terms.

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A good way to eschew disputes by entrepreneurs arising from agreements is by making use of legal services in the course of drawing up the agreement. In practice, however, it is a rare occurrence, largely confined to large entities which frequently have their own legal departments. Small and medium-sized companies mainly utilize ready-made agreement samples, and they make use of lawyers' services only when a dispute has already occurred[45]. Though even then numerous enterprises avoid litigation proceedings and attempt to achieve a "cure" by their own efforts.

Among breaches which most often result in legal actions being brought by the injured party the foremost are payment defaults and claims of third parties[46]. Whereas payment delays were assigned a lower weighting, it should be underscored that results mentioned refer to the period when the problem with collection of receivables from recipients began lose impetus and recorded a downward tendency in entrepreneurs' indications. After all, it should be expected that today in the face of enormous return of payment backlogs we will increasingly deal with undertaking legal actions by injured creditors.

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[27]   Act of 5 September 2001 on payment terms in business trade, Dziennik Ustaw [Journal of Laws] 2001 No. **129** item 1443.

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WORK TEAMS AND EFFECTIVE MANAGEMENT OF A FAMILY OWNED COMPANY

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Abstract. *Human resources are the most important asset of an organization. It is difficult to imagine a company working effectively without a properly selected work team. The idea of work team organization in family owned companies is presented in this monograph. The issue of family owned companies as groups of people with special characteristics is introduced. The concept of internal marketing is characterized as a feature which enables companies to build properly engaged work teams. The determinants of team effectiveness are discussed as they condition the efficient management of work teams. The project management as a new method of work organization, which may increase the work effectiveness in family owned companies is characterized too.*

Keywords: *work team, family owned company, project management, management.*

1. Introduction

Polish citizens are undoubtedly claimed to be an enterprising nation. Data on entrepreneurs contribution or people intending to do business confirm the above statement. Poland is in sixth place among other European Union economies when the number of enterprises is taken into consideration. About 1.8 million companies are run in Poland. The number has increased by 3.4% as compared to 2010. Small and medium sized enterprises comprise 99.8% of all companies. Newly established enterprises are mostly seen in Poland. In 2010 Poland occupied second place in this aspect, straight after France. As the Central Statistical Office data confirm, enterprises run in Poland generate almost three-quarters of Polish Gross Domestic Product. The dynamism of the gross value added created by enterprises in Poland has been continuously growing since 2005, among all company groups. The structure of enterprises share of GDP clearly

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shows that SMEs generate every second zloty (47.3%), including the smallest companies which generate every third zloty (29.4%) [3].

Family owned companies make up a significant group within SMEs sector. It is them that affect the whole national economy, becoming more and more important market players. One can barely provide an easy unambiguous definition of a family owned company. The main area of attention is its special characteristics contributing to its family nature. A family owned company exists when its founders and their offspring or relatives comprise human capital of a company holding managerial or the board of directors' positions at the same time. As a result, the company's ownership structure is shared by the family to the extent which allows them to control the company's activities. The interference in current activities and management is also possible when the family has their representatives in the board of directors. Furthermore, a family owned company is to take action to transfer the ownership and all company values to next generations [2].

People make up the foundation of each company. This resource is mostly appreciated in family owned companies. Not only is the concern about workers caused by economical and managing issues, but also by family based and personal relationships. Both, the staff and senior management while striving for their mutual satisfaction are equally concerned with the company and family. It is often observed that the number of processes as well as the dynamism of ongoing changes throughout a company requires coordinating human resource operations. It, therefore, needs the implementation of information systems as well as other process solutions. The purpose of this monograph is to show the role of workers in family owned companies which constitute a unique form of enterprise within SMEs sector. The role will be presented from the perspective of organizing job into work teams which may become an effective way of increasing work efficiency and workers' motivation.

2. Work Teams

No explicit and full definition of 'a work team' has been yet provided. Authors tend to mention different forms of transforming social groups into real work teams (e.g. Likert's idea of an effective work group). However, work teams are characterized by such phenomena as group norms, cohesiveness or group roles [6 p. 47]. Effective and efficient work

teams share some common features which, when properly used, might help in achieving a strong competitive advantage.

It is crucial to distinguish between work teams and work groups. Work groups are regarded to feature some cohesiveness standards, their members interact with one another, they have complementary competences and act in a coordinated way. The work group outcome consists of the results of individual people involved. They are, on the other hand, expected to have the synergistic effect. Although they have access to the same information and are affected by the same decisions, their work is not collective-natured. It is done rather in an individual way at certain stages. Furthermore, the scope of responsibility is also separate. Low coherence work groups are expected to have a less known effect – rather counterproductive to the synergistic effect – Ringelmann's social loafing effect. The level of cohesiveness tends to intensify as the size of the group decreases, as some external threats appear and in proportion to the amount of time mutually spent. It is therefore clear that in order to make the level of cohesiveness higher, a few things may be done such as stimulating competition with other groups, decreasing the size of the group or encouraging group members to make collaborative decisions and prepare operation [11 p. 298].

In large organizations many processes are performed via teamwork. Small companies, on the other hand, do not require them so often, but still their work teams [9 p. 86]:

- are not formally involved in the static organizational structure of a company,
- fulfill tasks going beyond an organizational chart,
- consist of specialists and managers,
- work periodically or constantly, depending on the situation,
- act within specific budget plan,
- bear responsibility within the set goals,
- complement the existing organizational structure but do not substitute for it,
- team members are all assigned to a proper position in a formal organizational unit,
- allow outside experts to get involved in enterprise activity.

Proper team-building process is an important factor influencing its future functioning. Team-building mostly concerns intentionally formed groups, towards the needs of a specific situation – secondary groups. The process needs to be premeditated and developed on the basis of training methodology. As the classic author, B.W. Tuckman claims, further group

development is stimulated through stages like storming, norming and performing [12 pp. 384-399]. In family owned companies we can observe the so-called integration, conceived without any influence from company authorities. Both, team-building and integration are to be for uniting the group and as a result eliciting the previously mentioned synergistic effect [4 pp. 89-98]. Being aware of a need for consistency as well as a mature attitude towards goals, which the group is created for, should lead to setting cooperation standards. This constitutes a condition for reaching the effective team work phase. Team-building is easier in family owned companies as its main purpose is to create and evoke such feelings, emotions and atmosphere that the group functions as unity and in an integrated way.

In order for the team success to feed the organizational success, a crucial role is assigned to its leader, whose main areas of working concern:
- properly locating the team into a company structure;
- selecting right workers – team members' expertise, among others;
- subdividing powers and responsibilities among team members;
- using proper motivational system;
- getting workers involved in a decision making process;
- constant staff training;
- showing workers interest and support;
- creating positive atmosphere;
- enriching intra-organizational culture;
- promoting and appreciating ethical behaviors among workers.

The literature mentions quite a lot of factors determining the growth of team effectiveness. According to R. Kreitner, the so called determinants of team's effectiveness have been grouped into [7 p. 452]:
- people-related factors:
  - personal work satisfaction
  - mutual trust and team spirit,
  - good communication
  - the lack of conflict.
- organization- related factors:
  - organizational firmness and job security,
  - management interest, proper reward system and ability recognition,
  - stable targets and priorities.

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– task-related factors:
- clear aims
- proper directions and leadership
- autonomy and challenging work
- experienced and qualified team staff
- team engagement and project 'visibility'.

Larson and LaFasto's division, by contrast, proves the existence of some success determinants of high performance teams. The factors are: clear objectives (the vision), competent team members, unified motivation, collaborative climate, standards of excellence, a results-driven structure, principled leadership, external support and relevant atmosphere [1 pp. 78-86].

The above mentioned factors may be of a different intensity, depending on situation and team type. Nevertheless, they constitute entirety and only their combination conditions success achievement in teamwork.

3. Work team effectiveness in family owned companies

As previously mentioned, family owned companies are mainly small companies or micro-entities. Even so, their work team effectiveness is a complex issue. It requires a thorough analysis of a number of variables which, depending on the team and the organization development stage, more or less influence the way of team performance. An organizational structure must be made a starting point as it conditions an internal work organization, relations between workers, managing styles and staff development opportunities. A work team itself does also stay significant, as well as its positions interrelation, age structure, employment and the needs of motivational nature.

Team efficiency and effectiveness are also determined by a set goal and a task type. Since tasks are generally imposed in accordance with the work allocation and functioning of an organization. Team members are instead obliged to carry them out. No matter the task type – whether it requires physical or mental effort, or the intensity of its compulsion is higher or lower – from a psychological perspective it is significant what

inner arrangements the team has, what standards it follows, if the tasks are realistic or unrealistic or if it really feels desire for success [6 p. 48]. Family owned companies deal with the phenomenon of compulsion less often. Workers tend to associate themselves with the company, they participate in creating its identity (private family meetings are a part of this concept) and thereby identify with it stronger.

The recruitment process in family businesses is quite peculiar, too. Firstly, job positions are sometimes created for particular persons. Secondly, workers do not always possess sufficient competences and, finally, staff turnover is rather poor and their dismissing rather difficult. Teams positively influence less efficient team members and individual members' motivation. An awareness that participating in a team contributes to knowledge, experience and skills growth, is said to be important. This, in turn, causes human and organization capital increase. Moreover, introducing a new employee to a company is considered to be easier and cheaper.

Implementing any organizational changes in small businesses results is temporary work confusion. Whereas teamwork eliminates the need for frequent structure modifications and its nature does not also require any organizational structure changes, for it fits in with existing solutions. Work groups, however, positively affect the process of implementation different changes in a company.

The atmosphere prevailed in family owned companies seems to be friendly and of a family nature. Nevertheless, private family disputes are often transferred to a professional area. Teamwork and collaborative goal achievement reduce unhealthy rivalry and improve work atmosphere. Cooperation causes team integration enhancement. What is more, small companies often build one team which eliminates harmful rivalry between more teams. The atmosphere, interaction between members, freedom of speech and personal views (even those adversarial towards others) all have an impact on team effectiveness, creative problem solving process and finding innovative ideas, when family owned companies are being concerned.

It is much easier to communicate, express and share opinions among family team members as they appear to have their own specific communication codes, the ones developed during official and unofficial meetings.

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Sharing knowledge is another important issue. Knowledge resources are considered as the most essential from the standpoint of operation of enterprises because, if properly managed, knowledge provides the basis for development of competitive and innovative business processes and business solutions. Knowledge represents a specific resource that differs significantly from factors of production. Managing these resources require a specific approach to the strategy, structure and organizational culture, and choosing appropriate knowledge management tool or acquisition of new employee competencies. Each employee, using their knowledge, experience and skills, generate value through creative thinking, analysis, synthesis and formulation of views. Further, using the tools, structures, systems and procedures that support knowledge development and knowledge flow, the employee makes decisions and takes activities to make the knowledge available for achievement of the enterprise's goals [8 pp. 168-174]. The problem does not usually concern family companies as their employees have safe established positions both, on business and family basis. They do not therefore face a prominent level of competition and, as a consequence, they share their knowledge with ease. However, teams still support sharing mainly specific knowledge, rather hidden and procedural, difficult to be expressed verbally. Besides, workers may use their knowledge and skills more effectively which, in turn, may result in enhancing activities like innovation implementation. Thus, work teams in family owned companies can be a substitute for R&D department.

Vast majority of family businesses are managed by their founders. This type of management is primarily based on the conviction that the owner's equity should be the only source of investment and development is best achieved with a step by step approach. Such a strategy results from tough market situation, where many small families owned companies struggle for their survival. Family businesses' staffs are certainly more trustworthy but, on the other hand, market needs should be prioritized over and above strong family relations [10 p. 253]. Work teams, therefore, prove to perform successfully. Managers do not have to put negative emphasis on employees, likewise, to apply unyielding standards and regulations.

Managing work teams is certainly not an easy task. As far as family owned companies are concerned easier managing is determined by such factors as a high degree of trust, similar habits, as well as the lack of job

insecurity [5 pp. 116-117]. No matter the team type, whether it is problem solving, self-directed, functional or virtual, the process of managing appears to be fairly easier.

Another issue concerns creative problem solving and team creativity. Although there is no research proving that a team surpasses an individual person in generating original ideas, it is clear that the individual person is simply unable to have a multi-level approach towards problems, self-criticism and broad competencies and experience. Besides, a team is believed to be more objective. Team creativity is, therefore, encouraged through cooperating and discussing. The synergy effect, which appears simultaneously, helps with efficient reactions and decision making.

Work groups, on the other hand, are employed increasingly in unpredictable circumstances. They have become an essential coordination, target-oriented integration and managing tool, all in highly variable surroundings, both internal and external.

Teamwork effectiveness determinants are as follows:

- setting a proper area of group operation (targets, timelines, criteria, personnel and organization of the group);
- creating suitable working conditions (a relation between the group and a stable organizational unit – how work is shared between them, place of work, budget, decision making competencies, tangible assets, equipment, administrative support, additional payment for group members);
- group-building process (determining group autonomy – a level of self-directing, responsibility for achieving goals, proper group personnel);
- providing current support (monitoring group needs, staying in touch with the management staff, responding to all obstacles, even those beyond the group influence, replenishment of resources).

To sum up, teamwork benefits mostly mentioned are: [6 pp. 13-14]

- working with other people triggers more energy and creativity; different views are easier to result in creative solutions;
- working with other people may be quite satisfactory, the team structure enables all its members to develop, so that each person could show their uniqueness;
- teamwork may be effective, the more skilled and experienced team members are, the better usage of energy and time.

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4. Conclusion

Current changes in the field of economy, society, culture, as well as the issue of globalization and modern technologies all force enterprises to be ready to make changes. Those companies which are able to alter their manufactured goods, target market or type of business activity have a real chance for success. Reaching status quo seems to be insufficient. A company has to adapt to changing market conditions, like a chameleon.

The process of change comprises an integral part of each company's functioning. Changes are known to activate an organization. Not only does the managing staff have to participate in the changes but also each employee. However, it is becoming more and more common that employees show willingness to be a part of a company and its actions. Their attitude towards work, high qualifications and previously mentioned factors are in favor of teamwork development.

Family owned companies' owners are required to operate in accordance with contemporary management demands and organizational improvement standards. That, in other words, simply means modern way of thinking. Family businesses ought to be considered significant market participants, contributing to economic growth acceleration rate. Their positive qualities should be therefore appreciated and prove that the organization creates positive working conditions and invests in human resources which, in turn, makes it more competitive at the market.

Work teams are becoming more and more important element of a company performance. They compose a mosaic-like image of their members' qualifications. What is being emphasized is their significance in a company, likewise, their influence on the effectiveness and quality of doing business. So important is their role, that many companies strive for implementing proper organizational and work processes changes, enabling teamwork functioning. Then, organizational processes and structures get the chance to be stimulated and revitalized. Hence, work teams just go beyond modern trends, they response to the need for improving work organization processes.

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CHANGES OF FIELDS OF STUDIES AT POLISH HIGHER-EDUCATION INSTITUTIONS IN THE CONTEXT OF THE LABOR MARKET NEEDS

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Abstract. *The paper concerns the issue of adjusting the offer of Polish higher-education institutions to the labor market needs. Massification of access to higher education reported in recent years has put into question the quality of education at higher-education institutions in Poland and thus the adequacy of their offer to the demands of the labor market. Therefore, the main objective of this paper is to analyze the changes in the sphere of higher education in recent years in the context of cohesion between education programs and demands of the economy.*

Keywords: *higher-education institution, labor market, educational offer.*

1. Introduction

The development of higher education accompanied by the increasing number of higher- education institutions and rising gross enrolment ratios was possible due to a few factors. One of these was the changes in higher education law introduced at the beginning of the nineties of the previous century, which enabled the creation of private schools. Another factor was, as far as the development of higher education is concerned, a favorable demographic situation, and finally, high educational aspirations of the society. All these factors made access to higher education institutions much easier. During the transformation in Poland, graduating from college or university was treated as a good investment. What may be surprising, however, is the fact such an attitude towards education was, to some extent, caused by market economy. Such beliefs had been common in developed countries for many years. One of the first people who treated education as an investment was J.R. Walsh. In the article published in 1935, he stated that "...education will bring economic

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benefits" [10]. This article became important also for the Polish economy since higher education could guarantee a better job and salary and interesting career prospects. Moreover, higher education could contribute to the fall in unemployment and to greater occupational and geographical mobility.

Taking the importance of social and economic aspects of higher education into account, the main aim of the paper is to analyze the changes occurring in this sphere in recent years in the context of adjusting the offer of academic institutions to the needs of the Polish labor market. The main thesis is that the changes occurring in higher education in Poland have not been accompanied by activity ensuring cohesion between the offer of academic institutions and the labor market needs.

2. Changes in higher education

The changes occurring in recent years both in the Polish economy and higher education have created a trend towards gaining knowledge by young people. This has been reflected in the gross enrolment ratios, which are a measure of universality of education (table 1). These ratios have quadrupled for the last several years. Gross enrolment ratios in the academic year 1990/1991 was 12.9%, and in the year 2011/2012 53.1%. Net enrolment ratio rose from 9.8% to 40.6% [6,7]

Table 1.

Higher education enrolment ratios.

enrolment ratio	1990/91	1995/96	2000/01	2005/06	2010/11	2011/12
gross	12.9	22.3	40.7	48.9	53.8	53.1
net	9.8	17.2	30.6	38	40.8	40.6

Source: *Higher education institutions and their finance in 2011*, GUS, Warsaw 2012, p. 28.

An increasing interest in higher education was connected with a significant growth of higher-education institutions, the number of which rose from 112 in the academic year 1990/1991 to 460 in the year 2011/2012 [1]. The most rapid growth was during the last ten years of the previous century and the first years of the present one (table 2).

Table 2.

Higher-education institutions according to type.

specification	Number of higher-education institutions			
	1990/91	2000/01	2010/11	2011/12
Total	**112**	**310**	**460**	**460**
universities	11	15	19	19
technical universities	33	23	23	25
universities of agriculture	9	9	7	7
higher schools of economics	5	94	79	77
pedagogical academies	10	19	18	17
medical universities / medical academies	12	10	9	9
maritime academies	2	2	2	2
academies of physical education	6	6	6	6
academies of arts	17	21	22	23
academies of theology	7	15	14	14
schools of national defence department and the interior department	–	10	7	7
other	–	86	254	254

Source: *Higher-education institutions and their finance in 2011*, GUS, Warsaw 2012, p. 29.

This development coincided with the rapid growth of private higher-education institutions. Their number increased from 12 at the beginning of the academic year 1990/1991 to 328 in the year 2011/2012 (figure 1).
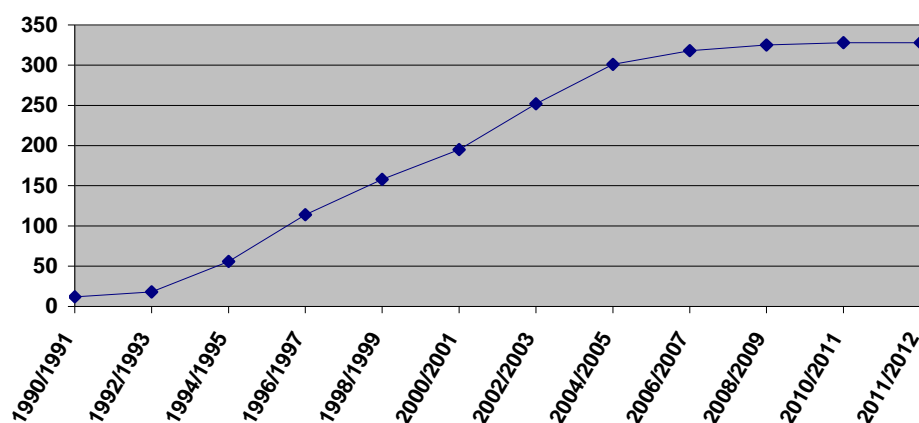
Figure 1. Number of private higher-education institutions.

Source: own elaboration based on *Higher-education institutions and their finance in 2011*, GUS, Warsaw 2012, pp. 29-30.

The rapid growth of higher-education institutions went hand in hand with a considerable increase in the number of students and graduates. While there were 403.8 thousand students and 56.1 thousand graduates in the academic year 1990/1991, the numbers rose to 1764.1 thousand and 497.5 thousand respectively in the year 2011/2012 (figure 2). It is worth emphasizing that the record number of students was in the academic year 2005/2006, which was 1953.8 thousand. Since then, the number of students has decreased steadily [3]. The main reasons are the demographic situation and the new legislation, which is the result of the changes in the *Higher Education Law Act*, which imposed the fees on the students who want to study a second subject or more and regulated the number of places available at a higher-education institution. If enrolment exceeds this number by 2% in relation to last year's, the approval of the Ministry of Science and Higher Education is required.
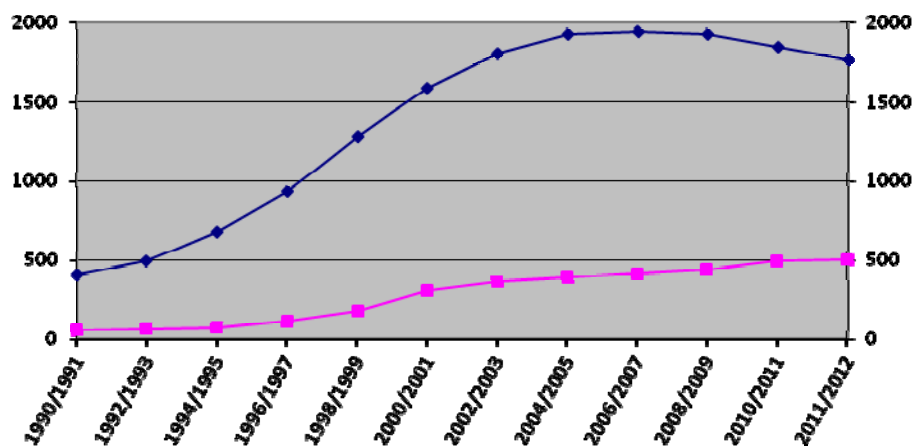
Figure 2. Number of students and graduates.

Source: own elaboration based on *Higher-education institutions and their finance in 2011*, GUS, Warsaw 2012, p. 28.

It is worth mentioning that a significant part of students and graduates comes from private higher-education institutions. Their record number of students was in the academic year 2006/2007 and was 640.3 thousand. Since there has been a steady decline in the number of students of private higher-education institutions, in the academic year 2011/12, the number of students was 518.2 thousand and the number of graduates was 171.8 thousand [8]. As far as public institutions are concerned, the numbers were 1,245.9 thousand and almost 500 thousand respectively.

3. Fields of studies and labor market

As it was mentioned above, more opportunities and a greater interest in studying at higher-education institutions lead to the increase in the proportion of people who have a degree. This refers to both people in general and particular groups. At the same time the structure of the unemployed changed, among whom the proportion of educated people increased year by year. At the end of 1999, there were about 2% people with higher education who were registered in employment offices; at the end of 2002 – almost 4%; at the end of 2011 – 11.4%; and at the end of 2012 – 11.7%. In the structure of unemployed graduates, there were 29.45% people with higher education at the end of 2012 [9].

As the data show, having a diploma does not guarantee immediate employment on the present job market, which is full of specialists with higher education, but it improves the chances of finding a job, since the unemployment rate is relatively low among people with higher education (also among graduates). During the fourth quarter of the year 2012 that rate was 5.7% in comparison with 18.7% in case of people with junior high school education, elementary and incomplete primary education [8].

The biggest number of unemployed people can be found among those who have the following three jobs which require higher education: a pedagogy specialist (16% in this job are unemployed); a public administration specialist (13.8%); and an economist (7.5%) [12].

The comparison between the above-mentioned data, the popularity of study fields offered by higher-education institutions and the choice of a study field by candidates do not go hand in hand with the labor market needs. It turns out that the most popular fields of study are the following: economics, administrative, pedagogical, humanities and social. It is true that the data on the popularity of study fields have shown in the past few years that the interest in them has decreased slightly, but there are still a lot of people who choose these particular fields of study (figure 3).

Figure 3. Students of higher-education institutions according to fields of study.

groups of fields	students			
	2008/09	2009/10	2010/11	2011/12
total (thousands)	**1927.8**	**1900.0**	**1841.3**	**1764.1**
including – in %:	100.0	100.0	100.0	100.0
pedagogical	11.8	12.3	11.8	11.2
arts	1.4	1.5	1.6	1.8
humanities	8.2	7.7	7.5	7.2
social	13.5	12.8	12.0	11.2
journalism and information	1.1	1.2	1.3	1.3
economics and administrative	23.5	23.2	22.6	21.9
law	3.1	3.1	3.2	3.2
biological	1.9	1.9	1.8	1.8
physical	1.5	1.5	1.5	1.5
mathematical and statistical	0.9	0.8	0.9	1.0
information technology	4.6	4.3	4.0	4.0
engineer and technical	6.9	6.8	7.2	7.7
production and processing	3.2	3.3	3.5	3.6
architecture and construction	3.6	3.9	4.2	4.7
agricultural, forestry and fishing	1.8	1.7	1.5	1.4
veterinarian	0.2	0.2	0.3	0.3
medical	6.1	6.7	7.2	7.2
social welfare	0.2	0.3	0.3	0.4
services for people	3.9	3.7	3.6	3.5
transportation services	0.9	1.0	1.0	1.1
environment protection	1.4	1.4	1.5	1,6
protection and security	0.4	0.8	1.5	2.3

Source: *Higher-education institutions and their finance in 2011*, GUS, Warsaw 2012, p. 32; *Higher-education institutions and their finance in 2010*, GUS, Warsaw 2012, p. 29.

Although a lot has been said about the growing importance of engineer and technical fields of study, there are very few graduates in them. In the academic year 2010/11 engineer and technical fields of study were the second, just after the medical ones (growth by 1.8 percentage points) that experienced the highest growth (by 0.9 percentage point to 5.7%). However, the proportion of graduates in these fields to the total number of graduates is symbolic.

What seems interesting in this context is the findings of the survey *Studia wyższe – dla kogo, po co i z jakim skutkiem* (*Higher Education – for whom, why and what result*) which was conducted by CBOS (Public Opinion Research Centre) in June this year. They show that 64% of respondents think that higher technical education improves the chances of finding a job. Moreover, the findings support the popular opinion about the disappearing elite character of education at higher-education institutions. As many as 78% of those surveyed state that higher education in Poland is on a mass scale and accessible to everyone. Also, 93% of those who hold a degree share this belief. Over half of the people asked think that having a diploma is not of great value on the labor market, which is often supported by both those who have such a diploma, managers who participated in the survey and students themselves. Also the findings of the international survey *Pierwsze kroki na rynku pracy* (*First Steps on the Labor Market*) show the necessity of changing the curricula in order to adjust them to the labor market needs. The survey was conducted again by Deloitte and Warsaw School of Economics in chosen countries of Central Europe in 2013. Another research report *Studenci – przyszłe kadry polskiej gospodarki* (*Students – Future Staff of the Polish Economy*) presents similar findings in this respect.

The amended *Higher Education Law* is to be the answer to the problem of the curricula which are not adjusted to the needs of the economy. Under Article 13 one of the basic tasks of an academic institution is "to educate students so that they gain and improve knowledge and skills necessary for work". Also, it is obligatory for an academic institution to monitor the graduates' careers so as to adjust fields of study and curricula to the labor market needs. Monitoring should take place immediately after graduation and, especially, after three and five years after it. Careers service is to play a big part not only in monitoring graduates' career paths, but also it is to be a link between students and graduates and the labor market. On the one hand, careers service should help students find a job after graduation or during studies [4]. On the other hand, its task is to establish and maintain contact with entrepreneurs in order to bridge the gap between the academic world and employers in connection with the issues concerning employment and the labor market.

Another step taken to adjust curricula to employers' needs is the participation of outside stakeholders in the process of their design and reform. Thus, a curriculum should include, apart from monitoring the graduates' career paths, the results of the analysis of the coherence between the anticipated educational outcomes and the labor market needs.

4. Conclusions

Massification of studies, which has been observed over the past years, casts doubt on the quality of education at higher-education institutions, including the adequacy of their offer for the needs of the labor market. The above-mentioned findings of the research clearly indicate that there is no coherence between the offer of higher-education institutions and the needs of the labor market. The main reason is surely the imperfection of the system, which was 'indifferent' to the development of fields of studies, without paying attention to their adequacy for the needs of the economy.

What is also significant is candidates' the choice of fields of studies. This is the outcome of many factors, for example, candidates' interests, the offer of a higher-education institution, the distance between home and the academic institution or candidates' abilities to take up particular studies. However, what is intriguing is how conscious young people are when they decide to take up studies which are thought to put them at risk of unemployment.

Another reason can be the changes happening both in the economy and in enterprises, which cause curricula to become soon outdated. This issue is often mentioned as an explanation why adjusting educational offers to the needs of the labor market is impossible.

In conclusion, in the context of the problems discussed in the paper, it is worth pointing out the social and economic aspects of the functioning of higher education institutions. These aspects have dominated the discussions about human resources and the investments which aim at their developing. The discussions concentrate on the thesis that "the effective development of human resources is connected with such supply of well-educated specialists that suits the needs of economy, culture, education system and education itself" [2].

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WHAT WAS NOT RESOLVED
BY THE ANTI-CRISIS STRATEGIES
IN THE EUROPEAN UNION

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Abstract. *Any economic crisis, where it manifests, involves a forced rebalancing of existing economic conditions at one point. From this perspective, the crisis can be seen as a natural reaction of markets correcting imbalances created by factors that often are closely linked to macroeconomic policies. In this sense we can see the crisis as an opportunity to learn how to correctly manage economies both at national and international level. This paper is an attempt to draw attention to some of the global economic problems, highlighted by the crisis and still unsolved due to various reasons.*

Keywords: *economic crisis, anti-crisis measures, global economy, macro-economic imbalances.*

JEL codes: E44, Q54, E43.

1. Introduction

The European Union has experienced the most recent global financial and economic crisis. As any economic crises that occurred throughout history, this economic crisis has forced some adjustments to restore those natural economic balances that were disrupted by various factors.

It's hard to say how many of the major players of the economy this crisis surprised. At least in European countries, where the economic crisis has made its presence felt after her debut on the American continent, we can say with reasonable certainty that it could have been anticipated. However, at least in words, many policy makers seem to have chosen to ignore this reality looming ever more clearly. If we look at statistics from that time, indicating how much dependency exists between European and U.S. economies and highlighting the local vulnerabilities existing at the

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onset of the crisis, we can easily see that it was impossible for the EU to not feel the effects of such global crises. The explanation for the reluctance of some to announce it can be explained by trying to diminish the feeling of panic or by trying to hide their incapacity or inability to prevent and combat this unwanted phenomenon.

The article is structured in five chapters. Chapter 2 deals with distinct issue of financial regulation in the European Union. It is important to note that both the U.S. and Europe economic crisis originated in the financial sector. This particular sector is one requiring more regulation, given the magnitude of adverse effects that failures of major financial intermediaries may cause on the whole economy. Chapters 3 and 4 relate to other issues in the European Union that stressed the negative effects of the financial crisis of 2008, in particular the issues related to fiscal policy and the large discrepancies between Member States and macroeconomic vulnerabilities. It is particularly important to understand what problems were solved and what remains to be done in order to avoid future crises and to be one step closer from the dream of a strong and united Europe. The last chapter is dedicated to conclusions.

2. Financial regulation

The financial sector is of particular importance for the economy because it provides the transfer of resources in an economy. For this reason, most of the problems in the financial sector are transferred very quickly throughout the economy. This is the mechanism through which a financial crisis turns into an economic one. An important vulnerability related to the financial systems faced by countries around the world refers to their enormous size. A highly developed financial system is not necessarily a bad thing, but it is a very serious argument for the need of proper regulation. The graph below illustrates, for selected Member States and EA18, the size of the financial system calculated as ratio of total liabilities of financial sector in the total GDP. One can easily see that the situation has not changed significantly in the European Union since the beginning of the financial crisis. Virtually all EU states have tried to save their institutions through measures that ensure liquidity in the system. The

chart below can give us an idea of how difficult it can be for the state to intervene in the field of financial sector.
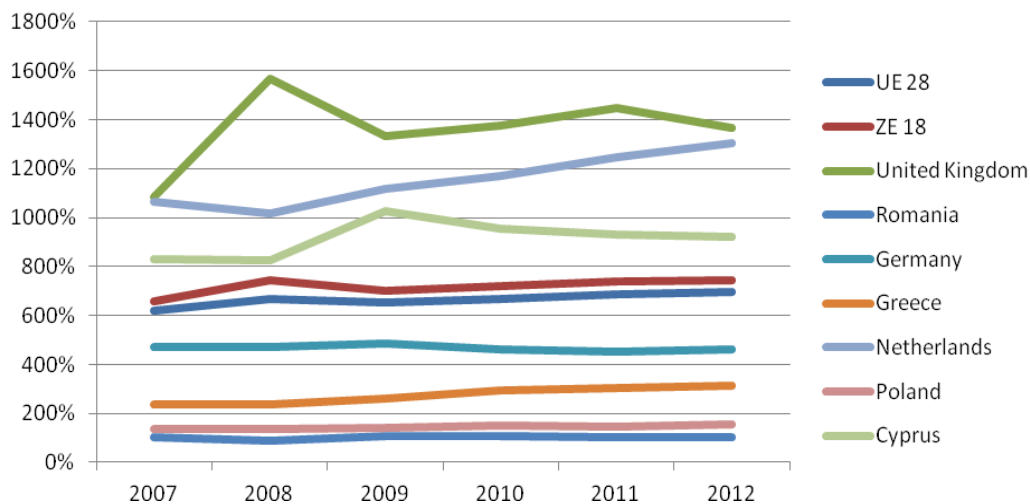
Chart 1. The share of financial sector liabilities in total GDP (%)
– Unconsolidated data –

Source: Eurostat

    Regulation of the financial system must be adapted to the specific conditions of each economy and made in such a way that it doesn't inhibit the specific feedback mechanisms of free markets. An over-regulation entails many problems, the most important being caused by the fact that a mistake from the center is transmitted throughout the system without the chance of being corrected by the individual decisions of players in the market. Certainly any regulatory authority in any field should consult before taking a position with all parties concerned by that measure. However the problem still remains.

    In the European Union the financial crisis was installed through two main channels. There were loans too easy granted in some Member States, a fact that is due to inadequate prudential regulations in those countries. But the main cause of the financial crisis in Europe was the financial instruments purchased by European banks from the U.S. markets. The financial crisis was felt soon after the fall of these markets. Management practices of banks on the old continent proved to be too reckless in their behavior of risk taking. Unable to lend as easily as in the U.S., but being attracted by the huge profits and bonuses in the US, they somehow managed to import a large part of America's financial problems.

No doubt this damaging behavior is largely due to specific corporate governance of European banking systems. Here arises the question whether the state should intervene in corporate governance in private companies. Until the financial crisis, the opinion supported by the majority of economists and macroeconomic policy makers was that corporate governance should remain the sole responsibility of shareholders. This is one of the ideas that the crisis seems to have changed. Currently, the European Union is implementing a series of measures to improve the quality of corporate governance in the banking systems. If these measures are properly implemented, this is one of the issues that can be considered solved.

However corporate governance is not the only problem of financial sector regulation. First, it is important to note that banks are only a part of the entire financial sector of an economy. This sector also includes insurance companies, pension funds, various other investment funds, leasing companies and other entities with a role in financial intermediation. In our opinion, one of the problems with financial regulation is that it is not uniform across the entire financial sector. Banks are the most heavily regulated because they invest money from attracting deposits, guaranteed to a certain limit and with "zero" risk normally considered by many. The policy of commercial banks has also an important role in the evolution of broad money. Both the U.S. and European Union financial problems came also from other financial intermediaries than commercial banks, the crisis highlighting the strong links between different types of financial institutions. In these circumstances, it is very important for the competent authorities to extend the measures to improve corporate governance across the financial sector.

Another welcomed initiative in European regulation of the financial system was the lack of standardization in all Member States. The idea of creating a single system of prudential supervision is a good one because the recent crisis did not care about any border and some Member States were forced to intervene on behalf of others to maintain overall stability in the European Union.

An unsolved problem globally, not only in the European Union, is the need to inventory all financial instruments and to keep only those that are useful. We don't have to see anymore similar tools to those mortgages backed securities (MBS), with extremely attractive yields.

3. Issues of fiscal nature

The reason that the financial crisis installed so quickly in Europe and was so hard felt by its residents was that it overlapped on some internal problems related to fiscal discipline in almost all Member States.

The mechanism to ensure fiscal discipline in the European Union before the crisis was the Stability and Growth Pact (SGP). The agreement involves monitoring Member States fiscal policies by the European Commission and Council of Ministers, and issuing annual recommendations for political action. When a Member State violates the maximum levels established (public debt to 60% of GDP and a budget deficit 3% of GDP), an excessive deficit procedure (EDP) through which the Member State receives some recommendations to correct imbalances. Otherwise financial sanctions could follow. The main purpose of the pact was to ensure the primacy of fiscal responsibility, and limit the ability of governments to exert inflationary pressure on the European economy. However, pre-crisis reality shows that this mechanism does not work, Member States often violating the limits. More serious is the fact that states did not all equally violated these limits, thus creating issues including monetary policy in the euro area (it must be synchronized with the tax).
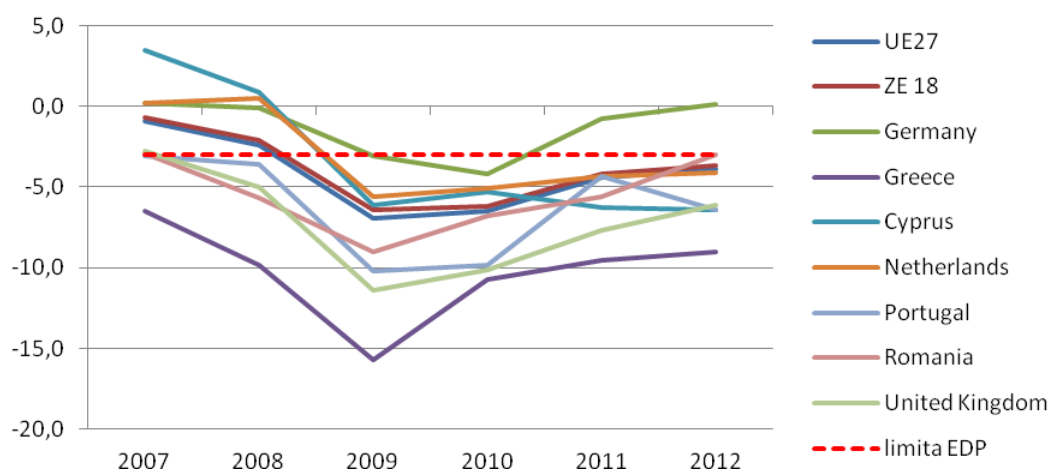
Chart 2. Percentage of budget deficit in total GDP (%).

Source: Eurostat
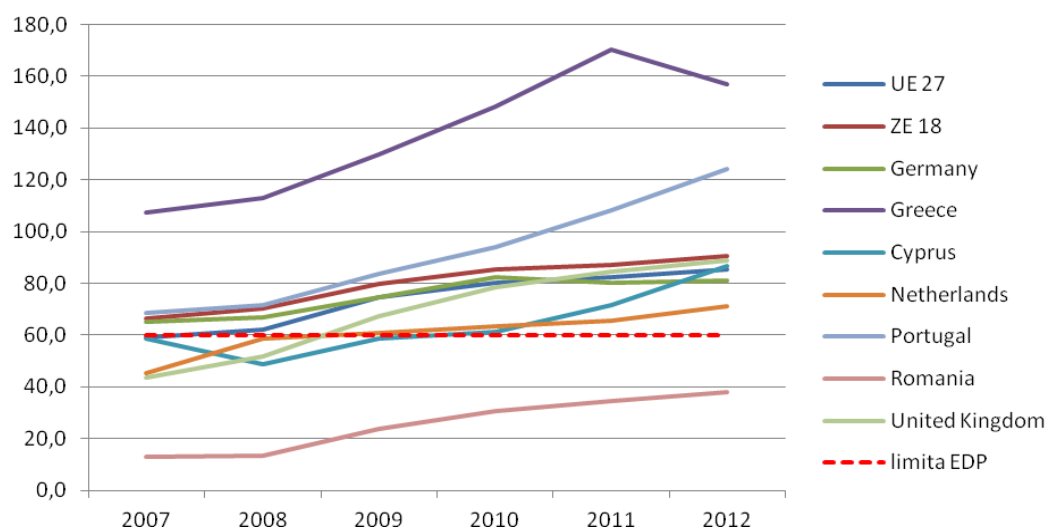
Chart 3. Government debt in total GDP (%).

Source: Eurostat.

The two charts above illustrate the total lack of fiscal discipline in the European Union. The result of these decisions was that in 2008 governments were not prepared to face the financial crisis. The crisis has only served to deepen these problems. Public debt has increased steadily in 2009-2012, reaching the EU-27 about 85% of GDP. However it can be said that something was slightly improved, that most states have reduced their budget deficits since 2008. Nor would it be beneficial forcing short-term public debt reduction because it would mean practically freezing public investment in some areas of utmost importance such as education or the environment protection. This is not a problem to be solved overnight. However the EU should require Member States which exceed those limits to have a concrete medium and long term strategy to reduce public debt and to not increase this indicator further.

In our view, including the limit of 60% of GDP should be reconsidered. The mere assumption of some limits that are breached year after year only produce effects on the bureaucracy in the EU Commission and undermines the credibility of the entire fiscal policies. At least in a medium time horizon, we believe that the share of public debt to GDP limit may be increased.

4. Large discrepancies between Member States

Perhaps one of the biggest European problems is related to the large discrepancies between Member States. This phenomenon is best explained by differences in per capita GDPs. Chart 4 illustrate this indicator. It is noted that recent entrants such as Romania have a real GDP per capita below 25% of the European average and below 20% of that of highly developed countries.
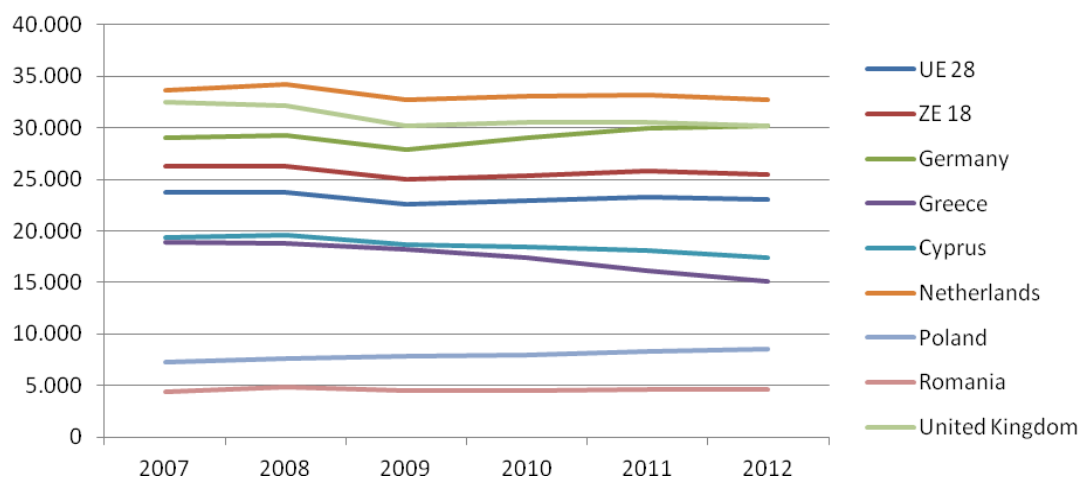
Chart 4. The evolution of real GDP per capita in selected member States
(EUR million)
Source: Eurostat.

The solution to this problem continues to be the mechanisms of social cohesion through EU funds. From the above graph we can tell that the differences throughout the financial crisis were largely preserved. Ideal would be to have a clear trend of states with low values to approach medium. But social cohesion is a lengthy process. In our opinion, this process should be accelerated as much as possible by the Member States in view, considering also the geopolitical issues from the eastern border of the European Union.
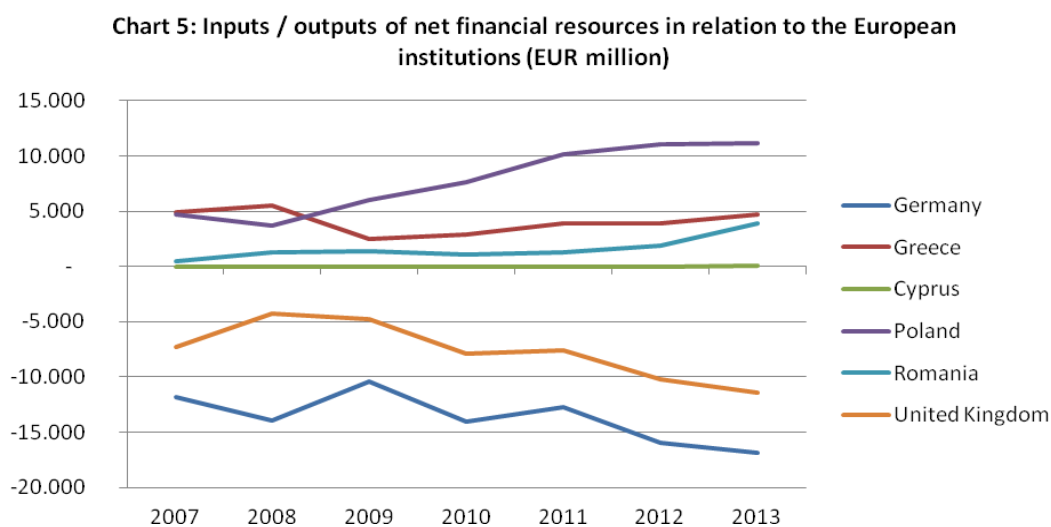
Chart 5. Inputs/outputs of net financial resources in relation
to the European institutions (EUR million).

Source: Eurostat.

In this last chart we tried to illustrate the magnitude of the catching up process by the net inflows of financial resources from selected Member States and European institutions. For the most part, the amounts received by countries consist of European funds and the amounts paid represent their contributions to the EU budget, in various forms.

5. Conclusions

Even if we still feel the effects of the crisis erupted in 2008, the European Union seems to have overcome this moment. Lessons that are emerging from this crisis but do not seem to be fully understood by policy makers.

Regulatory measures implemented are good, but not enough. Still financial instruments are traded on exchanges and those who buy do not know many details about them. The possibility of erroneous calculations with huge losses for large financial intermediaries exists. However, changes in corporate governance have produced significant changes in the behavior of financial managers.

The biggest problems remain fiscal discipline and large disparities between countries.

A good thing that seems to have brought the financial crisis is the idea that in order to have a future Europe must be united, because the rules

are always made by big players. At least in the area of regulation and prudential supervision things seem to be under implementation.

The developed countries should continue to support the process of catching up for the new entrants, who must close the economic gaps and continue to maintain prudent fiscal policies. This can only be achieved by making full use of all opportunities for growth and development.

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ENDO-AND EXOGENOUS DETERMINANTS OF THE PROVISION OF WATER AND SEWAGE SERVICES IN POLAND

Luiza MAŃKOWSKA-WRÓBEL[*]

Abstract. Water and sewage services as a public service of technical nature are provided in natural, local monopoly. It is related to the specificity of provided services, complicated technical infrastructure and high capital intensity. The main aim of this article is to present ongoing changes in the approach to the water and sewage services and the main determinant of running water and sewage business in Poland. The article discusses the basic legal, organizational, and economical determinants in this scope. The attention was also paid to the most common abnormalities which occur in the market of water and sewage services, concerning the protection of competition and consumers. The analysis was based on publications concerning the water and sewage sector and data from the Central Statistical Office and the judicature the President of the Office for Competition and Consumer Protection.

Keywords: *water and sewage services, municipal services, natural monopoly.*

Code JEL: 112.

1. Introduction

The period of political transformation and accession of Poland into the European Union contributed to the changes in the sector of municipal services linked to fulfill collective needs of society. Those changes are clearly noticeable in the field of water and sewage services.

Before 1980 in Poland there were 50 large single – line, state water and sewage enterprises, 80% of which had voivodeship or regional range. At that time organizational and legal determinants allowed the bodies of state administration the freedom with decisions related to fees for water and discharge of wastewater. Greater investments were planned at the central level and financed from the state budget [1, p.723]. The trade was dominated by the

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"engineering" approach, which was focused more on technical solutions and growth of production than on economic rationality and the level of provided services. After 1990 the water supply and wastewater discharge were considered as tasks owned by the borough. The process of decentralization and communalization of large voivodeship enterprises has begun. Boroughs and newly formed units deal with water and sewage services did not have enough resources to introduce essential organizational changes. Currently, the major challenge for the trade is to adjust Polish water and wastewater management to European Union standards.

The article presents the most important determinants of endogenous and exogenous implementations of water and sewage services in Poland. The attention mainly focuses on legal, organizational and economic determinants. General characterization of the economy of the water and sewage management in Poland was based on the data from statistical year books of the Central Statistical Office. Data concerning basic sources of financing for the development of water and wastewater management as a part of the National Program for Municipal Wastewater Treatment comes from National Water Management (NWM). Basic irregularities were also presented which appeared on the market of water and sewage services, which were the basis for the intervention of the Office for Competition and Consumers Protection.

2. General characterization of the sector
of water and sewage services in Poland

Polish territory is 322 575 km^2. The area has 38.5 million inhabitants. The average population density in Poland is around 123 inhabitants /km^2. 99.7% of Poland is in the drainage basin of the Baltic Sea, 0.2% in the drainage basin of the Black Sea and in 0.1% in the drainage basin of the North Sea. The main rivers which drain waters from Poland to the Baltic Sea are Vistula and Oder. The basins of these rivers comprise 87.9% of Poland.

In the last couple of years in Poland undoubted progress occurred in the field of water and sewage management and water and wastewater management. According to the year book of the Central Statistical Office "Environmental Protection" 2012, 2013 [11] collective water supply systems – waterworks systems – in 2011 services 95.4% of the population and collective wastewater discharge systems – sewerage systems – 63.5% of the population and 87.0% of the urban population and 27.8% of the rural population. Basic data concerning water and wastewater management in Poland are presented in Table 1.

Table 1.

*Basic data concerning collective water supply
and collective wastewater discharge in Poland*

Specification		Years					
		1995	2000	2005	2010	2011	2012
Total population of Poland	in thous.	38284	38254	38157	38529	38538	38533
Total number of cities	-	860	880	887	903	908	908
The rural population	thous.	23675	23670	23424	23416	23386	23336
Water consumption for needs of the national economy and population for the purposes of operating the waterworks	hm^3	*	*	2105,2	2062,4	2033,0	2030,8
Domestic water consumption in house-holds during the year	hm^3	*	*	1219,4	1197,9	1202,0	1200,5
Domestic water consumption in households during the year per 1 inhabitant in the cities	m^3	*	*	37,2	35,0	34,8	34,5
Industrial and munici-pal wastewater dis-charged into water or into soil discharged by sewerage network	hm^3	*	*	1273,6	1287,8	1258,8	1248,8
The length of waterpipe network in the cities	thous.. km	*	*	54,9	61,0	62,0	63,1
The length of waterpipe network in the countryside	thous. km	*	*	190,7	211,9	216,3	220
The length of sewerage network in the cities	thous. km	*	*	43,3	51,9	54,2	55,8
The length of sewe-rage network in the countryside	thous. km	*	*	36,8	55,6	63,5	69,8
Waterpipe connec-tions to residential buildings in the cities	thous.	*	*	1757,1	1910,7	1952,3	1990,6
Waterpipe connections to residential buildings in the countryside	thous.	*	*	2752,1	3036,7	3110,7	3186,6
Sewerage connections to	thous.	*	*	1156,5	1412,7	1478,4	1529,5

residential buildings in the cities							
Sewerage connections to residential buildings in the countryside	thous.	*	*	598,0	906,3	1015,5	1102,9
Number of cities equipped with waterpipe network	-	854	877	886	901	906	906
Number of cities equipped with sewerage network	-	793	845	881	898	905	906
Number of cities served by wastewater treatment plants	-	643	801	857	873	901	903
Population in cities served by waterpipe network	%	91,1	91,7	94,9	95,3	95,4	95,4
The urban population which uses sewerage services	%	81,9	83,0	84,5	86,1	86,7	87,0

Source: Yearbook CSO 2012, 2013; Yearbook of the Central Statistical Office *"Environmental Protection"* 2012, 2013 [10], [11].

In the cities the development of sewerage systems generally follows with the development of the public water supply systems, however in rural areas observed essential differences in this aspect. These differences are due to the considerable dispersion of rural buildings: 15.1 million of the rural population lives in more than 40,000 villages. Due to technical and economic prejudge about the need for individual solutions to wastewater discharge and treatment to the extent that ensures adequate protection of the environment.

Reducing the amount of pollutants entering the water saw a noticeable improvement of water quality in rivers and lakes.

3. Basic regulations and rules for the provision of water and sewage services in Poland

The basic legal act which is establishing a framework for Community actions in the field of water policy of European Union is called Directive of the European Parliament and of the Council 200/60/EC of 22 December 2000, commonly known as the Water Framework Directive (WFD) [7]. It

introduces an integrated water policy which is aimed at inter alia, to provide people, access to clean drinking water which will enable economic and social development at respecting the needs of environment.

Transposition records of WPD to Polish legislation occurred through the Act of June 7, 2001 for collective water supply and collective sewerage discharge [9], [10]. It specifies:

- the terms and conditions of collective supply of water intended for human consumption and for collective wastewater discharge;
- business practices of water and sewage enterprises;
- the rules for creating the conditions to ensure continuality of supply and proper quality of water; reliable wastewater discharge and treatment and also protecting the interest of recipients of services with taking into account the requirements of environmental protection and optimization of costs.

The Act also includes conditions that must be practiced by water and sewage enterprise and by the recipients of water and wastewater services. The Act regulates the rules for determining the tariffs for collective water supply and wastewater discharge. It assumes, among others: the annual period during which the tariffs are valid and calculation of tariffs based on the essential amount of income after (their) the allocation to individual recipients groups of services taking into account the costs associated with the provision of services in the previous financial year, changes of economic conditions, conditions of providing conditions and costs resulting from the planned capital investments.

4. The specificity of the market of water and sewage services

The needs expressed by the society are implemented by goods and services. The natural features of certain needs can be fulfilled only in collective manner. An example of these types of needs may be: public safety, national defense, the use of public needs, sanitation, water supply and wastewater discharge and others. The greatest importance in meeting the collective needs has public services which are very broadly defined [6, p. 71]. Provision of public goods and services can be fulfilled by both the public sector as well as the private sector. The funding of public services occurs in total or partial with the use of public funds.

Collective water supply and wastewater discharge – services provided by water and sewage units in Poland are considered as an example of a natural monopoly network. This kind of monopoly is local because actions connected with waterworks, water supply, sewerage and wastewater discharge in Poland are the tasks of borough. Boroughs can delegate its tasks in the field of water supply and wastewater discharge to specialized units, namely water and sewage enterprises.

The provision of services in terms of network monopoly is characterized by [5, p. 17]:

- continuity and universality of the provision,
- universality of access, satisfaction of the public needs,
- indivisibility of technical infrastructure solutions and high capital intensity of the investment cycle,
- contemporaneity of production, delivery and consumption,
- significant differences at the time of demand for services,
- low elasticity of demand with respect to price.

Furthermore, about specific features of monopoly – considering the specific nature of the goods found in the sphere of services related to the water supply – decide, among others: the lack of any substitute of water used mainly for household as well as manufacturing processes and a highly limited ability, to use one common network for transferring products by different manufacturers.

5. Changes in management of units that provide water and sewage services

Although the operation of the units which deals with water and sewage services is done in conditions of a natural monopoly, like any organization they have their various "external shareholders" who feel the consequences of actions and are really interested in the results. The influence of various interest groups on the organization which deals with water and sewage business is shown in Figure 1.

People who run public organizations and those whom belong municipal utilities, must cope with the implementation of multiple objectives – often political, to satisfy various stakeholder groups (especially external). Without their support the public organizations cannot exist.

Figure 1. The influence of various interest groups
on the organization which deals with water and sewage business.

The interaction between the unit deals with the activities of water and sewage sector and the various interest groups can be seen in several aspects [4]:

- economic and financial aspect of the business units of water and water and sewage sector which should be effective, profitable and the funds saved as its result should serve the development of the unit, modernization of the network and investments in water and sewage equipment and modern technologies;
- aspect of ownership conditions, management and control of local government units;
- the social and economical aspect concerning the final client.

Polish adaptation of water and sewage utilities to European standards is not only associated with the expansion and modernization of the network or the introduction of modern equipment and technology. It is also important to modernize and improve the activities in the sphere of unit management.

In recent years there has been a positive return in current, fairly conservative and not very dynamic engineering system which runs waterworks utilities. We can notice the tendency to look for more efficient and more modern ways of management. Partly it is due to the requirements of legal norms, the need of preparation appropriate analysis, planning renovation and modernization activities according to the expected level of revenues and costs as well as the need to search external funds for investments.

Great importance has also been placed on the growth of the quality, awareness and knowledge of company's management and contacts with utilities and consultants both national and international. A direct consequence of better management is the increase of interest in raising the qualifications of employees which decide about the level, quality, efficiency and culture of the organization, which is the company.

Moving away from the typical monopolistic position towards customers is another important element of the changes in the culture of the organization of water and sewage utilities. Creation of customer service offices not only increases the efficiency and the quality of the service, but primarily it creates a positive image of changes and attitude of the natural monopolist to the surrounding reality and builds public trust to waterworks enterprises.

Modern computer software and information systems allow for the collection and processing of data about the state of operating systems, parameters of devices which characterize the level of provided services, costs incurred within the business and the revenues from activities of the units. They can be a great tool for supporting the process of management and implement the supervisory functions by the owners.

6. Level of the prices and the rules for determining the tariffs for the water supply and the collective wastewater discharge

In accordance with the regulations of the Act concerning collective water supply and collective wastewater discharge, which were previously

discussed, the amount and types of charges levied by the water and sewage utility for the service rendered to customers indicates the tariff. According to the statutory definition it is a publicly announced statement of prices and changes for collective water supply and collective wastewater discharge, with the conditions of use.

Water and sewage utility determines the tariff for one year on the basis of the necessary revenue. To determine the necessary revenue, what must be taken into account is: the costs associated with the provision of services incurred in the previous financial year, which were determined on the basis of the accounting records including planned changes in those costs in the year during which the tariff is in force. Next to be taken into account is: changes of economic terms, the size of services and terms of provisions, costs resulting from the planned capital expenditures based on the plan of development and modernization of waterworks equipment and sewage treatment.

Provision of waterworks and sewerage service is characterized by a high ratio of fixed assets of the individual water and sewage unit to the annual operating costs, co called capital intensity. Capital intensity is closely linked with the ability to conduct own development policy and modernization of the infrastructure by water and sewage unit. Prices for water must take into account the necessary investments in this sector. Improvement of water quality requires, at least partial repair or replacement of old water supply networks and the rising costs of the expansion and modernization of wastewater treatment plants, water treatment plants and water and sewage networks have influence on increase of the amount of tariffs for water supply and wastewater treatment services.

Prices and rates specified in the tariff are differential for individual tariff groups of recipients of the services, are documented on the basis of documented differences in the costs of collective water supply and collective wastewater discharge. The fee for water supply and wastewater discharge shall be determined by multiplying tariff prices and rates, as well as they correspond to the quantity of provided services. The price, mentioned earlier in the regulation, is defined as the amount expressed in monetary units, which the recipient of service is liable to pay to water and sewage utility for 1m³ of discharged wastewater.

Table 2.

The prices of water and wastewater in Poland. Selected statistical results based on data obtained in the survey on 1-30 March 2013 (in PLN).

Description/ recipient of services	Households		Industry (production)		Services including trade		Public investments	
	for water	for waste-water	for water	for waste-water	for water	for waste-water	for water	for waste-water
Numerical amount of the test	241	243	221	227	207	207	241	243
The average value	3,91	6,28	3,88	6,60	3,90	6,16	3,91	6,28
The maximum value	15,64	34,27	8,21	18,40	8,21	18,40	15,64	34,27
The minimum value	1,85	1,78	1,85	2,33	1,85	1,78	1,85	1,78
Price range	13,79	32,49	6,36	16,07	6,36	16,62	13,79	32,49
Median	3,60	5,49	3,70	6,03	3,73	5,78	3,60	5,49

Source: Chamber of Commerce "Polish Waterworks" (http://www.igwp.org.pl/ infor-macje-ekonomiczne).

According to data published by the Chamber of Commerce "Polish Waterworks" (CCPW), the average price for water supplied to households in Poland in March 2013 was amounted to 3.91 zl, while the average price for discharged wastewater from household developed at the same period at 6.28 zl. Data concerning the average price for water and wastewater in households, in industry and services are presented in Table 2.

7. The major sources of financing development of water and sewage infrastructure

Construction, expansion and modernization of water and wastewater management is the responsibility of municipalities, financed from their budgets with the possibility of assistance from European Union and national environmental funds. Municipalities are responsible for the

amenities of the agglomeration in the collective sewerage system and wastewater treatment plants with a suitable degree of purification. When agglomeration is located in an area of several municipalities, the municipality may conclude inter – municipal agreements relating to, among others, entrust one of their duties to other municipalities.

In Poland, the National Program for Municipal Wastewater Treatment (NPMWT) is a program aimed at coordinating the activities of municipalities and water and sewage utility in the construction, expansion and modernization of sewer and wastewater treatment plants.

In order to obtain funding by municipalities for investment concerning wastewater management from environmental funds and EU funds is their inclusion in NPMWT. It should be emphasized that the implementation of NPMWT is the most expensive task among all the tasks arising from EU directives in the field of environmental protection. Particularly important in its implementation is the financial support from EU funds.

Comparing actual costs incurred during the realization of NPMWT in period of 7 years (2003-2010) in the amount of 33 782 670 thous. zl, with the projected cost of the project IV updates NPMWT till year 2015 i.e. 37 530 863,6 thous. zl, we see that the financial challenge facing Poland for the years 2011- 2015 is huge.

Funding of investments related to water and wastewater management in Poland since year 2004 is carried out with significant share of EU funds. To 30 December 2011 a total investment worth 32.9 billion zl was made, involving 19.3 billion zl funds from the EU, including:

- from 2004-2006 – projects worth 15.6 billion zl, involved 10.2 billion zl of EU funds;
- from 2007-2011 – projects worth 17.3 billion zl, involved 9.1 billion zl of EU funds [project IV NPMWT].

The programming period 2004-2006 – pre-accession funds were derived from the following funds: the European Regional Development Fund – Integrated Regional Development Programme, the Cohesion Fund (ISPA), the European Agriculture Guidance and Guarantee Funds – funds for private farming.

The programming period 2007-2013 includes funds from: the European Regional Development Fund – Regional Operational Pro-

grammes of individual voivodeship, the Cohesion Fund – Infrastructure and Environment Programme. Only with these two major sources were subsidized projects worth 31.9 billion zl in the amount of 18.9 billion zl.

Presented value of projects and refinancing does not include funds from: the EEA Financial Mechanism, The Norwegian Financial Mechanism and the Rural Development Programme.

National measures including those from the National Funds for Environmental Protection and Water Management to implementation of tasks in the field of water and wastewater management in Poland between years 2004-2011, stood at 18.5 billion zl and were only preferential loans.

8. The most common anomalies
in the water and sewage market

Analysis of the case – law of the President of the Office for Competition and Consumer Protection (OCCP) concerning the functioning of water and sewage utilities and international comparisons which were made, show that the functioning of water and sewage sector, both in Poland and in many other EU countries, generic problems and is the object of various government interventions.

In the water and sewage sector, in the field of the protection of competition, the most important thing is the prohibition of abuse of dominant position. If water and sewage utility do not have any competition, they can fracture above prohibition by using their economic advantage over contractors to enforce them to unfavorable contract term, as well as to block competition in the markets related to the collective water supply and collective wastewater discharge markets [5, p. 73]. Another frequently observed abnormality is unlawful charging of customers by costs of buildings some networks. In accordance with regulations they have the obligation to finance only the construction of connections and space where the main water meter and the measuring device should be located. Very often however, contractors are charged with additional costs, which do not arise from the law.

A large number of violations are consequences of efforts that water and sewage utility makes to protect its own interests. However, very often, water and sewage utility makes it with violation of applicable laws. An

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example of such behavior can be disabling the responsibility of water and sewage utility for the deterioration of the service quality caused by certain events or penalties determined for damage of the measuring device. Among the analogous behavior the following should be mentioned:

- making the verification of the correctness of the main water meter at the request of a recipient of services from the recipient to pay the deposit as a whole cover of the costs of such action;
- imposing recipients the obligation to cover the cost of replacement or repair the water and sewage equipment or measuring device in the case of damage. The recipient is not required by law to cover the costs of that;
- forcing customers to less favorable terms of payment than those restricted by regulations, in particular a shorter period of payment or contribute additional safeguards;
- restrict the possibilities to dissolve the contract and cut water supply if the recipient is not eventuate from the contract.

These behaviors are the instances of imposing onerous terms which bring the water and sewage utility unjustified benefits.

A common abnormality is exclusion, by traders of their own responsibility for interruptions in water supply. By law, the entrepreneur is responsible for the situation which was caused by his fault and is obliged to repair the damage resulting from his actions or omissions.

Another common mistake is the method of determining the charge for levied water in case of loss or damage to the water meter because of the recipient's fault. In such situations, the entrepreneur should demand payment for the water that was actually levied. When you cannot accurately measure the amount of levied water, then it should be determined on the basis of the average consumption in the last three months when the water meter was working properly or alternatively on the basis of the average consumption in similar period from the previous year.

The irregularities found by the OCCP also apply to situations in which the municipalities or utility companies solve contracts with consumers, thereby ceasing to provide services. May do so in four cases: the unlawful implementation of connection, lack of payment for two full accounting periods counted from the date when the consumer received the

reminder, illegal consumption of water and in situations when the quality of implemented sewerage did not meet the legal requirements or the damage was found or omission of the measuring device.

Monopolistic positioning of water and sewage utilities enables them to impose the unfair prices to customers. These types of violations are very rare because it is extremely difficult to make it clear whether the specified price is unfair. However, the water and sewage sector precise tariff regulation, which – taken as a reference point – make it easier to define unfair prices. In particular, will be the prices which are not determined in accordance with applicable law or in other way they infringe the principle of the equivalence of benefits to the determinant of at least part of the recipients [5, p. 87].

Decisions regarding the water and sewage sector were accounted in some years nearly half of all decisions issued by OCCP, on average accounting for about one-third of all decisions concerning abuse of a dominant position. Only in 2013, the President of the OCCP issued 39 decisions related to abuse of a dominant position and 24 decisions concerning the violation of collective interests of consumers, putting more than over 600 thou. zl of total penalty on entrepreneurs to provide water and wastewater receiving.

Conclusions

The last twenty years of providing water and sewage services in Poland is the period which completely changed the face of this sector. Many of the changes are a consequence of the economic reorganisation of the country after 1989. The greatest influence however, was the accession of Poland to the European Union. Poland was obliged to implement EU directives, which resulted in a change of law and a huge demand for investment capital.

A number of problems in the water and sewage sector in Poland is mainly connected with the specific provision of such services and also with the existing regulations, which are not always precise enough to describe the rights and obligations and balance the interests of consumers and producers.

One of the fundamental problems in this market is the fact that the municipality may appear at the same time in two roles: organizer and

supervisor of water and sewage services in its area. In addition, big fragmentation and the ownership structure of water and sewage sector can have a negative impact on the efficiency of its operation. Increasingly, there are calls concerning the consolidation of small utilities and return to regional units. Taking into consideration the very high number of irregularities disclosed during an inspection by the OCCP, also seems necessary the establishment of adequate, separate institution regulating water and sewage operations at the central or regional level.

Despite many barriers and interest of various interest groups, Polish water supply utilities are developing not only by modernizing and expanding machines and water sewage network but also by introducing modern methods of management and customer service departing from the typical monopolistic behaviors.

In addition, high impact to the modernization and development of water and wastewater management has the ability to raise funds from the EU funds for investment related to the implementation of EU directives. The process of modernization and construction of water and sewage infrastructure, which is realized currently in Poland although it is difficult and costly, it brings many benefits. It is expected not only to improve purity of water but also improving the living conditions, health status of Polish society and the rational use of natural resources. It will help to improve the image of Poland in the world in the field of compliance environmental requirements.

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COMPETITION POLICY IN BANKING SECTOR AND THE ECONOMIC CRISIS

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Abstract. *The economic crisis has led to changes not only in the real economy but also in the economic theory. The identification of the factors that generated the economic recession and the measures that should be adopted to minimize its adverse effects are a common concern. The article aims to clarify on the one hand, the extent to which competition policy applied in banking sector contributed to the crisis and, on the other hand, the opportunity for changes in the same policy aiming the economic recovery. Competition policy once reconfigured, it must be carefully implemented given the banking systemic risk and its essential role in the prevention and treatment of crisis.*

Keywords: *competition policy, crisis, rating.*

JEL Classification: E44, G01, G24.

1. Introduction

The recent economic crisis, considered by some economists even more serious than the one manifested in 1930, has rally all the world's governments in looking for solutions to overcome and minimize its negative effects. The emergence and evolution of the crisis, more or less surprising questioned many of the so far economic beliefs and ideals.

The slow response of the economy to the measures taken to combat the crisis gave birth to a series of controversies on how policies should be oriented so that their results manifest in time and efficiently. Certainly, besides the effects of the current economic crisis generated in the financial system and in the real economy, it will also generate a new perspective on business models, policies and measures that provide the best results.

In terms of economic theory, the crisis of 2008 has revived the debate between proponents of state intervention and those who argue that markets alone can lead to prosperity and growth. The lessons and solutions arising

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from these ideological confrontations seem to tip the balance more and more to the need of a more regulated, more controlled system, assigning a central role to the market in the economy but that show that without state intervention markets do not function properly. Market failure requires government intervention, not only when it occurs but also in order to prevent the manifestation of such failures.

The paper is divided in two parts. The first part provides a general overview of the crisis, focusing primarily on the United States of America and Europe while the second part is focused on the competition policy applied both before and post crisis, emphasizing the changes that took place at the level of this policy as a result of the global economic imbalances.

2. A review of the events

The banking systems have suffered numerous shocks over time which led to massive withdrawals of funds and which determinate an imminent bankruptcy of several banks. The biggest economic downturn which occurred in 1930 has outlined an opinion, more or less unanimous among economists, which says that "the thing that turned an ugly recession into the Great Depression was precisely the banking crisis" (Krugman, 2009, p. 180).

Among the solutions adopted then, in order to stabilize the system and to avoid future major imbalances, perhaps the most prominent was the Glass-Steagall Act that separated commercial banks whose main activity refers to making deposits, from the investment banks whose activity did not allow this. Investment bank activities consisted in advisory services, investment management, financing and research. Taking into account the level of risk to which those two types of banks were obeyed, it was also required a differentiated form of regulation. Commercial banks were subject to stringent rules regarding the risks that they can undertake and were able to take loans from the Federal Reserve System (FED), and their deposits were guaranteed. Investment banks instead were subject to less restrictive rules, given that in their case there is no risk of massive withdrawals because these institutions do not constitute deposits. At that time, the new form of organization of the financial system proved to be

efficient keeping, on long term also, the economy away from large scale economic crisis. Therefore, many economists have put the recent economic crisis, to some extent, on account of repeal of the Glass-Seagall Act in 1999. In Stiglitz's view, the main consequence of the repeal of this act consists in a change in the culture of the commercial banking system which determined the creation of more banks too big to fail. The confidence that these banks will be saved in case of a bankruptcy represented an incentive for taking excessive risks in order to obtain high profits (Weissman, 2009).

Looking in retrospective to the events that led to the largest decline of the modern economy, many papers written on this subject provide different answers to the question regarding the causes that led to the manifestation of such failures in the economy. But, in principle, two causes are widely accepted in the literature: the first cause is considered to be banking deregulation that facilitated risks taking by the banks and the expansion of the shadow banking system whose activity was not assimilated to traditional banking activity and for which the regulation was not considered a priority by the authorities. Referring to the shadow banking system to which it was assigned a major responsibility for the crisis, Krugman believes that is necessary that "… anything that does what a bank does, anything that has to be saved in case of a crisis like the banks are saved should be regulated like a bank" (Krugman, 2009, p. 188). The second cause takes into account the excesses, especially monetary excesses. The economic boom manifested in the early 2000s, was achieved also on the background of expansionary policies practiced by governments. For example FED lowered successively the discount rate from 6,5% to 1% between January 2001 and June 2003 (Lin, 2008, p. 2). The low interest rates and the favorable economic context led to a rapid growth of loans, along with an increase in house prices which stimulated even more the granting of loans, especially mortgages.

In the first part of the year 2007, the implications of this excessive consumption on debt became more and more obvious. Although the economic crisis has been, to some extent anticipated, it represented a surprise for most. In September 2006 the economist Nouriel Roubini, in a presentation held at the Internationally Monetary Found spoke about how the economy will evolve in the near future. Although at first no one believed him, a year later his predictions were confirmed. What followed

was a contraction of the economic activity manifested simultaneously in all economic sectors.

On 15 September 2008 Lehman Brothers Holding Inc. went bankrupt, after its takeover negotiations by Barclays PLC and Bank of America have failed. The equivalent value of its assets evaluated at U.S. $ 639 billion, has made it the largest bankruptcy in United States of America history (Onaran and Scinta, 2008). The panic created has spread rapidly throughout the financial system, outside the American borders. In this context, the main problem derived precisely from the relation debtor/creditor. Bank funding has been made, in most cases, for long periods of time by short-term liabilities, which created a high sensibility of the system to massive cash withdrawals. This type of problem has manifested itself much more seriously in the shadow banking system where the deposits did not benefit from hedging expose. The immediate reaction of the banks was to limit the loans, not only the ones given outside the banking system but also the loans given between banks, through this action the effects of the crisis have been transmitted to the real economy and the results were devastating. Many of the companies that did not meet the conditions to qualify for funding from the banks, have closed their activity, while others were forced to pay higher interest. The cessation of firm activities has led to a rise in unemployment, a decline in production and inevitably an increase in the non-performing loans within the economy.

The interconnections of the global banking system have facilitated the transfer of toxic assets in the European states as well, causing serious problems in many of these states. The lax regulation made pre crisis and the important role given to the banking system within the economy has made the cost of saving the financial system even higher. In United Kingdom, Northern Rock, the fifth British mortgage lender faced a typical situation of massive withdrawals of funds from depositors, situation unseen since 1866. The panic was caused precisely by the announcement made by the Bank of England regarding the support given to Northern Rock, which was meant to prevent withdrawals of funds, but the effect was the opposite one. The withdrawals amplified and all attempts to secure control of the situation have failed. The restoration of depositor's confidence was achieved only after they were assured that their deposits were safe (The

Economist, 2007). By early October 2008, United Kingdom was forced to recapitalize eight of its banks. The action was followed by an agreement at the euro area level regarding new liquidity injections into the banking system and providing guarantees for interbank loans, the cost of these actions was around $ 1.3 trillion (Wim, 2009, pp. 3-4).

The overvaluation of housing prices created in Spain as well, a real estate bubble that strongly affected the economy after 2007, along with the collapse of the international markets. The breaking of the housing bubble has affected especially the banks that were holding mortgages and loans to developers. The nationalization of the third bank of Spain, Bankia, in 2012, highlights the risks in the Spanish banking system.

A main problem of European states in the current economic crisis is debt. In Portugal, the increasing debt simultaneous with the economic contraction was the main preoccupation of the government. The inter-connections of the banking system have made many Portuguese companies to be financed by Spanish banks, creating the danger of a domino effect, through which the instable economy of Portugal could cause a deepening of the Spanish banking sector imbalances.

The bank failures have not spared France either, and the governments intervention to save the banks has not delayed. The crisis effects have manifested in all sectors of the economy, the funds reserved for investments were reoriented to support banks, while the decrease in trade and production led to a significant contraction of the gross domestic product in this country as well.

The aggravation of the problems in America and Europe triggered a decline in aggregate demand in all developed and developing countries. Developing countries were facing a decline in capital flows entering the country and in some cases even a reversal of this process, phenomenon produced in 2009 in Romania as well. The lack of funding to support the economy has forced many countries to turn international lenders. These loans have come accompanied by harsh austerity measures.

The increase in magnitude of the global economic crisis and of its negative effects has brought into focus the rating agencies and their lack of performance in identifying and assessing the risks to which the new products of the banks have exposed the economy. The erroneous decisions of the rating agencies have questioned their credibility. In September 2008,

Lehman Brothers went into bankruptcy with an investment rating of level A-. The same rating that insurance company American International Group (AIG) had when it was saved from bankruptcy by the government. In none of the two cases, no error or fraud in the institutions actions were found, that might justify the misinterpretation of the rating agencies.

Nevertheless, some causes of poor performance of these institutions can be identified. These include: conflicts of interest, credit rating agencies were paid by the same banks who's products they were evaluating; oligopolistic market structure of rating agencies, the three institutions Standard and Poor's, Moody's and Fitch have 95% of the market; the inability of the credit rating agencies to verify the information or to require any additional information needed in the evaluation process etc. (Rafailov, 2011, pp. 37-38).

The excessive risks taken by the banks in order to obtain high returns, the failure of rating agencies to assess and warn about these risks and the new policies of the governments, aiming the deregulation of the banking sector, have determined the biggest economic contraction in the last eighty years. The present and future concern should consider the causes and the modalities through which this economic downturn could be overcome and the tools which should be mobilized in order to prevent and stop such failures in the economy.

3. Competition policy and the global economic crisis

The economic crisis has not questioned a bit the general economic principle that competition leads to a more efficient allocation of resources, fosters technological progress and innovation, and leads to an improved national competitiveness as a whole. The doubts about the effectiveness of competition were considering a particular sector, namely the banking sector. The modern financial system is characterized by less competitive environment with large banks, which are highly interconnected and can represent a big problem for the uncertain future of the economy.

The repeal of the Glass-Steagall Act has created the possibility for the commercial and investment banks to unite. This lead to a more complex financial system, expanding the group of products that banks could offer thus creating large institutions whose failure became unacceptable due to

the widespread negative effects that it could produce with direct impact on consumers. The regulation of the financial system had the porpoise to avoid risky behavior of the banks and to ensure financial stability, taking into account the damage that the financial market failure can cause to the economy as a whole. The problems that emerged afterwards in the financial system were not determined by the existence of the regulation itself but by deficiencies in regulation and in the enforcement of the existing rules, which facilitated the transfer of the collapse costs of the financial system from the banks to the consumers.

The engagement of the resources in order to rescue the banks, created an incentive for taking new risks. Given the economic environment and the level of the capital injected into the global financial sector, inevitably comes the question: if banks are too big to fail, and need to be saved, on the taxpayers' expense, why are them let to become so big? The only justification for allowing the existence of such large institutions would be, if they would produce significant economies of scale or scope that would otherwise be lost. In other words, their existence would be justified only if these institutions would be more efficient than the small ones and the reduction of their size would be possible with an extremely high cost (Stiglitz, 2010, p. 165).

The protection granted by the state to these institutions creates an anti-competitive framework in relation to the other banks who do not enjoy the same treatment and who survive because of their effectiveness. This treatment provides to large institutions a competitive advantage, one that is not based on efficiency and performance but one generated by the distortions that government guarantees create.

However, the problems of the financial system are not a strict consequence of the size of institutions but also a problem of the high degree of interconnection between banks. The failure of even a small but highly interconnected institution can cause the same negative effects as the failure of a large institution. Therefore, regulation of the banking system is difficult and specific. Competition policy and the legal framework of the banking sector may be the necessary tool to prevent and combat the problems of the financial system and minimize the chances of new large imbalances in the global economy.

The benefits that competition policy creates are generally more important in times of recession, and the link between competition policy and economic growth should be considered first. The application of efficient competition measures, which prevent illegal mergers between companies or the ones that consider cartels dissolution produce benefits to consumers through lower prices and increased buyer power. However, a competitive environment stimulates firms to innovate, automatically determining an improvement in productivity witch boosts economic growth.

The changes in the economic environment raise new challenges for competition authorities and competition policy. The economic crisis requires adjustment measures to meet the new situations arising. Such adjustments may take into account: temporal adjustments of the measures implemented, so that it could respond to the urgent situations arising; competition policy focus on sectors that directly or indirectly affect household spending to minimize the burden on consumers and the sectors in which competition can increase productivity; supervision of the implementation modalities of state aid (Lowe, 2009, p. 6).

In the context of the global economic crisis, especially in the European Union there have been pressures on the competition rules regarding state aid, to minimize the interference effects and distortions created by liquidity injections in order to support the economies. To this end, the European Commission adopted a Communication to smooth the way for the application of state aid rules for financial institutions receiving assistance from the state. Through this Communication it will be ensured the implementation of measures such as not to create distortions in the common European market.

Regarding the antitrust measures applied in the European Union, there were pressures to relax these measures and to tolerate cartel and abuse of dominant position, where they were needed, but the competition authorities at the level of the Union considered the relaxation of these measures as contraindicated.

Consumer protection must remain a priority for the competition authorities even in periods of economic recession. The crisis cannot be used as an excuse to pass the costs of the recession through cartels or abusive practices of firms that face problems, to consumers (Lowe, 2009, p. 22).

4. Conclusions

Understanding the events that led to the global economic downturn is of particular importance and should consider finding the answer to the question; *why* such events were possible in a system that seemed safe and stable, founded on the lessons of the crisis from 1930.

The economic crisis has highlighted weaknesses in the regulation, the development and the expansion of the financial system has not been accompanied by legislative rules that could limit the reckless behavior of the banks and could guarantee the safety of the population savings. Easing credit conditions and using a deficient economic model which took into account a continuous increase in housing prices led to the collapse of the banking system that brought down with it the entire economy. The negative effects manifested in the real economy were hardly supported by the population, and the costs of recovery can be seen in the high levels of debt and financial deficits held by most states.

But behind the banking crisis, which through various measures and efforts of the governments and states will be outdated sooner or later, another type of crisis is emerging, a crisis of confidence in financial systems and in the economic efficiency of the model followed so far. This type of crisis will be much more difficult to overcome and it will slow down the global economic recovery.

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THE ECONOMY OF PUBLIC-PRIVATE PARTNERSHIPS: LEARNING FROM INTERNATIONAL EXPERIENCE

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Abstract. Many European countries have used the investment model of Public Private Partnership (PPP, P3 or P^3) to implement large-scale infrastructure projects and to accelerate development, but Romania has little experience with such type of projects, although there is a strong economic reason for implementing infrastructure investments, because it can easily be seen the need for investments in this field. This paper is determining the literature review on PPPs, how the regulations of the member states of the European Union is implemented by dedicated PPP units at the national level and, finally, presents the techniques and processes of the contract management. Financing Public Private Partnerships cannot ignore the international economic and financial context. As it could be seen in this paper, the data on PPP market shows that the crisis had a negative impact on their development and implementation at the level of the EU Member States. EU has been promoting PPPs as an important instrument of accomplishing the goals of Europe 2020 strategy. In Romania, the interest in PPPs must be encouraged and the knowledge in this field could increase the administrative capacity of the country.

Keywords: Public Private Partnership, Project Finance, Development, Investment policy.

JEL Classification: H41, J18, L33.

1. Introduction and general data on the European PPP market

PPP projects originate from the financial needs of the public authorities to provide public goods or services at a high quality level. PPP is used at central and local level mainly in Canada, UK, Poland, Czech Republic, France, Germany, Ireland, Italy, Spain, Portugal and most of them have specialized units coordinating the PPP. In 2013, UK was the

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largest PPP market from Europe in terms of value and number of projects, 31 transactions closed (compared to 26 in 2012) for a value of EUR 6 billion (EUR 5.6 billion in 2012)[1]. The next largest PPP value markets were Italy, France, Netherlands, Turkey, Spain, Croatia, Germany, Poland, Ireland, Austria, Belgium, Denmark and Lithuania. The transport section remains the most active in terms of value with EUR 9.6 billion, which represents more than a half of the total market value. This was followed by the: healthcare sector (in terms of number of deals), education, public order and safety/recreation/culture and telecommunication. Although the financial crisis affected the PPP investment sector, the European PPP market showed good signs of improvements in 2013. Public Private Partnerships (PPP) are generally long-term high-value contracts with a high political profile. Many of the PPP contracts fail to ensure Value for Money[2] because of the transfer risks that are an important part of the process that comes out from the complexity of the projects. Value for money means an equitable allocation of risks between the public and private sectors (Grimsey and Lewis, 2000).

According to Prof. Erastus Tarangul Diti, "the state is a bad contractor and administrative bodies lack personal interest to analyze the needs of the citizens and civil servants who receive their regular salaries regardless of performance, it shall endeavor to work in public service the best conditions, but an individual has a personal interest in the proper functioning of the enterprise". Public Private Partnership system currently in place has been shaped since 1980 and took the form of cooperation between local authorities and the private sector to rehabilitate industrial sites and was supported by legal regulations so as to encourage initiative. In Europe, PPP appeared in 1992 in the UK, the PFI (Private Finance Initiative), which supported complex and diverse projects and this has increased the partnership initiatives, innovation and financial engineering. This type of cooperation between public and private has greatly expanded health and currently over 15 % of public investment in the UK PFI type contracts were completed.

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[1] Review of the European PPP Market in 2013, The European PPP Expertise Centre (EPEC).

[2] "the optimum combination of whole-life cost and quality (fitness for purpose) to meet the user's requirement" (Definition by UK Treasury). These costs may include, separately to the costs of design and construction, the costs of service operation, asset repair and maintenance, user support, training, decommissioning/disposal and supply of materials.

In Romania, the first forms of PPP have occurred after 1989, due to the public administration reform and the theoretical point of view is supported by public choice theory, both at central and local level, but developing this funding mechanism has been slow and must be encouraged through effective fiscal policy. Currently, PPP is practiced very little, although the current financial problems faced by local authorities should open the appetite for using PPPs, which gave very good results in other European countries.

A PPP process has four different phases, which consists of a number of other steps as well.

PHASE 1 INITIATION	PHASE 2 STRUCTURALIZATION	PHASE 3 SELECTION	PHASE 4 IMPLEMENTATION

2. Data Collection and Methodology

This analysis is based primarily on research and presents extensive theoretical literature existing in the PPP, the institutional and legal analysis related to these types of projects in EU Member States.

3. Results/Findings and implications for the research

PPP projects are complex and in practice they tend to become less optimal than the theories suggested. Among the most common reasons stemming from this are the existence of incomplete contracts and the length of the concession, which may bring uncertainty and changes the structure of a PPP project. Shared decision making can be very difficult due to the involvement of many actors: government, sponsors, lenders, as each pursues objectives and different interests. As it will be shown in the research, the existence of well-defined legal and institutional framework represents the provided primarily by the parties' confidence that with proper management of risks related to PPP projects, will requires finalization and conclusion of nationwide successful partnerships.

4. PPP – Complex system of providing public services

Since PPPs become part of the increasingly important traditional public investment it was observed a particularly interest in the efficiency and success of these projects.

Professional literature of PPP contains many case studies, monographs that analyze and discuss the theoretical aspects, problems, dimension and essence of the PPP investment project, using descriptive and normative models and the general result is that these types of projects are less optimal than the theories suggest.[3] Many articles on PPPs tend to have a national focus and that's why comparative cross-country studies are few (Koppenjan, 2005). PPPs were analyzed taking into consideration the regulatory policies, cost transaction theory and new political economy (Muhlenkamp, 2004). PPPs is seen as a joint of this organizational concept with that of corporate social responsibility (Budaus, 2005). In addition, Public Private Partnerships are examined from a theoretical and institutional based perspective (Tenbensel, 2005) and (Hall and Soskice, 2001) analyzed these type of projects starting from the concept of cost-effectiveness.

The definition of PPP given by the OECD (2008) is not complete although it highlights important characteristics and lefts opened several issues: "*An agreement between the government and one or more private partners (which may include the operators and the financers) according to which the private partners deliver the service in such a manner that the service delivery objectives of the government are aligned with the profit objectives of the private partners and where the effectiveness of the alignment depends on a sufficient transfer of risk to the private partner – Reference to risk allocation is asymmetric: instead of sufficient transfer the expression reasonable (fair, balanced) share (split, allocation) might be politically correct. The set of risks is open; some of them are generated by the partnership itself*".

PPPs are vehicles for bringing together the knowledge, skills and resources of both the public and private sectors (Bovaird, 2004), and in this way, they can contribute to solving problems that otherwise could not be addressed completely by the public sector individually (Stocker, 1998). As Huxham (2003) stated, the rationale for partners to get involved in a PPP is that they have the potential to create "synergy", so called "collaborative advantage". Some scholars use PPP as a generic term to refer to any type of working arrangement between government and the private sector which is projected at achieving societal objectives (Bovaird, 2004; Pollitt, 2003, Skellcher, 2005). There are different approaches to PPPs all over the world, but it needs to fulfill the basic EU rules on public procurement, but how to configure the structure or regulation of PPP itself it is up to the

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[3] Anatomy of Public Private Partnerships: Their creation, financing and renegotiations, Joaquim Miranda Sarmento and Luc Renneboog, page 2;

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member states, and that's why some countries have dedicated law or regulation and specialized support unit. These aspects are important because they can have a positive or negative influence the overall implementation aspects of PPP projects.

Country	PPP unit	PPP law	Country	PPP unit	PPP law
Romania			Malta		
Bulgaria			Latvia		
Spain			Sweden		
Portugal			Lithuania		
Italy			Slovakia		
Greece			Ireland		
Cyprus			Estonia		
Hungary			Czech Republic		
Austria			Slovenia		
Turkey			Germany		
Belgium			Luxembourg		
Denmark			Netherlands		
Finland			UK		
France			Poland		

Need for PPP unit and some action taken (or only a regional unit existing);
– PPP unit in progress (or existing, but in a purely consultative capacity);
– PPP unit existing (actively involved in PPP promotion);
– Legislation being proposed;
– Comprehensive legislation being drafted / some sector specific legislation in place;
– Comprehensive legislation in place.

5. Contract Management – Design, techniques and processes to manage performance

Focusing on the function of the contract management function established by the Contracting Authority, the practice of PPPs has revealed the following key elements to having effective management of PPP contracts:
- Ensuring a consistently management performance throughout the „life" of the PPP;
- Existing an appropriate design of the contract management function;
- Elaborating a detailed contract management architecture so as to ensure that the private partner is indeed delivering on time the specified services/goods that has contractually committed and to the standard agreed;

- ▪ Remaining the contractually agreed risk transfers with the private investor during the contract;

Although these key elements should be applied in the early contract period and from the begging of the contract, it depends very much on the decision taken during the contract award phase. In the phase of designing the contract management function, the Contracting Authority faces many key challenges, such as:

- ▪ Good communication and sufficient knowledge transfer from the procurement to the contract management team, especially regarding the objectives of the contract and the ways these should be implemented, and for these reason it should be necessary the continuity of the personnel, although existing the advanced arguments of separation of duties between the procurement team and the contract management to prevent conflict of interest, as it was stated by the National Audit Office for the House of Lords Economic Affairs Committee Report on Private Finance Projects, UK 2009;

- ▪ Skilled personnel, with adequate resources and abilities to manage the contract; otherwise, the private investor will receive inadequate signals, especially that the public authority doesn't perceive the contract management of being of high importance and finally, the negotiations could fail in these respect. It is important that the contract management staff should be motivated also, because many employees will be coming into new function and which will evolve over the life of the contract.

The huge potential of using PPP projects in Romania is widely considered to be worthy, especially in the use of EU funds related to European multiannual framework 2014-2020 as structural and cohesion funds will be allocated and may help catching up large infrastructure, education, health etc. In this context, it will have a key role and initiatives of local and regional authorities are important in order to promote such projects of modernization. Their assistance will improve local infrastructure and employment in the regions concerned because it will be necessary for staff personnel for the successful implementation of these types of projects. But to materialize implementation in Romania of such investment partnership models it must be provided a clear legal framework in accordance with European standards that allow flexibility and economic efficiency, eliminate duplication of public procurement legislation and mechanisms to base operational risk, bankability and transparency. Representatives of the European Commission estimated that Romania must

adopt a very cautious approach in identifying the private partner and the models of PPP, the payback assessments have low accuracy, especially for road infrastructure. In Romania, the partnerships of PPP are assimilated to concession contracts and in other countries such as Japan, Croatia, Philippines, China, USA, India, a large number of PPP projects were released in a specific form that is called Build-Operate-Transfer (BOT: Build-Operate-Transfer) that means a system of financing public projects in which the private partner invests its own resources and in which the cost and profit recovery is on a long-term, based on a credit in connection with the viability of the project, not the entity loans, and credit insurance is done even with the assets of the project and not the ones of borrowed party. The object of the contract is transferred to the public authorities at the end of the concession period. From the legal perspective, Public Private Partnership differs from public procurement because both private investors and public authorities assume all or part of the economic risk of exploitation afererent to a good or service.

In Romania, the first forms of PPP have occurred after 1989, due to public administration reform and from the theoretical point of view is supported by public choice theory, both at central and local level, but the developing this funding mechanism has been slow and must be encouraged through effective fiscal policy.

Most countries in Europe have a legal tradition based on civil law. Their legislation stems from a set of written rules or civil code. By contrast, in common law jurisdictions such as England, Ireland and Gibraltar, the common law (case law and precedents that rather than a civil code), which is the fundamental basis of all commercial transactions and which developed principles underlying the allocation of risk. Some countries have specific legislation for PPP projects and in other countries it is incorporated into other laws, such as the public procurement law. Commission focuses on optimal distribution of risks between the private and public partners, which is an important step for the success of PPP projects.

6. Conclusions

In conclusion, Public Private Partnerships contribute certainly to economic recovery and growth and sustainable development of the European Union. The main benefits of Public-Private Partnerships can be summed up as following:
  ▪ facilitating public projects, especially for infrastructure;

- sharing financial risks and reduce costs for infrastructure;
- promote sustainable development, innovation, research and development, due to competition commitments and private enterprises;
- increasing market shares of European companies in public procurement in third countries.

PPP doesn't mean privatization and it is an agreement between public and private sectors that require a stronger role from the government of a country. If we could make PPP more accessible to the private investors it could have an important role on the infrastructure and public services that people could have access to. These partnership investments should arise from the actual needs of a community/region and must take into consideration the positive social implications of implementing PPPs (environment, health etc.).

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