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A review on the sun tracking mechanisms for PV strings

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Abstract. This paper deals with a review on the solar trackers used for increasing the energetic efficiency of the photovoltaic (PV) strings. To begin with, the context from which the utility of the tracking mechanisms emerges is presented. The study continues with the systematization of the PV systems according to the structure that is oriented (i.e. the configuration in which the PV panels are disposed / arranged), presenting also the main advantages and disadvantages of the existing structures. Thus, it is retained as a solution for deepening the research that of the simultaneous orientation of the PV panels arranged in a string-like configuration. Afterwards, the study is focused on the main components that are taken into account in the design process of the tracking systems for PV strings, such as the tracking mode, the evaluation of the solar energy potential (involving the modelling of the solar radiation), the emplacement/disposing scheme of the panels in different array configurations, the mechanical and control devices of the solar trackers.

Keywords: *PV strings, energetic efficiency, mechanical and control devices*

Introduction

The work is the result of a preliminary analysis of necessities that identify the existence of a strategic frame at global level concerning promoting and implementation of the renewable energy systems, the necessity to open the economic environment to interdisciplinary top domains, the existence of direct-indirect customers from the economic and social environments, the development of new/innovative solutions for complex products that are economically and energetically efficient.

In this frame, the study is approaching a theme that belongs to a very important (and topical also) field: renewable sources for energy production - increasing the efficiency of the photovoltaic systems. The researches in this field represent a priority at global level because provides viable alternatives to a series of major problems that humanity is facing: the limited and pollutant character of the fossil fuels, global warming or the greenhouse effect. By promoting of the renewable energy systems, in the spirit of energy saving, the project is in a perfect agreement with the actual effective integration politics of Romania into European Union and respectively is targeting one of the thematic areas stated by the European Frame Program (namely, Energy).

The photovoltaic systems can deliver energy on large-scale to a competitive price, as stated by the European Commission for Energy, in the report "A Vision for Photovoltaic Technology for 2030 and Beyond". The report emphasizes as the development of advanced technologies in the photovoltaic area, and a European strong and competitive industry will support the strategic initiatives concerning to the security and the diversity of the electric energy sources. The realization of the PV arrays (system of panels that function as a single electricity-producing unit) appeared as a necessity for the development of large systems for producing electric energy based-on the solar energy.

PV tracking systems

The energetic efficiency of the PV arrays depends on the degree of use of the solar radiation, which can be maximized by use of mechanical systems for the orientation of the panels in accordance with the paths of the Sun. Basically, the tracking systems are mechanical systems with M=1 or M=2 degrees of mobility (corresponding with the number of revolute axes), driven by rotary motors or linear actuators, which are controlled in order to ensure the optimal positioning of the panel relatively to the Sun position on the sky dome, on the entire period of the day (the diurnal motion, East - West), and also depending on the season (the seasonal/elevation motion).

From energetic point of view, the photovoltaic array with tracking is efficient if the following condition is achieved: $\varepsilon = (E_T - E_F) - E_C >> 0$, where E_T is the electric energy produced by the PV array with tracking, E_F - the energy produced by the equivalent fixed (without tracking) PV array, and E_C - the energy consumption (demand) for tracking the sun. In the current conditions, the maximization of the efficiency parameter ε through the optimal design of the tracking system became an important challenge in the modern research and technology.

Having in view the operating principle, there are two fundamentals types of tracking systems: passive and active trackers. The passive trackers are based on thermal expansion of a Freon-based liquid from one edge of the tracker to another because of the heat sensitive working fluid [13]. The active trackers are based on electrically operated positioning drives, which need motors, gearboxes, mechanisms, couplings etc. Usually, the nowadays active tracking systems are based on planar or spatial linkages, gear mechanisms, chain or belt transmissions. The orientation of the photovoltaic panels with active solar trackers may increase the efficiency of the conversion system from 20% up to 50% [1, 5, 9, 11, 26].

The tracking principle of the PV panels is based on the input data referring to the position of the sun on the sky dome. For the highest conversion efficiency, the sunrays have to fall normal on the receiver (i.e. the PV panel) so the system must periodically modify its position in order to maintain this relation between the sunrays and the panel. The positions of the Sun on its path along the year represent an input data in designing the tracking system, so the geometrical relationship between the Earth and the Sun has to be considered. The Earth describes along the year a rotational motion following an elliptical path around the sun. During one day, the Earth also spins around its own axis describing a complete rotation, which generates the sunrises and the sunsets. The variation of the altitude of the sun on the celestial sphere during one year is determined by the precession motion, responsible for a declination of the Earth axis in consideration with the plane of the elliptic yearly path [42]. Consequently, for the design process of the solar trackers, there are taken into account two rotational motions: the daily motion, and the yearly precession motion.

Under these circumstances, there are two fundamental ways to track the sun, by one axis or by two axes, what determines two types of tracking mechanisms (figure 1): mono-axis (a), and dual-axis (b) solar trackers. The mono-axis tracking mechanisms pivot on their axis to track the sun, facing east in the morning and west in the afternoon. The tilt angle of this axis equals the latitude angle of the loco because this axis has to be always parallel with the polar axis. In consequence for this type of single axis tracker is necessary a seasonal tilt angle adjustment. The two-axis tracking systems follow combine two rotational motions, so that they are able to follow very precisely the sun path along the

period of one year; that's why dual axis tracking systems are more efficient than the single one. For the tracking systems based on the scheme b.1, there are two independent motions (daily motion and seasonal motion), and this because the main (daily) motion is made by rotating the panel around the polar axis. At the same time, there are tracking systems that realize the daily motion by rotating the panel around a vertical axis - azimuthal orientation (b.2); in this case, it is necessary to continuously combine the vertical rotation with an elevation motion around the horizontal axis, the corellation between motions increasing the complexity of the control process [26].

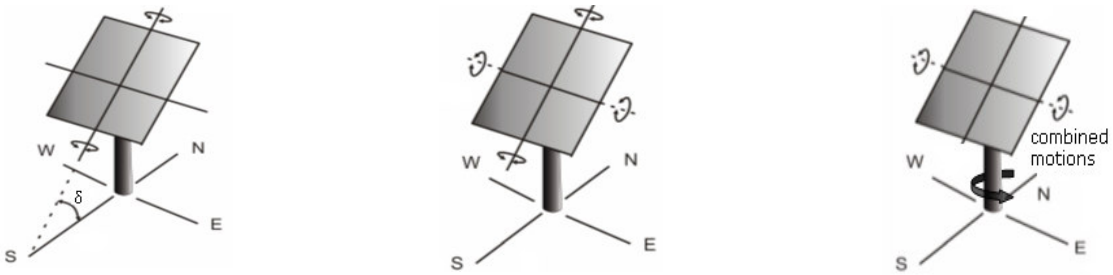

Figure 1. Basic types of tracking systems.

In practice there are two solutions for developing the PV tracked arrays:

I. PV platforms, where the panels are mounted on a common frame (panels with same sustaining structure), orientation being realized simultaneously by the orientation of the entire platform;
II. array of individual panels, where the panels are separately mounted on individual sustaining structures.

The PV platforms, even they have the advantage of a unitary electrical scheme, where the energetic management is safer and more feasible, generate multiple inconvenient concerning the construction, which has to be massive and solid (in the case of a greater number of panels, the assembly platform - sustaining pillar may reach masses in the terms of tones), or integration in the built environment, which may be difficult or even impossible (e.g. it cannot be mounted a platform on a roof because these impose the construction of a foundation). Another major disadvantage of the PV platforms consists in the fact that the efficiency of the system may be smaller because of the close mounting of the panels that may provoke overheating.

The array with individual panels eliminates the disadvantages of the platforms but they need a larger area for mounting (the sustaining structure is not compact as in the case of the platforms), and the disposer of them have to care out of the eventual auto shadings that may appear between the individual panels. For panels with individual supports, the tracking can be realized in two ways:

II.1. tracking independently each panel of the array (panel with own tracking system - self motor source);
II.2. simultaneous tracking of all panels of the array, or tracking for groups of panels, by using single driving source (for single-axis systems, M=1) or two driving sources (for dual-axis systems, M=2), which transmits the motion to the all panels of the array/group (figure 2).

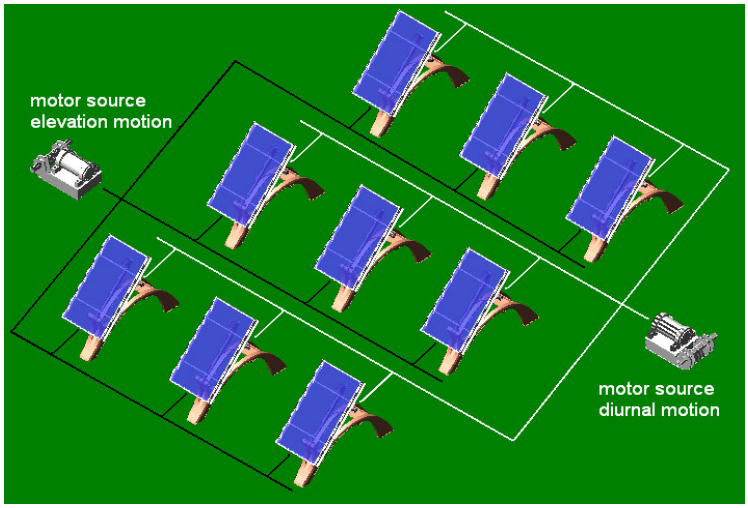

Figure 2. Simultaneous orientation in a PV array.

Obviously, the second solution (II.2), even is more complex by constructive aspects (needs the design of the mechanisms suitable for transmission of the power from the driving source to the panels of the array), ensures theoretically a greater energetic efficiency because of the minimization of the consumers in the array. The orientation of the arrays/groups of panels, with the predicted advantages and the characteristic problems that involves, opens a research area insufficiently explored since now, fact sustained by the literature and practical developments in the field that refer almost entirely to the orientation individual panels. The evaluation of the state of the art in the field is based on the attentive exploration of the literature, considering with priority ISI and BDI journals, proceedings of the conferences organized by recognized international forums, and reference books in the field.

In the design process of the tracking systems, the solar radiation represents the main input data. The total solar radiation received at ground level includes two main components (figure 3): direct solar radiation (A), and diffuse radiation (B). The solar radiation can be measured using traditional instruments, or can be digitally recorded with a data acquisition system. Within an EU funded project, a solar radiation atlas was realized for Europe [38]. At the same time, there were developed large meteorological databases, such as Meteonorm (www.meteonorm.com).

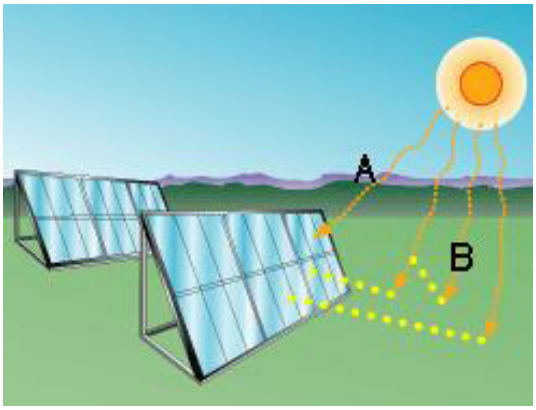

Figure 3. Solar radiation components.

In addition, different models were developed for estimating the solar radiation. The traditional Angstrom's linear approach is based on measurements of sunshine duration, while relatively new methods are based on artificial neural networks - ANN [43]. In reference [37], there are studied four models for estimating the monthly mean solar radiation, including linear Angstrom-Prescot variation,

quadratic equation, logarithmic variation, and exponential function; the root mean square error is the principal elements of this comparative analysis. A step by step procedure was developed in [31] for implementing an algorithm to calculate the solar irradiation, using both zenith and azimuth angles to describe sky element's position, for a surface that is tilted to any horizontal and vertical angle. For a similar azimuth system, the mathematic model developed in [3] estimates the hourly and daily radiation incident on planes of three step tracking and hour angle three step tracking. Several simple clear sky and cloudy sky models were tested in [7] for evaluating the global solar irradiance under the climate and latitudes of Romania.

Other papers in literature refer to the computation of the yearly energy collection allowed by different tracking strategies. A theoretical analysis of different intervals of intermittent two-axis tracking of the sun, by a gear mechanism, on the amount of annual energy received by flat-plate collectors, has been carried out in [21]; the solar radiation (both direct and diffuse components) is estimated considering Ashrae assumption (standard sky). Using as input data the location latitude and commonly available values of monthly irradiation, a relation between the latitude of the chose location and the most suitable solar tracker is established [41]. In reference [11] , there is developed an analysis model for comparing the energy capture between fixed tilt angle and sun tracking systems, in clear sky and mean sky conditions, using the Moon-Spencer and the Aste models. Specific software tools were developed in [27] for simulating the energy yield of PV systems as a function of the ground cover ratio, for different tracking cases. An one axis three position sun tracking PV module is designed in [17] for adjusting the PV position only at three fixed angles (three position tracking): morning, noon and afternoon; in this way , the optimal stopping daily angle in the morning or afternoon, relative to the solar noon position, is obtained. An experimental study was performed in [8] to investigate the effect of using a continuous operation two-axes tracking on the solar energy collected; the energy gain relative to a fixed panel is up to 47%.

As it was previously mentioned, the active tracking systems contain mechanisms (e.g. linkages, gear mechanisms, cam mechanisms, chain or belt transmissions), which are driven by controlled motors & actuators. The research of the literature reveals the limits of the actual stage in the development of the tracking mechanisms (i.e. the mechanical device) for the PV arrays. Since now there are no unitary modelings on structural, kinematical and dynamical aspects in designing the mechanical structure; at the same time, a general approaching for the conceptual design and the structural synthesis of these mechanisms is missing. Thus rises the necessity of a unitary modeling method of mechanisms, such as the Multi-Body Systems method [15, 39], which may facilitates the self-formulating algorithms, having as main goal the reducing of the processing time, for making possible the real-time simulation.

a. b.

Figure 4. Constructive solutions of tracking mechanisms for PV strings.

The literature presents some constructive solutions of tracking mechanisms, mainly for individual PV panels [10, 14, 18, 19, 23, 28, 30]. In the case of the arrays/groups of panels there are only summary descriptions of different producers for such systems, for simple topologies (line - string) and single-axis systems (M=1) [47]. For example, the tracking system shown in figure 4.a, produced by SunPower, realizes the diurnal orienting for a line-array, the motion being transmitted with a

parallelogram mechanism. The constructive solution from figure 4.b, developed by Energy Innovations, contains a tracking system that adjust the elevation angle (to track the sun altitude) for a string of three sticks of panels (each stick has a proper support); the motion is transmitted with a double four-bar mechanism.

Regarding the control process of the tracking systems, in literature, closed loop systems with photo sensors are traditionally used. The photo sensors are responsible for discrimination of the sun position and for sending electrical signals, proportional with the error, to the controller, which actuates the motors to track the sun. Many authors have adopted this method as a basis in construction and design of such systems [4, 9, 14, 19]. Although, the orientation based on the sun detecting sensors, may introduce errors in detection of real sun position for variable weather conditions (ex. cloudy day), and requires some automatic drivers to point it to the east at the beginning of the day.

The alternative consists in the opened loop systems [1, 2, 32], which are based on mathematic algorithms/programs that may provide predefined parameters for the motors, depending on the sun positions on the sky dome (i.e the astronomic movements of the sun-earth system). These positions can be precisely determined because they are functions of the solar angles that can be calculated for any local area. By using this control technique, based on predefined parameters, the errors introduced by the use of the sensors may be avoided (the systems are not affected by clouds, irradiance values or other optical circumstances). The astronomical computerized systems require a reference or zero positioning; the reference can be adjusted at the beginning of the operation, but recalibration is required.

Other solution is to incorporate some kind of sun position sensor to check and calibrate automatically the astronomical control system. In addition, the tracking system can also be adjusted to provide maximum output energy, to self-trim it initially or self correct itself throughout its life [36]. Such hybrid control system, which consists of a combination of opened loop tracking strategies based on solar movement models and closed loop strategies using a dynamic feedback controller, is developed in [34]. The comparative analysis between a classical open loop tracking strategy and the hybrid one is also presented, considering the energy saving, which implies that the sun is not constantly tracked with the same accuracy, to prevent energy over-consumption by the motors. The tracking mechanism described in [33] is operated by a digital program in the control system, while in the active operation mode, the tracker uses the signal of a sun detecting linear sensor to control the pointing; the position of the sun is calculated, and the pointing errors appearing during its daily work are stored for later analysis.

From the controller point of view, different control strategies are used [5, 28, 32, 46], such as classical techniques as PID algorithm or more advanced strategy such as fuzzy logic controller - FLC. In reference [45], whose aim is to design a low cost two-axis solar tracker for obtaining a high precision positioning of the panel, the control-board is able to support different control strategy, PID and FLC; using the error signal, the tracking capacities of the proposed approaches are tested on an experimental prototype. In reference [12], the implementation of a fuzzy logic neural controller (FNLC) in photovoltaic systems has been studied; this controller, which is an evolution of the fuzzy control concept, allows the system to learn control rules. A controller which incorporates the advantages of two alternate design techniques (a deadbeat regulator for quick, rough control, and an LOG/LTR (Linear Quadratic Gaussian with Loop Transfer Recovery) regulator, for soft, final tracking) is presented in [35]; the first one performs approaching the target in a minimum of time; the second one allows a soft approach to the target. The first order Sugeno fuzzy inference system is utilized for modelling and controller design of an azimuth & elevation tracker [6]; in addition, an estimation of the incident radiation corresponding to the dual-axis tracking system is determined by fuzzy IF-THEN rules.

A specific problem for the photovoltaic arrays consists in the establishing of the emplacement/disposing mode of the panels. Basically, the panels can be arranged in line, in string, or in matrix, the number of panels in a specific emplacement scheme depending on the size of the array / covered area. For this kind of systems, knowing the losses due to self-shadowing among panels is a

key issue. Knowing these losses allows optimizing the placement of the panels over the area as well as quantifying the energy production losses; however, there is very little literature about this matter. Such a subject is approached in [29], with the purpose to develop a procedure for calculating the irradiance losses due to self-shadowing among trackers as a function of the position and distance among them. The procedure is divided into three parts: calculating the solar irradiation that reach to one PV panel free of shadows; calculating the shadows produced by one panel over another one, and so the losses of solar radiation are estimated; obtaining the solar irradiation losses in a PV array by composing the shadows over each panel produced by the other ones surrounding it. In this way, so called butterfly graphics (with the percentage of shadowing losses between panels) are obtained, as shown in figure 6. The procedure was applied for the solar park of 6.4 MW installed in Lorca (Murcia - Spain). Reference [22] examines the theoretical aspects associated with the design of azimuth trackers for a PV array, taking into account shadowing between different trackers and back-tracking features, and this tracking alternative is compared with the more conventional fully stationary array approach; the application is made for a 1.4 MW PV plant. Reference [20] shows a simulation model for the sizing of stand-alone solar PV systems with interconnected arrays, which are comparatively less susceptible to shadow problem. The non-tracking (e.g. fixed and tilted) and mono-axis tracking aperture arrays having cross-connected modules of solar cells in a 6×6 modular configuration are considered; finally, a simple cost analysis has also been carried out.

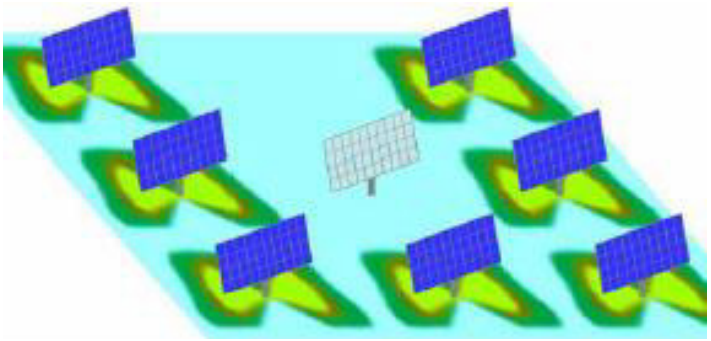

Figure 6. PV panels layout based on butterfly graphics.

Other subject that is insufficient approached in literature is the evaluation of the non-stationary external loads (such as the wind or snow action) on the dynamic behaviour of the tracking system, as well as on the system's components. Some aspects are presented in [40], dealing with the calculation of the wind action, which is modelled by three dimensional-normal forces, on the bearings of a tracking system, the effect of the weight forces being also considered. Specific models for considering the deformability (for bodies and joints) and vibration characteristics of the components are missing in literature, as well as the evaluation of the tracking systems durability.

Final remarks

The background research reveals a series of aspects and hardships in the literature concerning the tracking systems for PV arrays. Based on this study, the following conclusions and recommendations for further research directions were formulated.

In the literature there are no unitary models for the tracking mechanisms of the PV arrays/strings referring to the structural, kinematical and dynamical issues. In the same time, there is no general approach for conceptual design and structural synthesis of these mechanisms. In this regard, a method for the unitary modelling of the tracking mechanisms should be used, and this can be based on the MBS (Multi-Body Systems) theory. On the other hand, the literature mainly addresses tracking

solutions for PV panels arranged in simple topologies (line - string), especially for mono-axis systems, with one degree of freedom (for the diurnal or elevation motion). From this point of view, it is desirable a global approach of the array topologies (generally, the matrix topology), considering dual-axis tracking systems, with two degrees of freedom (for the both motions), so as to capture as much solar energy (incident radiation) as possible.

The issue concerning the control of the tracking systems is approached mostly for the tracking systems of the individual panels, using different techniques/methods (such as PID, FNC, FNLC). The research is focused mostly on the quantity of the energy achieved by tracking, but less on the energy consumption (demand) for performing the orientation (consumed by the actuating sources). This is mainly due to the fact that the system is not approached as an integrated assembly (mechanical device - actuating & control device). Thus, it is desirable the integration of the main two components at the virtual prototype level, during the entire design process (i.e. modelling in mechatronic concept), which will allow the simultaneous evaluation of both the energy gain brought by orientation and the energy consumption to achieve the orientation.

The literature presents different models/methods for the evaluation of the radiation potential as input data in the design of the tracking systems (the number of the modules from the array depends on the solar energy potential of the mounting area and respectively of the necessary amount of the energy that has to be provided). In the case of the PV systems equipped with tracking mechanisms, the modelling of the incident solar radiation has to consider the tracking method (i.e. the type of tracking mechanism, equatorial or azimuthal - see figure 1), because this influences the modelling of the incident angle, which is then found in the incident radiation captured by the PV panel.

The layout/arrangement of the PV panels within an array is approached in the literature almost in exclusively from the point of view of avoiding the self-shading. Complementary, this issue should also be approached with the aim to simplify - optimize the solution for transmitting the motion from the actuating source to all the PV panels of the array in order to obtain high efficiency systems. Following this trend, it is desirable a modular approach of the PV array by designing modules of panels with tracking systems, having the possibility to transmit (or receive) the motion to (from) another module, depending on the number of the panels of the PV array.

Finally, another research direction that should be studied more intensively consists in the evaluation of the dynamic behaviour of the tracking systems through compliant models, by considering the deformation and vibration characteristics under FEA (Finite Element Analysis) software environment, within a virtual prototyping platform. Moreover, by the prediction of the product lifecycle, the economic efficiency of the tracking systems can be evaluated more precisely.

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Design an analysis of a straight bevel gears transmission

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Abstract. One of the most important application in mechanical transmissions with gears is the transmission by bevel gears. In this paper we are going to perform a computerized design of the bevel straight gears transmission and the static analysis of the bevel gers transmission under load. We presume that these gears are manufactured in conical blanks by cutting, using same known methods. The static analysis is performed using the Finite Element Method. We present the results of the comportment of the system under load for displacements and stress in the region of the root of the teeth, the total displacement due to elastic deformation of the structure and the results in conditions of Hertzian contact under load.

Keywords: *computerized design, mechanical transmissions, bevel gears*

1. Introduction

One of the most important application in mechanical transmissions with gears is the transmission by bevel gear. Their purpose is to transmit power and movement by rotation between intersecting axes. An usual application is the straight bevel gears transmission where the axes are arranged at angle of 90^0 which is the case studied also in this paper. In the scientific field of computerized design and research of bevel gears are a lot of papers of interest. Between these an important part is dedicated to the study of straight bevel gears with localized bearing contact. We mention here important papers of Litvin at al., [1],[2], [3]. But there also a lot of scientific papers concerning the comportment of the bevel gear set under load [4]

In this paper we are going to study the computerized design and the function of straight bevel gears. We presume that these gears are manufactured in conical blanks by cutting. One of the most used method of manufacture these gears from blank cones is Gleason Coniflex Method ® [5]. Other well known method is Gleason Revacycle Method ®.

2. The model of the bevel gears transmission

In this chapitre we will present the design of the each gear in the mechanical transmission, the functioning set of the gears transmission and the model prepared for the analysis with Finite Elements Method.

2.1. Designing the geometry

The geometry of the bevel straight gear is based on the classical geometry reference involute profile. The base design for straight bevel gears set model is presented in the figure 1. [6]

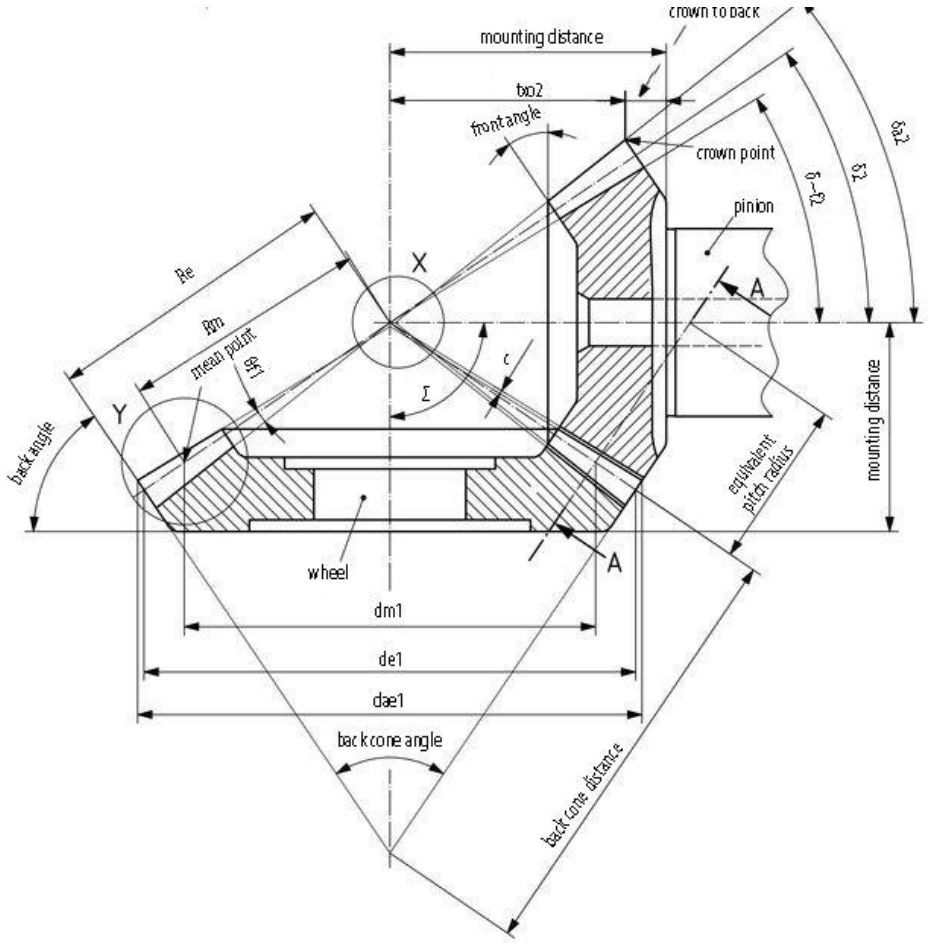


Figure 1. Geometrical characteristics of the set of the bevel straight gears –
- adapted ISO 23509:2016(en)
[6] https://www.iso.org/obp/ui/#iso:std:iso:23509:ed-1:v1:en

but also, on the geometrical characteristics of the tool for manufacturing. In this paper, we choose to simulate the driving and driven bevel gear manufacture following the process of Gleason Coniflex method and tools.

The algorithm of the numerical manufacturing process includes the profile (which is designed with two profile curves and a curve of fillet with a radius in accordance with the fillet of the cutting tool) as we can see in figure 2(a). In figure 2(b) is represented the simulation of the 3D cutting process according Gleason Coniflex method. According Gleason Coniflex method are used two cutting discs or two cutting blades, each of them cutting a half of the tooth with profile. The Gleason Coniflex method is based on the application of dual interlocking circular cutters (DICC).

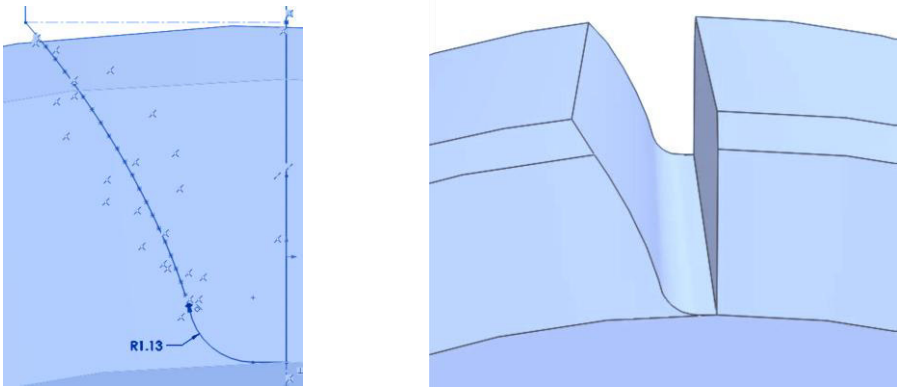
The elements of the geometry of the set are described in Table 1.

This method is a hobbing method. There are two circular intermeshing milling cutters to reproduce, as a counterpart of the rack, the generating surfaces. Each profile of each side of the tooth is generated along the conical blank of the bevel gear. In figure 2(b) is represented the left part of a body of a tooth, realized by cutting with a disc with a radius fillet. In figure 3(a), 3(b) is represented the result of the numerical cutting process (simulation) of pinion - driving gear, and the wheel – driven gear. In this algorithm was tested also the geometrical fitting of the gears in the functioning conditions with null load, only in the rotation (figure 4)

In Table 1 is presented the geometrical characteristics according the nomenclature of the [7], Bevel and hypoid gear geometry, ISO 23509:2006(en), revised 2016.

Table 1. Bevel geometry characteristics for the set model.

Element	**Symbol**	**U.M**	**Pinion gear**	**Wheel gear**
Module (ext)	m_e	mm	3	3
Number of teeth	z	-	19	47
Pressure angle	α	deg	20	20
Transmission ratio	i	-	z_2/z_1= 2.474	
Outer pitch diameter	d_e	mm	57	141
Base diameter	d_{be}	mm	53.5625	12.4970
Outside diameter	d_{ae}	mm	63.1800	146.8200
Root diameter	d_{fe}	mm	50.8200	131.5800
Circular pitch	p_e	mm	8.85639	8.85639
Contact ratio	ϵ	-	1.31652	
Whole depth	h_m	mm		
Working depth	h_{mw}	mm		
Addendum	h_{am}	mm		
Dedendum	h_{tm}	mm		
Number of imaginary teeh	Z_{tv}	-	20.494	125.404



(a) **(b)**

Figure 2.
(a) The involute profile fillet with the profile of the cutting tool;
(b) The simulation of the cutting process

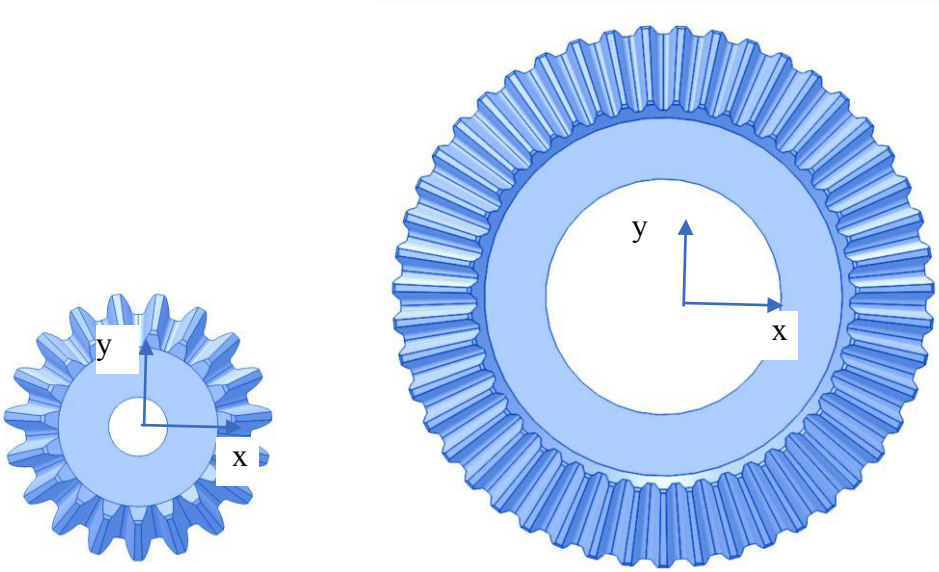


Figure 3.
(a) Pinion-driving gear; **(b)** Wheel -driven gear

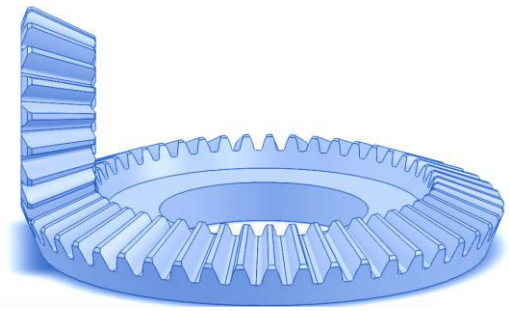


Figure 4. The gears in mesh

2.1. Finite Element Model

Based on the design shown in the previous chapter a finite element model was conceived to perform the static analysis under load of a set of gears, as it is shown in figure 4 To achieve the file transfer of SolidWorks, where the solid model was created, in Ansys Workbench file, in order to perform FEM analysis, the model is saved in format ACIS (SAT). A segment of the pinion with four teeth and a segment of the gear with three teeth are used to simulate the contact in the functioning conditions. Once imported file in Ansys-Design Modeler we apply general control. The model is presented in figure 5.

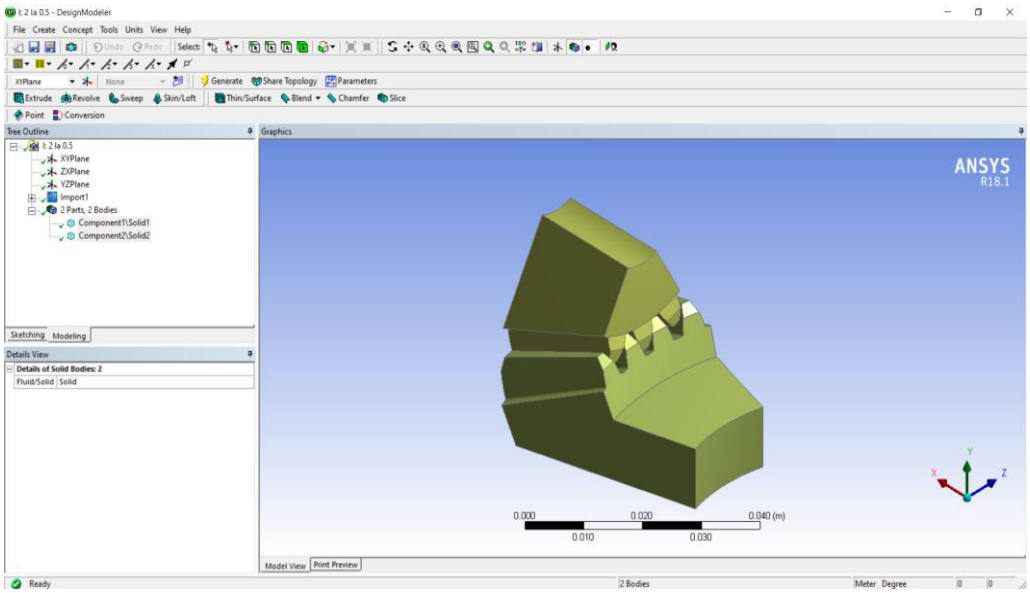


Figure 5. The model of the meshing gears for the FEM analysis

The finite element models are not built automatically. We choose to realize a discretization of the contact region and the region on the foot of the tooth with more elements and nodes, in order to obtain a result of the comportment under load with a maximum precision (figure 6) [8]

Node coordinates are determined on the gear tooth surfaces as a function of the chosen numbers of nodes in longitudinal, profile, and fillet directions.

Lateral surfaces of the bodies in contact are considered to keep the boundary conditions, represented by rigid surfaces, far enough from the contact area. The node on the axis of the pinion and the node of the gear are considered the reference in order to controls the motion.

3. Analysis

For simulate the comportment of the transmission under static load we take into account the material properties of the system and the load applied. The load was considered as a torque applied at the pinion body.

Concerning the materials properties, the pinion and the gear were considered made by the same material, steel, having an elastic modulus (E) of 220 GPa and Poisson ratio (ν) of 0.33. Three-dimensional solid elements of type C3D8I [15] and GAP elements are used. The volume elements are used as in order to improve their bending behaviour. For the baseline design, which has an outer module of 3 mm, a load-torque of 100 to 600 Nm was applied to the axis of the pinion (the body of the pinion).

The structure is composed of about 240,000 nodes and 129 134 elementsand the dimension of the smaller element is around 0.5 mm.

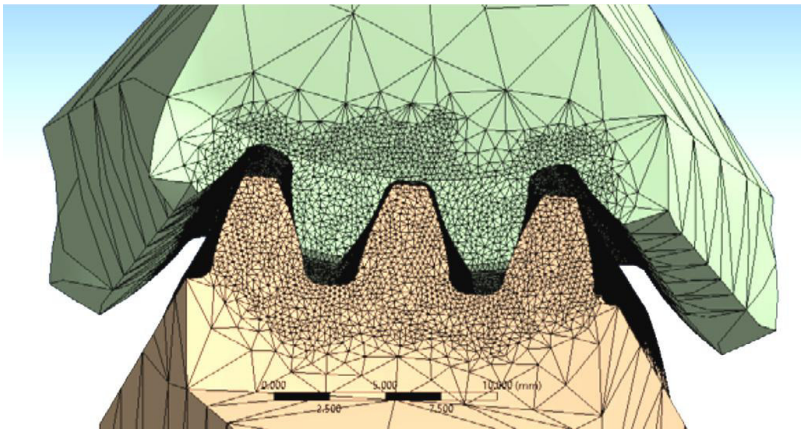


Figure 6. FEM discrete model in mesh

Concerning the contact conditions, we applied the general condition of analysis as Static structural analysis. The menu to set the contacts in the shown model is activated in ANSYS code. We can choose the type of contact between surfaces. For this simulation we chose to use contact without friction. The conditions (the surfaces) in contact are shown in the figure 7

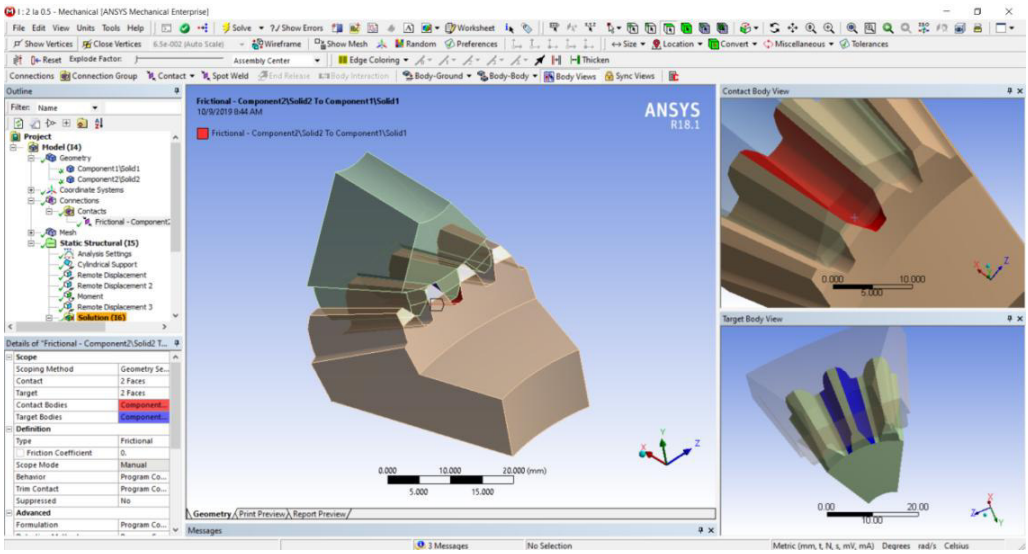


Figure 7. Surfaces sets for contact

4. Results

There are some aspects we were concerned to observe in this analysis. Due to elastic deformation of the system we can observe in the analysis the effect of the bending of teeth in contact at the pinion, the effect of Hertzian (local) contact between the teeth in the pair of contact and, of course, the displacements of the structure. The displacement will be considered for the segment of the wheel with the blank, as is shown in figure 5 and figure 7. The explanation of the displacement of the entire

structure is due to the torque applied at the level of the body, from the axis of the shaft. Even if the analysis is a static analysis, we consider performing the analysis in real conditions of functioning.

For this purpose, first we study the total deformation of the structure, as it is shown in figure 8. In the figure 8 we can observe that the maximum displacement of the structure is at the tooth of the driven gear which is free to follow the displacement of the structure under load applied at the pinion. The values of the deformations (maximum) for the toques applied are shown in the figure 9.

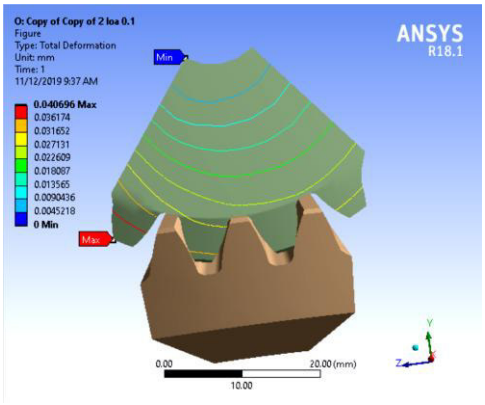


Figure 8. Displacements of the structure in mesh

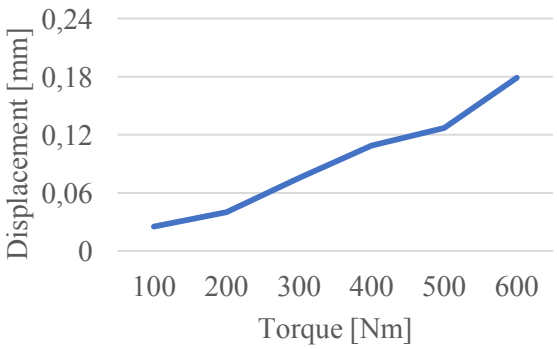


Figure 9. Displacements at the gear wheel versus load applied at pinion

Concerning the comportment of the teeth under load in the region of the foot of the tooth, we present the result of the state of stress in the region of the foot of the tooth in contact in figure 10. In figure we can see that the maximum bending stress at a load of 250 Nm is around 260 MPa, which is in the upper part of the bending stress at elastic deformation for the gear with material and geometrical characteristics shown above.

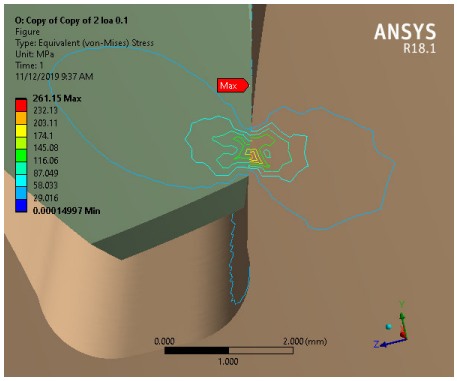


Figure 10. Bending stress analysis

Concerning the local comportment in a Hertzian contact, we present in the figure 11 the situation of contact and stress at the same level of 350 Nm torque load. Also, the value of the stress, 1268 MPa is similar to a real one in the same conditions of loading, for the same material and the same geometry of the structure.

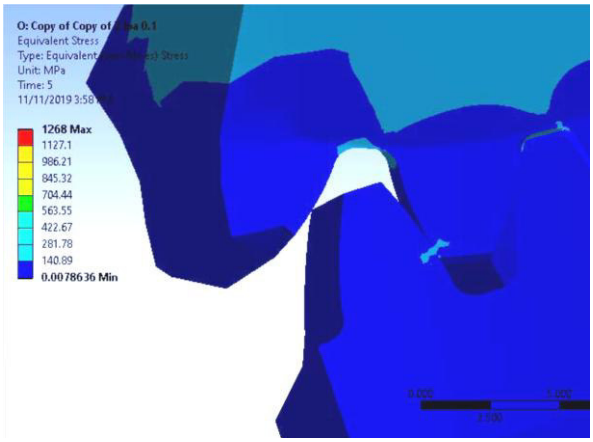


Figure 11. Hertz contact stress analysis

5. Conclusions

In this paper we designed on the parametric principles the geometry of the straight bevel gears. First, we designed the pinion-gear, after that the wheel -gear and finally the gears in mesh. A static analysis of the mechanical system in mesh was performed. The conditions of contact were carefully choses using the possible surfaces in meshing contact. The analysis was performed in order to find the elastic deformation of the structure, the state of bending stress at the pinion and the state of Hertzian contact stress at the pinion. The results encouraged us to consider that the design of the parts and the meshing gears is a model to follow for another useful studies.

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The community of practice in the education

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Abstract: A community of practice is a group of people who share a concern, a set of problems or a passion about a common topic, a passion for a professional or personal activity. Universities may be regarded as professional communities in which joint activities are carried out, with well-defined structures. Using networks at university level increases joint assembly of ideas held by each individual, while the exchange of ideas and practices inevitably may lead to the system enrichment, producing effectively loops of innovation and development.

Keywords: *community of practice, university, development*

1. Introduction

In a modern context, implementation of communities of practice was applied in Chrysler Company. Thus, until 1988, Chrysler Corporation was traditionally organized with directives from the top of the management structure. Being threatened by the Japanese companies' competition and being on the verge of bankruptcy, the company had to develop something innovative to stay on the market.

The solution was a formal community of practice composed of engineers from all divisions of the company in order to speed up the process of developing a new car model. The result was spectacular: from 5 years as the process of creating a new model last, they managed to release to the market a new model in just 2½ years. Communities of practice formed by Chrysler benefited from the already established relations between the same field engineers who met informally and discussed on what the other such teams were doing, what were the difficulties they were facing and how they overcame them.

IBM, Xerox, British Telecom and The World Bank are just a few of the organizations who understood the role that communities may have and they acted for their development.

Brown & Duguid (2000) [1] recounted that in the company Xerox, the technicians that had repaired the machinery started to exchange suggestions and tricks for solving problems. They did it through informal sessions of lunch breaks. The company had admitted that the value of these interactions had created project Eureka in order to encourage that these interactions to be shared in a general way, to all the technicians. It is estimated that project Eureka brought over 100 million dollars in economies.

A community of practice is a group of people who share a concern, a set of problems or a passion about a common topic, a passion for a professional or personal activity. Community consolidates its knowledge in a particular field through continuous interaction of its members. Examples of communities of practice in the online environment – virtual worlds: Second Life, Entropia Universe; –

providing information: Blogs, Google Docs, forums, Wikis; – networks: YouTube, Linkedin, Facebook.

E. Wenger, R. McDermott and W. Snyder (2002)[2] in "Cultivating Comunities of Practice" present communities of practice as "groups of people with common interests who meet regularly or not, in formal or informal manner, and discuss on the field which unites them, share experiences, tips and information and, in some cases, study in detail and thoroughly this information for future reference".

The members of the communities can work in different scenarios, but when they meet, they realize that their interactions are valuable, because they can share new information's, new understandings, their needs, aspirations and enhancement suggestions. According to Smith, Hayes & Shea (2017) [3] the practice community is one of the most important conceptions regarding social education. The theoretical framework of the communities offered a conceptual direction for the learning environment, which are searching for professional development.

2.Principles for communities of practice development

Wenger, E. shows the seven basic principles for communities of practice nurturing, principles that can help us to be more flexible and to understand their needs.

- **Design as progressive structure**

Communities of practice must be designed as natural progressive structures, usually on relationships structures already existing. The mission of the coordinators and key members of the community is to think new ways of capturing the interest of members, to attract new members with new ideas and new areas of interest in order to build new relationships within the community. The new members may have related interests also in other areas so they can determinate the community of practice to evolve towards other areas of interest too.

- **Openness to dialogue between interior and exterior**

Dialogue is the solution for an efficient community of practice, this because only through dialogue it can form a clear picture of problems. However, there may be difficulties in encouraging dialogue within the community because people do not know how open they should be, they are afraid of dialogue and of how this could affect their inner balance.

- **Invitation to the different levels of participation**

Within the community of practice can be identified three main levels of participation and a secondary group outside the community. The first is the *Central* group; it ensures the community functioning, being involved in discussions, identifying community problems, solving its problems and it comprises 10-15% of the community members. From here the leaders are chosen. The next group is the one called *Active*; it comprises 15-20% of the members; they occasionally participate in debates and forums. Then, there is the group called *Peripheral* which rarely participates in events and sits on the sidelines observing the interactions of the first two groups. Finally, there are the *Outsiders* that gravitates around them; they are outside the community; they are not members, but they are interested in community life. Community members can move from one group to another, sometimes staying active for a period and then they may lose interest or, alternatively, they may get involved in more heated debate and move to a higher level of interest.

- **Development of both inside and outside space of the community**

For effective functioning of a community, it is necessary to create a space for public interaction, venue, debate sessions, meetings, where as many community members as possible can come, but also private spaces where its members can meet face to face. Communities focusing on geographical point of view is very important because they can not operate dispersed. It must not insist too much on the public events on the expense of private events in which members express their problems and where they are being placed in relation with useful resources located both inside and outside the community.

- **Focus on value**

It is essential to attract more and more valuable members, experienced in the field, who give weight to the community and provide innovative contribution. The value results mostly from the activities and

daily interactions of community members. Small achievements from the beginning give confidence to community members and provides moral comfort to achieve major breakthroughs. Communities thrive through innovation, through the contribution value brought to the community, groups of individuals and teams that are part of them.

- **Combining the familiarity with interest**

Giving participants a familiar environment, an environment that makes them feel comfortable and invites them to take part in discussions and other activities, to seek advice and share opinions is the key to a successful community. It can combine both familiarity and interest for the new which make the members to connect fully in community life.

- **Create a community rhythm**

To ensure continuity and maintain an active community, it is necessary to impose a certain rhythm in its activity, rhythm which is achieved through sessions, meetings, informal activities, tasks, deadlines. It is very difficult to create a rhythm of community because each community member has a specific rhythm imposed by other communities to which he belongs (family, job, friends, sports). If it's too fast, people feel overwhelmed and leave the community. The community rhythm is the best indicator of community of practice's life because this rhythm moves people and keeps their keen interest for the community.

Developing knowledge through communities of practice can be carried out, in the opinion of E. Wenger, in seven steps[4]:

1. Understanding the strategic needs of knowledge: what knowledge is essential for success?
2. Identifying practical fields (finding communities): where will people form communities around the practices in which they can engage and with which they can identify?
3. Developing communities: how to help key communities to reach their full potential?
4. Expanding borders: how to engage and transform communities into broader learning systems?
5. Encouraging the sense of belonging: how to stimulate such a feeling?
6. Running business: how to integrate communities of practice in organization business management?
7. Application, evaluation, reflection and renewal: how to develop a strategy of knowledge through waves of organizational transformation?

To support knowledge, we must focus on the community that owns it and the people who use it, not on knowledge itself (McDermott). In building a community, we can speak about four challenges:

- technical challenge (human and informational systems design that not only make information available, but also helps community members to think together);
- social challenge (developing communities that share knowledge and yet retain enough diversity to encourage thinking rather than copying);
- managerial challenge (create an environment that really appreciates the sharing of knowledge);
- personal challenge (to be open to the ideas of others, willing to share ideas and maintain our thirst for new knowledge).

3.Communities of practice in the university education tehnical system

Improving educational systems can be achieved through networks consisting of universities and professionals from education field. These networks can be formed by professionals from the same university, from different universities, from educational and social services in the same locality or different localities, in collaboration with educational, professional administrations and different communities.

In Era of knowledge, the ability to recognize patterns, to share ideas with communities of interest and the opportunity to grow personally through a set of relationships is how an individual integrates and develops (Poley, 2002)[5]. Continuous changes at organizational and didactic level, produced within educational system reveals the need to promote the exchange of knowledge between

professionals, the ultimate goal being the one of improving the efficiency of the educational process of students.

Internal collaboration at the university level carried out regularly in departments, research centers or faculties is already a routine activity. However, these types of collaboration and networking are limited processes and circumscribed at teachers individual level, with poor participation of other agents, such as students or other external institutions.[6]

Communities of practice are learning forums where members teach and learn from each other and, irrespective of their position within an organization, regard each other as fellow practitioners, teachers, colleagues and sources of knowledge.

In this respect, promoting activities and community projects, promoting courses conducted by involving various agents may lead to increasing knowledge and sharing responsibility and participation of multidisciplinary teams of teachers, students, representatives of other institutions or community, and also of schools in the case of education sciences.

There are enough examples of collaboration within the educational system, so collaboration between schools and universities in the implementation of projects is commonplace, creation of university consortia bringing together universities around common mission is already accomplished.

We can consider universities as professional communities in which joint activities are developed, with well-defined structures. Universities isolation can be overcome by strengthening collaboration processes that not only provides a powerful framework for professional exchanges, but also mutual support to overcome the problems that arise in teaching and learning processes. Using networks at universities level increases joint assembly of ideas held by each individual, and the exchange of ideas or practices may inevitably lead to system enrichment, producing effectively loops of innovation and development.

As shown, communities of practice are made up of people who are part of a collective learning process, in a shared field of human activity. A community is a group of people, at work or leisure, whose identity is defined in large part by developing roles and relationships and who share group work. An important role in organizing communities of practice has the legitimate peripheral participation (Wenger, 1991) and this requires transferring knowledge and skills across groups using various forms of guidance, implicit learning and active participation in the community. Legitimate peripheral participation is the way to achieve the relations between new and old members and also the relationships between activities, identities and communities of knowledge and practice. As the development continues, community members are moving from peripheral participation to full participation.

A practice community is developed when it “adds value to the organization, to the team and each one of the participants” (Wenger and Colab 2002); even so, the development is not expected to be smooth and uncomplicated. Conflicts must often be overcome and in front of difficulties you must persevere. The creation of practice communities is a necessary challenge, which every education professional person must assume, the ones that are dedicated to the preparation of the teaching staff, because through them you can on one hand transfer and generate new knowledge and on the other hand realize the best practices in the area of researching and teaching (Bozu si Muñoz 2009) [7].

A practice community has the potential to transform a profession characterized through individualism and professional isolation, which prevents schools as organizations to learn. In these cases, capable and experimented professors exist and other with incipient or weak teaching abilities, without the knowledge being shared or without adding to the whole.

Practice communities work around the problems, in order to better understand them and to develop solution strategies through interaction. In addition, it generates planning, programs, and evaluation systems or simply just a silence deal, which they share împărtășesc (Wenger și Colab., 2002).

In a practice community all professors which want to learn from the expertize of their fellow man and to share their experiences participate, with the goal to enhance the studying of their student. The participation to a practice community is differentiated. Not all members of the community participate with the same level of implication, there will be central members which coordinates and organizes the

actives, central members which contribute with experience and their capacity to analyses and periphery members, which are of small participation, In the beginning, the ones who join a community study in the periphery, that means that they don't have a central role in the activities of the community.

This is conceptual knows as: legitimate implication of the peripheral. [8] As they become more and more competent, they implicate themselves more in the community and go to a full participation (Lave & Wenger, 1991), so as the teaching is not conceived as gaining knowledge by the individual but as a process of social participation.

A common element of successful community practices is the leadership of the central members because they identify the basic problems which will work on, and they assume the responsibility for maintaining the vitality and efficiency of the community. They are the ones who are responsible for the level of participation of the rest of the members and play an important role in moderating and regulating the reunions. In addition, the leaders handle the relationships between the practice community and the formal organization, including the communication of what the community produces, not only for the organization but also for their members (Baker & Beames, 2016).[9]

The functioning of any community of practice depends on the following facilitators (Milton, 2005[10]):

- Institutional changes that facilitate the development;
- Promoting necessary technical innovations and tools facilitating to foster modern and flexible contexts;
- Open participation and horizontal structures of functioning;
- Teamwork;
- A properly coordinator;
- Participation of experts of recognized prestige;
- An initial meeting to establish common goals and directions for action;
- Appropriate degree of autonomy for characteristics and functions;
- Alignment with organizational strategy.
- Specialized structures of communication, interaction and storing common knowledge;
- Regular and frequent interaction;
- Task orientation and clear deadlines;
- Shared interest, desire and motivation;
- Good use of technology;

The community of practice is not a scientific community, it does not deal with science but with the practice derived from knowledge and with the management of this knowledge creation process. This process is achieved in a collaborative form and through a continuous process of establishing strategies of participation, leadership, identity and use or mobilization of knowledge.

A relational structure of a community of practice is shown in Figure 1.[11]

The type of relationships established between a community of practice and an organization can be very varied and can range from absolute lack of recognition of the community of practice to understanding the community of practice as an absolutely necessary part of the organization.

Although the communities of practice don't have a hierarchical structure, does not mean that all members have the same position. There are differences of power that may conditionate the internal dynamics of the community of practice. The community of practice helps interaction and knowledge sharing, but bad management can lead to a flawed implementation of innovative processes.

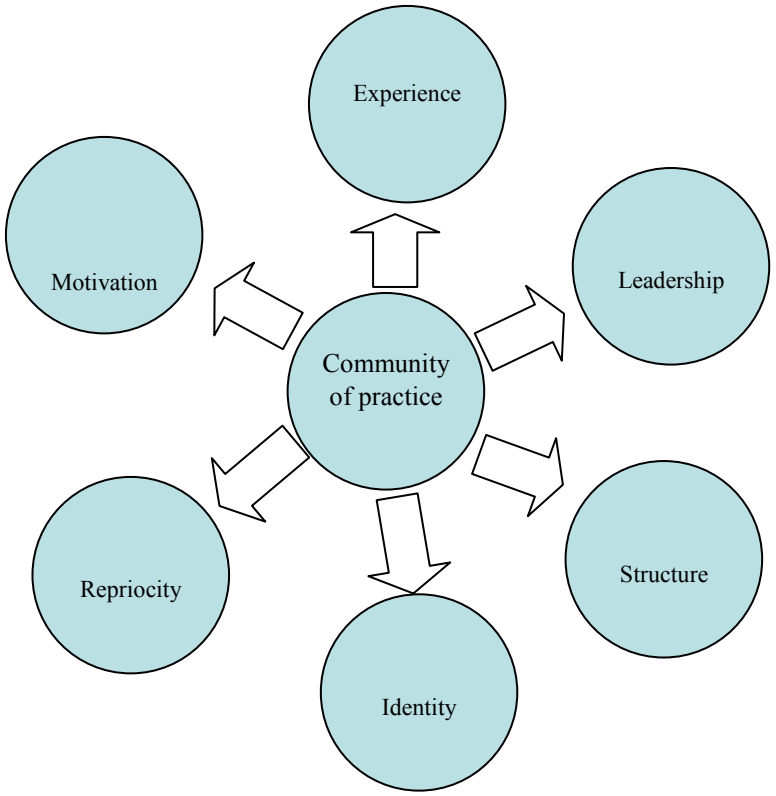

Figure 1. The Structure relationship of the community of practice

4. Development of communities of practice

In developing a Practice Community, we must take into account the following elements:

- Creating professional development opportunities. The practice community must be based on the promotion of authentic knowledge, and it must be based on a strong institutional policy;
- Creating learning-based learning opportunities. Learning is effective if it is based on experimental learning, practice, and solving concrete problems;
- Using self-evaluation as a learning resource. Forming self-assessment skills is essential in the development of practice communities;
- Transfer of learning and knowledge building. Learning in a community of practice involves analytical and reflexive processes as well as knowledge creation through knowledge among peers.

The management of practice communities must take into account:

- An efficient leadership
- Creating a culture of learning
- Providing learning at all levels
- Use of distributed leadership
- Coordination of professional development

The establishment of a strong community of practice in a university must also take into account the external factors of the university. Therefore, collaboration mechanisms between the university and external agencies should be promoted and developed: transfer, assessment and construction of knowledge.

In order to substantiate a community of solid practice, it is necessary to create sustainable relationships with various partners, including through the involvement of students, student associations, Alumni associations, community members, research centers, social services, industry or the business community.

The university's external context can influence the ability to create and support the Practice Community in an effective way. Such external influences can be considered: educational policies and their stability, institutional policy oriented towards the effective involvement of members of the academic community and transparency in decision-making to anticipate the activities of teachers.

But personal involvement is fundamental in creating and developing communities of practice. Professional communities operate as small groups, and universities have well-defined structural units that work in the form of departments or research centers and which must be involved in promoting the Communities of Practice.

Universities' leadership must provide mechanisms to ensure the Community's sustainability of practice by stimulating the interest of the participants, maintaining the incentives for change and motivating community members to practice.

The first Practice Communities at Constantin Brancusi University in Târgu Jiu have been established since 2015. Three communities of practice, a Community for Legal Sciences, a Community for Accountancy and a Community for Business Administration have been set up. The establishment of the three communities of practice was possible with the help of POSDRU ID 140930 "Improvement of university study programs in the fields of Business Administration, Accounting and Legal Sciences by consulting Alumni".

Each community was made up of 15 members and enrolled students from each year of study both from undergraduate and master students. Planned meetings were held, attended by members of the community of practice and invitations: community practitioners. Among the results of the activity in the practice community were:

- Improvement of university study programs and adaptation of the university curriculum by consulting the graduates, with long-term positive effects on the correlation of the university curriculum with the needs of the labor market;
- Strengthening cooperation between the university and the business environment through alumni for better correlation of higher education with the labor market;
- increase the involvement of the business community in the activities and processes of defining the competences and the programs of university studies;
- increasing the communication between universities, students and employers, - developing a platform for the management of the communication process between the academic environment - students - graduates - employers;
- improving students' practice - a more focused and multidisciplinary strategic plan;
- developing and implementing more efficient, coordinated communication with alumni;
- developing and implementing a marketing plan that focuses on mutual expectations and benefits - university-alumni.

Starting with 2017, the Industrial Engineering Practice Community was established on the previous model, comprising students from the Machine Building Technology and Masters degree from the Manufacturing Quality Management Program. There have been meetings with specialists from the field, working in the Oltenia Region companies, and among the obtained results: improvement of the study program, improvement of the students 'practice, increasing the employers' interest in the competences obtained by the graduates of the University

Communities of practice have been established at Constantin Brâncuși University of Targu Jiu as a strategy for promoting best practice in learning and teaching in the area of engaging disciplines by fostering interdisciplinary approaches to curriculum design and development.

In cultivating interdisciplinary at Constantin Brancusi University of Targu Jiu, communities of practice may focus on one or more of the following priorities:

- **Problem solving** Most communities of practice have an element of problem solving within their sphere of practice. A community brings together expertise from a variety of sources to focus on solving a common problem, thus providing benefits to members and their elements.
- **Knowledge creation and sharing.** One of the main tasks of communities of practice is to develop new knowledge that will improve the quality of learning and teaching at University.

A knowledge development community may decide to focus on finding, collating, organising and distributing the knowledge that their members use every day. This involves the community in organising shared information processes and focusing on filling knowledge gaps.

- **Best Practice.** A community of practice focuses on developing, validating and disseminating best practice and may have as one of its projects the documentation and dissemination of such practice.
- **Innovation.** Communities of practice may be based around issues of common interest to professional peer groups, with a focus on new and emerging areas of knowledge where there may be the opportunity to innovate. These groups can provide the basis for rapid dissemination of new ideas and resources.

5. Conclusions

Communities of practice are formed by people who are part of a collective learning process in a common field of activity. Promoting activities and community projects, promoting courses conducted by involving various agents may lead to increasing knowledge and sharing responsibility and participation of multidisciplinary teams of teachers, students, representatives of other institutions or community, and also of schools in the case of education sciences.

We can consider networks as types of organizational structure based on interaction without having a central point or predetermined sequences, but allowing non-sequential development of functions in an organization.

The community of practice is not a scientific community, it does not deal with science but with practice derived from knowledge.

The community of practice helps interaction and knowledge sharing, but an incorrect implementation can lead to failure.

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The consequences of the electronic trading and eFulfillment services development on human resources

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Abstract: A actualy distribution system in electronic commerce is the e-Fulfillment. In the first part of the paper by presenting the concept and technological developments we have highlighted several classifications thereof. The biggest part presents the main operations are conducted at the operator e-Fulfillment, from taking products from suppliers, management, logistics, comparative analysis of classical storage and eFulfillment systems, some aspects of the advantages of using these systems, the costs involved and examples for Romania. The paper ends with some aspects of the consequences of the electronic trading and eFulfillment services development on human resources.

Keywords: *eFulfillment, distribution system, technological developments, online operators*

1. Introduction

Currently, information technologies, where the Internet is the point of reference, are present in all fields of activity of the contemporary man and the generalization of electronic exchanges of information has determined the universal character of interpersonal and business communication. Due to the changes in the way of shopping worldwide, the trade has gone from the direct contact between people to being done through intangible means and a variety of alternatives, offered according to the needs of the customer to obtain goods. E-commerce is the basic element or piece of the new economy, and the Internet is the main medium through which it makes its presence felt.

Although e-commerce has changed the nature of global trade, it is developing at different rates worldwide [7] and has a significant impact on businesses and the business environment seen as a whole. As the number of Internet users grows, experts believe that e-commerce will soon become the main means of affecting transactions [1].

E-commerce has grown rapidly over time and more and more organizations are generating these channels of communication with the customer to enhance business relationships [3]. As a result, organizations that have offered products through traditional channels, find better alternatives to make nice profits through virtual channels corroborated with increasingly modern forms of storage and distribution.

2. Efulfillment research

Currently, online store administrators have the opportunity to outsource inventory management, ordering, billing, packing and parcel delivery through e-Fulfillment services. Therefore, starting from the operating mode, e-Fulfillment can be defined as a logistic service addressed to online stores for taking over their operations [2].

The first in-depth research on fulfilment strategies was published by Mather (1988), where he discusses the relationship between production time P, that is, how long it takes to manufacture a product and time to complete demand C. Their sum represents the time that customers is willing to wait for the execution of the order, from the request addressed to the point of sale to the delivery of the product to the customer. Sometimes order fulfilment is used to more accurately describe the distribution act or logistics function, but in a broad sense it refers to how companies respond to customer orders.

Currently, all companies are trying to permanently reduce this time, reducing being often considered a competitive advantage in front of competitors. In this context the operationalization of eFulfilment is a necessity and an advantage. E-fulfillment is the service by which an operator takes over the entire process of order fulfilment on behalf of an online store, from storage, to taking orders, packing and delivery or even website management, based on cloud management, reporting and order tracking. Basically, the order fulfilment time is greatly reduced by taking the goods on the e-fulfillment platform.

In other words, e-fulfillment means the sum of the logistical processes by which a product ordered in an online store is packaged and delivered to the courier for delivery to the consumer.

Considering the gradual increase of e-commerce sales and the increased interest for omni-channel (OC) e-Fulfillment trading, it is a powerful logistics system [5] and which allows the implementation of efficient and quality services [4].

As for the benefits of implementing the eFulfillment system, they delimit a new stage in the development of e-commerce and the transition from traditional online merchants to those who implement a logistics system of "inventory matching on demand" [8].

Thus, the main advantages for companies that use eFulfillment systems can be analysed from the perspective of the relationship between consumers and online operators and refers to: a more direct and beneficial relationship with producers; high expectations for conventional producers and retailers regarding the implementation of development strategies; reducing costs on the distribution chain, by reducing transport, handling and even management and packaging services; achieving a balance between the manufacturer and the online retailer; maintaining a more distant consumer position with regard to retailers, lower prices for consumers; much easier identification of suppliers and business partners etc.

3. Comparative analysis of classical storage and eFulfillment systems

Since 2000, Delphi Group has identified a new trend regarding the emergence of new types of intermediaries in the electronic commerce, intermediaries who take over most of the activities carried out in an electronic store and a concentration of the activity of several owners towards a single distributor.

The advantages of the eFulfillment system change the traditional warehouse that has been declining in recent decades by the gradual introduction of Just In Time (JIT), which involves automated work processes, so that a drastic reduction of the human resource inside the classic warehouses takes place. In addition, sales and operating decisions are increasingly closely linked, as delivery and after-sales services become key components of the product offering [6].

Moreover, through these systems some warehouses are without workers, fully automated. Pallets and products are handled with a system of automated conveyors and automated storage and with the

help of recovery machines coordinated by programmable logic drivers and by computers with logistics software.

Due to the development of e-commerce and the direct or indirect influences of eFulfillment services, several consequences can be delimited that affect the workforce of these companies:

- reducing errors, in general and human errors, in particular, through the automation of work processes, following the increasing introduction of information and communication technologies;
- improves the systems by using ERP system modules that work integrated through the use of a common database and which involve highly qualified employees;
- change of occupations, some disappear and new ones appear (statistician, soft worker, etc.);
- the use by managers of solutions / applications based on interactivity, support in decision making, use of organizational memory to capitalize information and knowledge etc. They allow considerable improvement of the management process and the responsibilities in the job description;
- in fact, the use of ICT leads to a true effect of organizational coherence (coherence between the organizational structure and the decision-making structure). The Internet determines the organizations to reconsider the coordination mechanisms (communication and control). ICT also influences the elements related to structure (organization). Processes and relationships are reanalysed and structured so as to streamline information flows and ensure seamless communication between employees (information is provided at the right time and the person who needs it);
- the introduction of automated technologies allows the reconfiguration of the spaces in a company with eFulfillment services and the replacement of the employees mostly with the systems of product identification, take over the tape and their packaging and labelling;
- use of systems in low temperature warehouses to prevent products from deteriorating and which allow the protection of human health.

The e-fulfillment service presents many advantages, especially for e-commerce start-ups due to the fact that it provides them with flexibility and fast scalability in the storage, management, take-up and delivery of their products, while being a simple solution, immediately implementable, of which the main advantage is that it turns a fixed cost into a variable one.

Table 1. e- Fulfillment advantages.

	Type of advantage offered through eFulfilment	The effects of the beneficiary of eFulfillment services
1	Taking over of storage operations, taking orders, managing goods, invoicing, packing, delivery.	External storage, order taking, asset management, billing, packing, delivery.
2	Transformation of indirect costs into direct costs in proportion to the number of orders delivered and stored the volume of goods.	Reducing the functioning of the expenses with the electronic store.
3	The owners of online stores can focus exclusively on business development, increasing the portfolio of commercialized products, promoting and strategically positioning them on the market.	Focusing on product portfolio development, increasing competitiveness and promoting them.
4	Track the activities undertaken by the e-Fulfillment cloud by ERP and Business Intelligence, which allows you to view a dashboard at the end of the day or in real time.	Visualization, supervision and control of outsourced services.
5	Achieving minimum shipping times, guaranteeing well-packaged items, consistent delivery and an easy return process. (as is the case with eMag).	Creating a competitive advantage by increasing the efficiency of deliveries

4. The influence of eFulfilment operational processes on the workforce

In the figure below it is presented in the form of a diagram, the use of ICT that causes major changes in terms of strategy, structures, management processes, but also the role of the people, respectively of the human resources within the companies that offer e-fulfillment services.

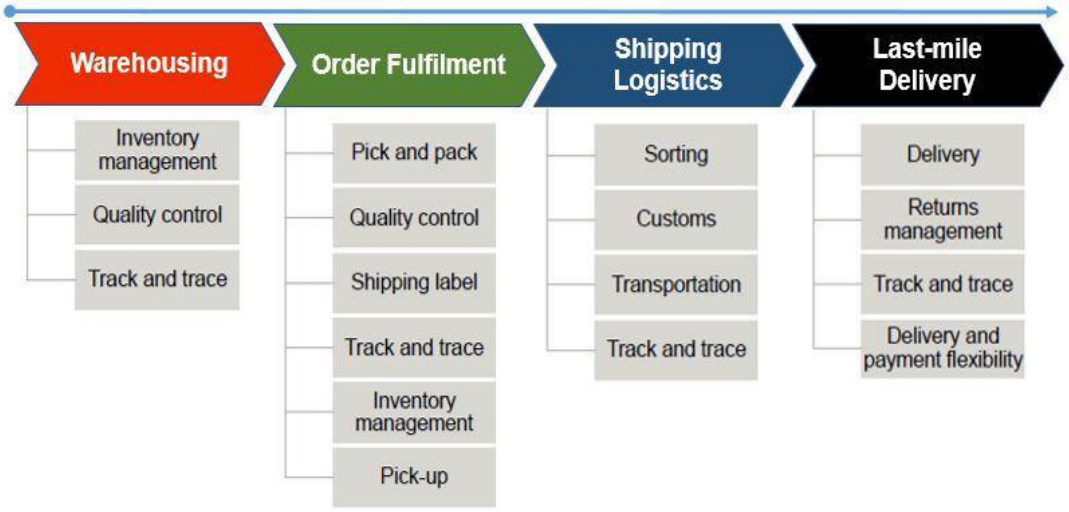

Figure 1. Elements of the eFulfillment operational process.

The presence of logistics platforms with automated elements of the distribution system in which operations are carried out for transhipment of goods, warehousing, marketing of bulk goods, packing, sorting and grouping of goods for their shipment reconfigure the need to prepare employees, so that they are registered a shift from the use of the unskilled labour force to the specialized workforce and preferably with higher education.[1]

In other words, it creates an influence on the workforce that results into different norms of work, the number of employees is decreasing, but instead, the automation is increasing.

To highlight the main problems faced by distribution centres, the results of a survey conducted in 2017 by the research company Aberdeen Group Inc are shown in figure 2.

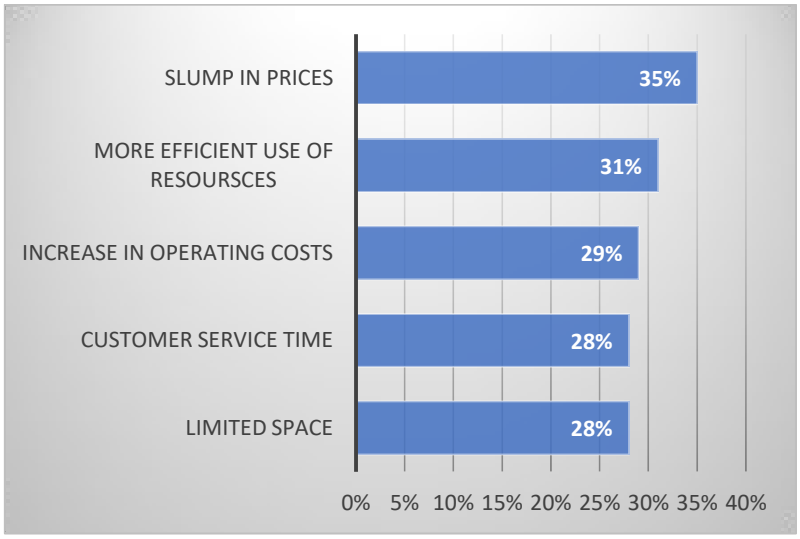

Figure 2. Results of the survey on the problems of distribution centres
Source: processing by Senior software Good practices in warehouse management

The survey was conducted on a sample of 159 international companies that have distribution centres. The problems mentioned in the graph above are known to the logistics specialists and their solution is gradually solved by introducing WMS-type systems that automate and optimize the activities of reception, storage, collection and dispatch of the goods, offering permanently real-time information on the status of the stocks, of the storage space, allows the packaging, inventory or resupply. The integration of these systems allows the visibility of the stock in all channels and distribution locations, optimizing the flow of goods and satisfying the multi-channel demand. From a financial point of view, the wage expenses with the labour force from the warehouses register a substantial pressure on the operational costs, with weights of up to 45%, which amplifies the need to adopt the e-Fulfillment systems.

In conclusion, the appearance of e-fulfillment deposits, as compared to the classic deposits, has produced changes in the work force as follows: the emergence of new occupations such as pickers, the reduction of the number of personnel and of the expenses with the payment of the salaries due to them.

Conclusions

E-commerce confirms the role of information and communication technologies in enhancing the competitive potential of an enterprise and ensures its complex development prospects. In this context, the e-fulfillment service represents an opportunity through the multiple advantages that it offers materialized in reducing costs and transforming fixed costs into variable costs, flexibility and speed in the storage, management, take-over and delivery of goods**.**

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Renewable energy development as a job creation mechanism: Lessons from New Mexico

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Abstract. In addition to the environmental benefits from renewable energy development, a variety of reasons are also offered as justifications for government policies to promote these energy resources. These reasons include the creation of new jobs, often in geographic regions that face adverse employment conditions, such as remote and rural areas. It is important, therefore, that in order to assess the societal impact of renewable energy development, the impact of such development on employment be studied. This paper uses the U.S.A. state of New Mexico as a case study to examine the trends and role of green (renewable) energy employment and highlight some key methodological issues that create significant difficulties for studies of the impacts of renewable energy development on employment.

Keywords: *Renewable energy industries, employment, green jobs.*

1. Introduction

Renewable energy sources are "already the world's second largest source of electricity". [1] This development is the result of several factors, including as a response to climate change, as a consequence of significant drops in the prices of these energy sources, and because of innovations in digital and communication technologies that allow better integration of these sources in the electricity grid. The pace of development of renewable energy sources, however, is still greatly dependent on government policies. [2] In the United States of America, both national and state policies play significant roles. Furthermore, in the U.S.A., fluctuating political support for responding to global climate change has meant that different rationales must be used to sustain political support for policies that promote renewable energy development. One rationale used frequently by the renewable energy industry, environmental groups, labour organizations, and many politicians, is the presumed positive impacts of such policies on national and local employment. [2]

The idea that renewable energy development could be an important engine of job creation is based on a variety of studies and reports, which produced findings to this effect. A study produced by the International Renewable Energy Agency (IRENA) estimates that the renewable energy sector, at the end of 2018, employed about 11 million people. While most of these jobs were in China, the U.S. and the European Union, other countries in Asia, North Africa, and Latin America also experienced significant growth of employment in this sector. [3]

A meta-study compiling the findings of thirteen independent reports analysing the economic and employment impacts of clean energy industries in the U.S.A. and Europe arrived at the conclusion that these industries had a much higher job creation rate than the conventional fossil-fuel-based energy sector. [4] Another study, which built a simulation model to explore job creation in the U.S. energy sector, also concluded that renewable energy and energy-efficiency improvements would create jobs at a faster pace than fossil-fuel based energy industries. [5]

However, the literature on the impacts of policies promoting renewable energy development also includes studies that show a more complicated effect on labor markets. For example, a study analysing the impacts of the growth of renewable energy in the North Rhine-Westphalia region of Germany indicated a loss of employment in the region, due to the decrease in the conventional energy sector, but a gain in overall employment in Germany because of the substitution of imported fossil fuel by renewable energy systems whose components and plants were primarily manufactured within the country. [6]

Similar conclusions are drawn by a study focusing on the Asturias region of Spain. Renewable energy development is predicted to lead to a gradual loss of employment in fossil-fuel reliant industries. While the employment gains in the renewable energy industries are expected to be greater that these losses, these gains will be in two different areas: construction and installation, and operation and maintenance. Jobs in the first area will be involved in the process of building the infrastructure which may, or may not be long lasting. [7]

Projections in the literature of the impact of renewable energy development on employment range from strongly positive (significant job gains) to moderately negative (some job losses). [8][9] This divergence of findings is difficult to reconcile. There is some indication that it is primarily driven by the methodology applied in the various studies. The authors conclude that "outcomes seem to depend very much on the methodology. The estimations that include induced effects are generally less optimistic about net employment creation in the wake of the energy transition. Partly because policy reports tend to use methodologies that do not include induced effects, they generally report more positively about net employment creation related to renewable energy than do academic studies." [10] Because most studies do not include induced effects, the current literature might be too optimistic about the size of the net employment gains from renewable energy and energy efficiency. Nevertheless, the emerging consensus seems to be that the net effect on employment from increased use of renewable energy will be positive. [10]

2. Renewable energy development in New Mexico

The economy of the state of New Mexico is quite dependant on revenues from energy production. New Mexico has more than 6% of U.S. total proved crude oil reserves, more than 4% of the nation's natural gas reserves and 2.5% of the estimated recoverable coal reserves. In 2017, it produced 5% of the crude oil, 4% of the natural gas, and 2% of the coal produced in the U.S. [11] Because most of these reserves are in lands owned by government (Federal, State, and Native American Tribal lands), their development is an important source of public revenue. However, the price volatility of fossil fuels, and especially oil and natural gas, has resulted in significant fluctuations in the revenue from these resources. In the period 2006 to 2017, oil and gas extraction produced between a low of $4.6 billion (2016) and a high of $8.8 billion USD (2014). [12] These fluctuations have had a deleterious effect on the state's economy and, as a result, have led political leaders to seek diversification.

Fortunately, New Mexico has a very significant renewable energy potential, particularly for wind and solar energy: "The state has some of the highest rates of solar irradiance and best wind conditions in the United States." [12] Consequently, in the past two decades, there has been a shift in energy production in the state. This shift initiated in 2000, when the state's Public Regulation Commission (NMPRC) passed a renewable portfolio standard, obligating investor-owned electric utilities operating in the state to produce a certain portion of their electricity from renewables. Following legal challenges to this NMPRC action by some of the utilities, the state's legislature codified the standard into law, the New Mexico Renewable Energy Act (first enacted in 2004).

As a result of these actions, renewable energy development in the state accelerated. Especially during the past ten years several renewable energy projects have come online and many more are in the pipeline. [13] Taken together, all of these projects have stimulated growth in the renewable energy sector of New Mexico's economy. Some of the greatest strides in renewable energy efforts took place in 2010 and 2011, when over the course of only one year, New Mexico's solar energy sector tripled, going from 43 megawatts to 116 megawatts, placing New Mexico firmly among the leading U.S. states in solar energy efforts – in fact, New Mexico was fourth among the states for the production of solar photovoltaic power in 2011. [14] Photovoltaic energy development continued to grow rapidly and, as of 2017, the state had a total installed solar capacity of 750 megawatts (See figure 1). [12]

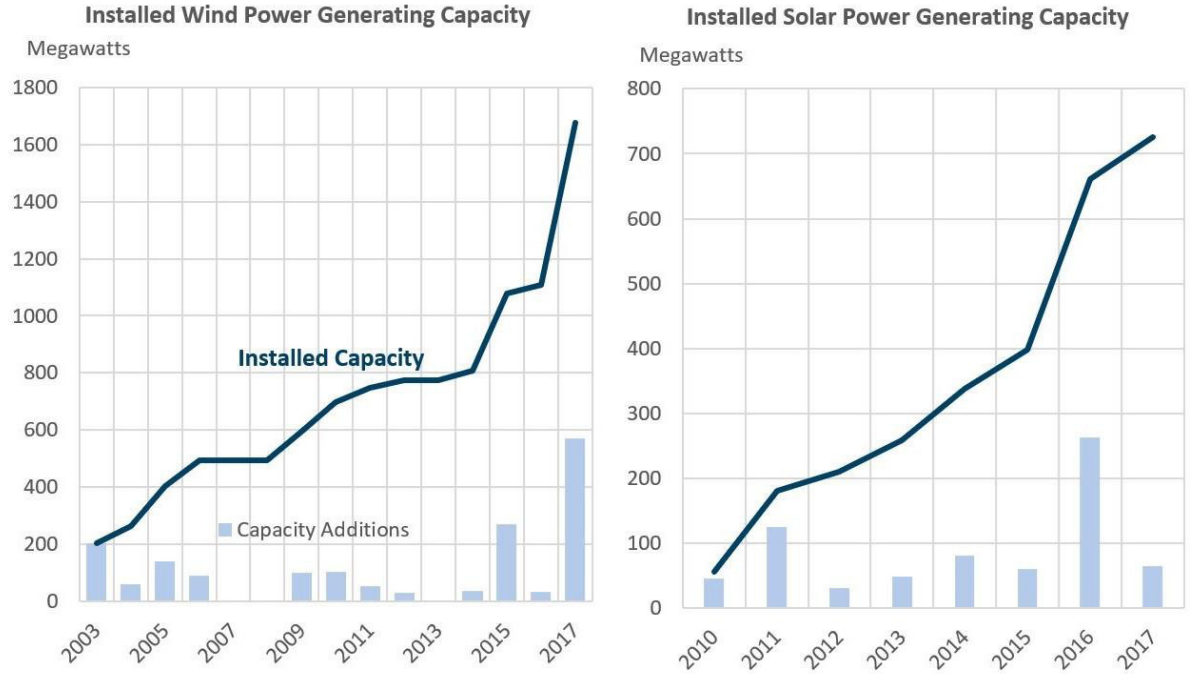

Figure 1. Growth of wind and solar electricity generating capacity in New Mexico

Wind power remains the largest contributor of renewable energy in the state, accounting for more than half of total renewable energy production in 2017. [12] The installed wind electricity-generating capacity was about 1.7 gigawatts, with more than 1000 operating wind turbines as of 2017 (figure 1). Together, wind and solar accounted for 18 percent of electricity generation in the state, setting it well on track for meeting its Renewable Energy Portfolio Standard, which requires investor-owned utilities to obtain 20 percent of the electricity they sell in the state from renewable energy sources by 2020. [12]

3. Employment in the renewable energy sector

Considerable difficulties exist in measuring employment in the renewable energy sector in the U.S.A. as a whole and, therefore, in New Mexico as well. The Bureau of Labor Statistics of the U.S. Department of Labor is the main source of employment data for the U.S.A. The Bureau uses a three-digit numerical code to classify the sectors of employment within the U.S. economy. This system, however, does not assign any specific codes to the renewable energy industry (nor, as a matter of fact, for energy efficiency improvement jobs or any other "green" energy employment). In addition, the U.S. Department of Energy does not offer any definition of "clean" or "green" energy. [15]

A secondary source for statistics on employment in the renewable energy sector are the trade associations representing different portions of the industry. These have their own different ways for defining what "clean" energy is, and what employment positions qualify for counting as jobs in the sector. Nevertheless, a reasonable estimate, based on the best data available, would be of about three million jobs nationwide. [15]

The best methodology for enumerating jobs in renewable energy is to directly survey the employers that make up the sector. For example, a study of the wind energy workforce in the U.S., conducted by the National Renewable Energy Laboratory, identified specific wind energy employers and educational institutions offering degrees or certificates in wind energy. It then surveyed these employers about the numbers of people they employ, the types of employment, compensation, etc. [16] The problem with this approach is that it requires that all possible employers in the sector be identified and contacted, that a significant majority report their data, that they report data accurately, etc. Also, this method identifies only those directly employed in the industry and not those whose jobs depend on the economic activity engendered by those directly employed in the sector (indirect employment effect).

Whatever estimates exist concerning employment in the renewable energy sector in the U.S. however, do not break down such employment by state. It is, therefore, very difficult to obtain employment statistics which pertain specifically to New Mexico. The only source of these data we were able to identify dates from 2007 and studies "green" jobs in the Rocky Mountain States (one of which is New Mexico). The report indicates that while the number of total jobs in New Mexico in the period 1995 to 2007 grew by 13 percent, jobs in clean energy grew by 152 percent and in energy efficiency by 241 percent. [17]

Because renewable energy sources continued to be developed at a fast pace in the decade from 2007 to 2017, one can fairly safely assume that employment in this sector also continued to increase at a fast pace. Furthermore, in regard to the future, although there are no estimates available of the overall growth of employment in the renewable energy sector in the state of New Mexico, there are some indicative predictions for specific jobs in this sector.

According to the New Mexico Department of Workforce Solutions, for the period 2016-2026, the top two jobs projected to experience the highest growth rate in the state are "solar photovoltaic installer" and "wind turbine service technician". The former is projected to grow by 112.6 percent, and the latter by 57.5 percent during this period. Perhaps equally important is the fact that the median compensation for these jobs ($39,430 for the former and $45,430 for the latter) is greater than the median compensation for the state, which is projected to be $33,450. [18] We should note here that the jobs discussed above are easy to identify as "belonging" to the renewable energy sector. Determining the overall employment in the sector, however, is complicated by the fact that many more jobs cannot easily be identified as belonging to the sector—jobs such as in construction (some of which will be due to the expansion of the renewable infrastructure and some not), power line maintenance and repair, etc.

Given the commitment to renewable energy development, which the state of New Mexico has shown through policies it has put in place (a subject we discuss in the following section), there is near certainty that employment in this sector will continue to grow strongly. It is also certain that the jobs in this sector will be relatively well compensated.

The difficulty in determining the *net* impact on employment in the state from the development of renewable energy is in 1) calculating the reduction in employment in the conventional energy sector *attributable* to the expansion of renewable energy and 2) accounting for the possibility that some renewable energy sector jobs may be lost to other countries as a consequence of globalization and international trade. [2] These calculations are extremely difficult, require numerous assumptions, and are, ultimately beyond the scope of this paper.

4. Political context for renewable energy development in New Mexico

4.1 Overview of New Mexico governmental structures

In order to understand the political context for development of renewable energy in the state of New Mexico, it is important to first discuss the relative roles of three key governance entities: the executive branch, specifically the Governor, the legislative branch (bi-cameral, comprised of state senate and house of representatives), and the New Mexico Public Regulation Commission (NMPRC). It is important to note that the role of the latter entity is unusual among the states because it is one of only eleven (out of fifty-one) such bodies (which each of the states, as well as the District of Columbia, has in one form or another) that is directly elected by the people. The direct election of its five commissioners was set forth via an amendment to the state constitution, accomplished by popular vote, on November 5, 1996 (Article XI, Sections 1 and 2, New Mexico State Constitution). [19] Prior to the 1996 constitutional amendment taking effect the commissioners were nominated by the governor and confirmed by the state senate. [20]

The Public Regulation Commission plays a very important role in the development of renewable energy in the state of New Mexico because it exercises oversight of electric utilities. This oversight includes setting parameters for electricity generating facilities and approving the plans of utilities in regard to the resource mix they use for electricity generation. Because by far the most important application of renewable energy technologies is in electricity generation, the role of the NMPRC in this area is direct and significant. The fact that the commissioners are directly elected has meant that the NMPRC is an independent political body, willing and able to exercise policy-making authority.

The governor of the state of New Mexico plays an important role in setting the agenda for energy and environmental policy and regulation in the state. The governor's power is both direct and indirect. It is direct through setting priorities, issuing executive orders, and exercising the legislative veto power to prevent the legislature from acting in ways that would counter these priorities. It is indirect through control by appointment of the leadership of key departments such as the Energy, Minerals and Natural Resources Department (EMNRD) and the Environment Department. These Departments have the power to promulgate rules and regulations, or rescind such, in ways that advance the governor's policy priorities. They also can create or eliminate special programs, which allocate funds, to advance policy priorities. In the case of renewable energy development, because most of the regulatory system that would impact such development concerns the electricity industry, the governor's and broader executive branch's power is limited to tightening or loosening environmental regulatory standards.

By holding exclusive legislative authority, the state legislature, at least in theory, holds the most powerful policy-making tool. In practice, the bi-cameral nature of the legislature disperses and dilutes its power. In addition, the New Mexico legislature is not a full-time legislative body. The state constitution limits regular sessions to 60 calendar days, and that only in odd-numbered years. In even-numbered years, the legislature convenes for a short, 30-day session, which is generally limited in scope to budget issues (Article IV, Section 5, New Mexico State Constitution). [19] So, essentially, the legislature has 60 calendar days every other year to draft, debate, amend, and enact legislation.

4.2 Evolution of renewable energy policy from 2000 to 2019

A clear starting point for a discussion of the evolution of renewable energy policy in New Mexico is the passage of the Renewable Portfolio Standard (RPS) by the NMPRC in 2000. Prior to that time renewable energy development was being promoted through fiscal policy, such as tax credits, which had resulted in only a few distributed wind and solar installations. This action by the NMPRC had two important outcomes. The first was the decision by PNM, the largest investor-owned electric utility in the state, which is also based in New Mexico, to pursue the RPS and to contract for the building of the New Mexico Wind Energy Center, a 200 megawatt facility, which was not only by far the largest renewable energy project in the state but also one of the largest such projects in the world at

that time. The second outcome was the decision of the rest of the investor-owned electric utilities operating in New Mexico, all of whom were based in Texas, to bring a lawsuit against the NMPRC in an attempt to overturn the RPS.

The election of Bill Richardson as governor (in office Jan. 1, 2003-Jan. 1, 2011) was a second important time point in the development of renewable energy in the state. Richardson, a Democrat who had served as U.S. Secretary of Energy under president Clinton, brought considerable knowledge and interest in energy policy broadly and renewable energy development specifically. He immediately set out to enact policies that would promote the expansion of renewable energy sources in the state. One of his first priorities was to put the NMPRC's RPS objectives into state law, thus nullifying the legal challenges to the Commission's rule. Working with a Democrat-controlled state legislature, he succeeded in this objective and the New Mexico Renewable Energy Act (REA), was enacted in 2004. From that point on, state law required all investor-owned electric utilities operating in the state to supply an increasing portion of their electricity sales from renewable sources. [21] Following that, governor Richardson issued Executive Order 2009-002 *Expanding New Mexico's Clean Energy Economy*, which declared New Mexico as a "Clean Energy State" and set it on a path to expand significantly the share of renewable energy in the state's economy. [21]

In 2011, Richardson was succeeded as governor by Republican Susana Martinez. The Martinez administration was not inclined to continue promoting renewable energy development. However, because at no point during the eight years she served as governor was there a Republican-controlled state legislature, governor Martinez was not able to repeal or amend the REA. As a result, her efforts to roll back the intensive pursuit of renewable energy focused on curtailing environmental regulations that disadvantaged fossil fuels. Governor Martinez cited economic reasons for repealing strict environmental regulations, such as cap and trade rules for carbon emission reductions, calling such regulations "job killing." [22] Ultimately, the REA proved to be a very effective vehicle for promoting renewable energy development, even in the face of strong opposition from the executive branch. As figure 1 shows, additions to the state's wind and solar electricity generating capacity continued at a rather fast pace during the Martinez administration. Despite its concerted efforts to promote fossil fuels, the Martinez administration failed to secure a future for the aging coal-fired electric generating stations, which are primarily concentrated in the north-western corner of the state. More stringent federal environmental regulations raised the price of coal-generated electricity. At the same time, steep declines in the price of natural gas, wind, and solar-generated electricity effectively rendered the coal-fired plants uneconomical. [12] Of the nine coal-fired units operating in this part of the state in 2000, five have already shut down. Two more are scheduled to close by 2022. [12] This process has adversely affected employment in the area, with job losses that have not been locally replaced by new jobs created by renewable energy sources.

5. Conclusions

As with any policy efforts to advance employment and stimulate the economy, the promotion of renewable energy presents a complex picture, which policy-makers need to consider carefully. The review of the literature supports the argument that renewable energy development has a positive impact on employment—both by creating more jobs than it replaces, and by creating jobs that offer relatively higher wages. However, these impacts are not distributed evenly in space and time. As the case of New Mexico illustrates, jobs lost in one geographic area, particularly an area with a high concentration of fossil-fuel related industry, may not be replaced sufficiently by renewable energy jobs in the same area. Furthermore, as a significant proportion of these jobs are in construction, they may not persist once the renewable energy infrastructure has been built.

When trying to estimate the number of jobs created by renewable energy sector, several significant methodological issues need to be resolved. For an accurate accounting of the impacts on employment, both direct and indirect jobs need to be counted. However, neither is easy to count. For direct employment, it is often difficult to distinguish whether jobs such as in construction, grid operations, office support, etc. should be attributed to renewable energy development or some other cause. For

indirect employment, the situation is even more complicated, as it is difficult to estimate the creation of jobs throughout the economic spectrum, from financial services, to auto repair, the hospitality industries (restaurants, hotels, etc.) and beyond. Even more difficult is the issue of determining whether, and how to count impacts to the self-employed such as farmers and ranchers. As an example, in New Mexico, a significant proportion of especially wind capacity is placed on private land. Farmers and ranchers on whose land wind turbines are built, along with ancillary facilities such as roads, transformer stations and power lines, receive significant lease payments. Ranchers on whose land the wind turbines of the New Mexico Wind Energy Center were built, told the author that without the lease payments they derive, it would have been difficult or impossible for them to hold on to their land and continue operating their ranches. Are jobs saved by renewable energy development to be counted as jobs created by it?

Finally, the argument is often made that renewable energy development is dependent on the will of politicians in power, and that political swings impact consistent development. [2] The case of the state of New Mexico offers an example of how this problem may be minimized or overcome. At least in the political context of the USA, where political power is divided between the executive and legislative branches, casting policy in a legal rather than regulatory framework renders it more persistent and resistant to swings in the political climate. It is much more difficult to repeal or amend laws than regulations and executive orders.

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Environmental effects due to the technological processes of lime production

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Abstract. The paper presents the way of obtaining lime, the technological processes adopted and the resulting products. The process of obtaining lime has effects on the environment, affecting through the emissions of pollutants, as well as the quality of air, water and soil. That is why this process of obtaining lime must comply with the regulations in force to ensure a balance between the industrial environment and the environment. At the same time, it is important to know the sources of pollution, but also the measures for the protection of the quality of the environmental factors, so as to ensure a control of the emissions resulting from the lime industry and a low level of pollution, without significant effects on the environment.

Keyword: *environment, lime, technological processes*

1. Introduction

In a lime factory there are several technological processes that are carried out for obtaining lime, namely: obtaining lumps lime in vertical ovens; obtaining the ground lime; obtaining hydrated lime; production of lime in the vertical oven, regenerating with 3 tanks in parallel flow type Maerz[1]; technological process for obtaining lumps lime with granulation (20-50) mm.

2. The technological process of obtaining lumps lime

The technological process for making lumps lime comprises the following stages:

- unloading and storing limestone in 4 silos with a storage capacity of 600 tons each;
- burning of limestone in 4 vertical type Bicaz[2] ovens;
- lime storage and shipping.

The raw material used to make the lumps lime is the limestone that burns in the furnaces, using as a source of energy the natural gas. The limestone deposited in the silo is sorted on a sieve with bars and then transported with the aid of the tape system to the furnace feed bunkers, located at its top.
In the area of the bar sorter there is a dust filter and at each furnace a filter that dusts the flue gases from the oven to the basket.

Obtaining the finished product, lumps lime, in vertical Bicaz [2] type ovens takes place in three stages, in the three zones of the oven:
- at the top - preheating of the raw material;

- in the central area - calcination - decarbonation of limestone at 1200-1300^{0}Celsius;
- at the bottom - cooling of the lime.

Two minifilters are provided for the clearing of the transport system for lumps lime.
Lime extraction is done through 4 extraction holes using an oscillating gutter and is stored in 4 siloes.
Filters that extract gas from the furnaces are also common with the lime extraction area [10].

1.1) Obtaining the ground lime

The lumps lime is extracted through a mechanical extraction system mounted under the silo and is taken by a conveyor belt and transported to the mill with hammers. The mill is equipped with a bag filter for dust removal.

In the hammer mill, which has a feed rate of 15t / h, the crushing of the lumps industrial lime takes place at a granulation of (0-15) mm.

The crushed lime (lime splint) from the hammer mill is taken over by an inclined conveyor belt and transported to the 80-ton buffer silo. This silo is equipped with a filter with dust bags.

In order to obtain the milled lime for BCA[3] - the granulated lime is extracted from the silo of 80 tons, by means of a bar and a dosing tape and is introduced in the single-chamber ball mill type Liasa[2]. After grinding in the ball mill, the ground lime is transported by means of a screw system - elevator - rubber band, in the dynamic separator with cyclones. In the separator the pneumatic separation of the ground lime takes place:

- the fine fraction will reach the cyclones and from there it will be guided in the collecting screws and then in the elevator with cups on the chain that will lift it and will unload it gravitationally in the storage and delivery silo.
- the coarse fraction will reach the central cone of the separator and from here it will be recycled into the ball mill by means of a screw. The mill for milling and the dynamic separator are equipped with filter bag.

1.2) Obtaining hydrated lime

The raw material used to obtain hydrated lime is lumps lime. The lumps lime is ground in the hammer mill up to 0-15 mm granulation and stored in the granulated lime silo from where it is introduced into the three-step hydrator.

Hydration of lime is a strongly exothermic reaction that generates around 1140 KJ / Kg CaO[10].
The hydrated lime obtained is discharged into the elevator and from here into a dynamic separator which results in two fractions: the fine fraction that is stored in the hydrated lime silo and the coarse fraction that is ground in the ball mill and is reintroduced into the gray elevator after which the cycle resumes.

The delivery of hydrated lime is done in bags, using the packing machine which is equipped with a dust filter, or bulk for which there is the loading facility being transported in tanks.
Hammer mill, granulated lime silo, hydration plant, hydrated lime silo, ball mill are provided with a dust filter.

1.3) Lime production in the vertical furnace, regenerating with 3 tanks in parallel flow type Maerz

The furnace is made of 3 rectangular shaped tanks arranged at 120 degrees, connected to each other at the lower limit of the combustion zone through gas circulation channels. The oven capacity is 300 tons lime / day. The oven has a non-stationary, cyclical operation, each tank passing successively through 3 periods of 10-7 minutes each, one burning and two regenerating, separated by short inversions of approx. 1 minute, in which the change of the position of the valves, the feeding with limestone and the unloading of lime are carried out.

The extraction of lime is done all the time of the oven's operation with the help of the extraction masses, whose operation is controlled[5]. The extracted lime is collected in a bunker, and from here it is guided by opening the sluices in the drainage bunker and transported according to quality and necessities.

The furnace is fed from the storage silos, the limestone is extracted by means of an oscillating gutter and transported with conveyor belts to a sorting system provided with two screens where the separation of the limestone takes place in the two granulometric fractions necessary to supply the furnace and the elimination of the lot.
The sort <20 mm is stored by means of a bucket elevator, in a metal bunker, from here it is taken with self-tilting machines, weighed and stored for later processing in order to obtain the limestone filler or it can be marketed as such.

After sorting, the two particle size fractions are sent through a conveyor system with tape to an intermediate silo near the oven. The silo is divided into two compartments: one of 60 tons for the sort (40-70) mm and one of 20 tons for the fraction (20-40) mm. Each compartment is provided with a vibrating extractor that extracts the amount of limestone programmed in the weighing bunker. When the programmed quantity has been reached, the extractor shutdown and the closing flap of the weighing bunker are automatically activated, the limestone being discharged. The skip transports the limestone in a bunker with three holes, with a capacity of 6 tons, located at the top of the oven. The three-way bunker is provided with three hydraulically operated discharge valves and is connected to the three tanks through three discharge funnels. From the bunker during the inversion period the limestone is unloaded in a tank by opening the corresponding flap the other two remain closed.

To burn the limestone, the material goes into the furnace, where the decarbonation of the limestone takes place, until it reaches the final product, lumps lime[8]. The combustion air is introduced into the tank in which the combustion takes place on the upper part, equilibrating with the material.

The gas is introduced into the combustion zone of the tank through a combustion system composed of three parts:
1) the gas installation itself consisting of: electrically operated solenoid valve, three electro-pneumatically operated valves, a safety valve, two bi-pass valves. The valves are operated with pneumatic air at a pressure of 6 bar;
2) the automation installation that serves the gas installation electronically controlled by the automatic oven program;
3) gas spears made of refractory stainless steel. In each tank there are 20 vertical, parallel and equidistant spears arranged symmetrically on the surface of the vessel at an appropriate distance from the masonry. The lances are fitted with nozzles with diameters between 5-8mm, depending on the gas pressure.

The required gas pressure is 3,5 bar and the gas consumption is about 1400mc / hour[9].
The cooling air circulates in the cooling zone in counter current with the lime, after which it passes along with the flue gases coming from the upper part through the connecting channels in the other two tanks of the oven.

The required cooling and combustion air for the lime furnace is provided by a blower station. There are eight blowers: five of combustion, two of cooling and one common reserve. For adjusting the cooling and combustion air flows according to the requirements of the combustion process, two blowers are variable speed. The furnace is provided with a hydraulic installation that ensures, by means of pistons, the actuation: the shut-off valves, the discharge bumpers, the double combustion air flaps, the feelers, the extraction tables, the detent flaps, the locks. The pistons in turn are controlled with the help of electrodistributors depending on the operating conditions imposed. The hydraulic system working system is in open circuit, with manual oil pressure adjustment. It consists of three groups of elements: the pumping group consisting of two pumps and the oil tank; the furnace installation that includes the blocks with distribution-adjustment devices and the hydraulic cylinders for operating the mechanisms; pipes that ensure the connection between the pumping station, the blocks with the distribution-adjustment devices and the actuating cylinders.

On the furnace there are mounted measuring and control devices: on the combustion air pipe and on the cooling pipe are installed - diaphragms for flow measurement and pressure gauges; on each fan there is a pressure measuring device; on each thermocouple tank for measuring the flue gas

temperature; for measuring the lime temperature there are two thermocouples in the area of the extraction tables; in the connecting channels the gas pressure and the gas temperature are measured.
For measuring the level of limestone in the oven is mounted on each tank a device that consists of a shaft with two chain wheels, the shaft being mounted on bearings with bearings. One end of the chain is fixed to a wheel and the other is attached to the rod of a hydraulic control cylinder. The other wheel is provided with a chain with welded spindles, one end of the chain is fixed to the wheel and to the other the weight of the chain is stretched and actuated. On the axis of the device is also mounted a gear wheel that controls the potentiometer for remote signaling of the position of the stretch weight. The device is enclosed in a housing. The operating command of the device is given by opening the oil circuit to the tank, which allows the counterweight to lower by pulling the cylinder piston. When the counterweight encounters the limestone in the oven, the device stops rotating and the potentiometer indicates at a distance the level of the stone in the basin. Weight lifting is done by means of the hydraulic cylinder which brings the feeler to the resting position.
The flue gases give off the heat of the limestone from the furnace, facilitating the start of decarbonation.

After the inversion, a tank that was in the combustion period enters the first regeneration period. During this period the flap air flap is open to the flue and closed to the combustion air pipe.
During the next inversion, the limestone is loaded into the tank. The feeding is done in weighed batches. The feed hopper being provided with three discharge valves, feeds successively the three ovens tanks. It feeds a tank that enters the second regeneration period.

Lime extraction is performed throughout the operation (both during the combustion period and in the two regeneration periods) with the help of the extraction tables whose operation is controlled so that at the expiration of each loading cycle the level of the limestone is lowered exactly in the existing position before the previous upload.

The lime extracted from the tables falls through the outlet funnels in three bunkers with flaps (locks). Through the locks the lime reaches the common reception bunker, from where it is evacuated with a vibrating extractor on a conveyor belt that unloads it in an elevator with buckets on the chain. It is taken from a conveyor belt and stored in one of the storage silos[6].

The temperature of the extracted lime should be between $60\text{-}100^0$ C. If the temperature rises, the flow of the cooling air is increased and if it decreases, the flow of the cooling air is reduced.

The obtained lime is stored in storage silos, the quantity of lime obtained is determined by silo measurements, by stock differences and by taking into account the density of the obtained lime.

Lime is used both for the production of lime assortments in its own production sections, but can also be delivered as such directly to the beneficiary.

1.4) Technological process for obtaining lumps lime with granulation (20-50) mm
Obtaining the lumps lime with a predetermined granulation is done in a crushing-sorting plant composed of: conveyors with tape; crusher; screen; storage bunker.

Lumps lime extracted by free fall from the storage silo, is taken over by a conveyor belt and discharged into a jaw crusher. Under the crusher the lime is taken over by a conveyor belt and through a drainage trough falls on a vibrating screen, operated by an electric motor. The end is discharged on a conveyor with a strip located below the sieve and follows the flow of lumps lime extracted from the vertical ovens being stored in the silos used for grinding. From the sieve the refuse is taken through a gutter in a bucket elevator that transports it to the metal silo. For the delivery of sorted lime, under the silo is located a conveyor with rubber band from which the lime falls in the means of car transport.

The finished products obtained are: lumps lime; hydrated lime; ground lime for BCA[6].

3.Protection of the air, water, soil and phonic quality

3.1Protection of air quality[13]
- Sources and causes of air pollution:
- Technological process of obtaining the lumps lime - limestone calcination;

- The technological process of obtaining the ground lime;
- The technological process for obtaining granulated lime;
- The technological process of obtaining hydrated lime;
- Hydrated lime bag installation;
- Granulated lime silos;
- Hydrated lime silage;
- The technological process of obtaining the lumps lime at the Maerz [1]oven;
- The technological process of obtaining the lumps lime with the dimensions between (20-50) mm at the sorting crushing plant;
- The technological process of transport and storage of lumps lime in silos.

The potential cause of pollution would be the anormal operation of the electrofilters.

To prevent pollution, containment, depollution and dispersion equipment such as[9]: Donaldson bag filter DLM C 2/7/15; bag filter Independenta Sibiu, filter Donaldson SA C 100; Donaldson Siloair VS 21 filter; Donaldson CPC12 dust collector; Donaldson VS 28 filter; filter with Luehr jet pulse bags, 60 filter bags; 2 Donaldson DLM V 18/15 filter; Donaldson CPC filter 8; CimZeropol 1000/20 Hydrator filter; Jet-Puls filter (ICT); Donaldson DLM V 60/15 filter; Donaldson DLM filter C 2/3/15.

The indicators are monitored with the following devices: TESTO 300 M[2] exhaust gas determination device; permanent analyzer at Maerz [1] oven basket.

Air emissions are emitted by: powders, CO, NO_x and SO_2 whose values must be permanently monitored so that they remain below the maximum permissible limits[4]. For example, table 1 shows the concentrations recorded for the dust emissions from the sources of pollution from a lime factory. From the measured values it can be observed that they are below the maximum allowed limit, which means a limitation of the impact exerted on the environment and a good management of the pollutants released into the atmosphere [7].

Table 1. Variation of powder concentrations

Parameter name	Generating sources	Concentrations			Value CMA and the legal basis [mg/Nm^3]	Amounts [t/an]
		minimum [mg/Nm^3]	average [mg/Nm^3]	maximum [mg/Nm^3]		
Powder	Exhaust basket filter mill 2 with lime balls	4,25	2,7	8	10	0,208
Powder	Exhaust filter silo granulated lime filter 2	7,36	6	9	10	0,037
Powder	Cart filter silo, grinding lime 2	4,60	2,8	7	10	0,017
Powder	Crusher filter drain basket 10, with hammers	6,29	3	8	10	0,037
Powder	Crusher filter evacuation basket with minced lime jaws	4,27	2,6	8	10	0,018
Powder	Bulk lime filter sorter cart	4,24	2,7	5	10	0,019
Powder	Exhaust basket filter sieve sort limestone stone	3,75	2,8	5	10	0,022
Powder	Exhaust filter discharge filter limestone band	3,34	2,1	5	10	0,005
Powder	Maerz oven filter outlet	6,03	0,24	9	10	0,972
CO		5,46	0,78	20	500	0,88
NO_x		40,74	27	72	100	6,57
SO_2		0.00	0	0	50	0
Powder	Exhaust filter storage tank lumps lime floor 2	3,60	2	6	10	0,007

3.2.Water quality

The technological water is used for the manufacture of hydrated lime and is used in excess of the amount of stoichiometric water needed[11]. The technological water is also used to cool the mill bearings, it is recirculated being used in the product by pumping and introducing it into the hydrator.
These are pre-treated in different decanters and separated, then through pipelines and collecting channels to the treatment plant.

Technical and technological installations for the collection (collection) of pre-treatment and water treatment:
- collection / decanting basin for the waters from the administrative pavilion;
- decanter - separator for the water from the workers' changing rooms;
- separate wastewater collection basin from the laboratory;
-wastewater treatment plant;
- the rainwater from the platform is taken through a network of streams and pipes, collected in a decanter where decanting / separation takes place.

After settling, both domestic and stormwater reach the sewerage network at the edge of the industrial platform.

The water samples for analysis are collected from the last house before the discharge into the channel.

3.3.Soil quality protection

For the protection of the soil[12], the diethylene glycol tank is provided with a concrete retention tank, to prevent any leakage of the product; there is a rainwater collection system, a system for collecting any accidental leaks and the fuel storage tank is located on the concrete platform and is provided with a retention tank.

3.4.Sound protection

- sources and causes that generate noise;
- compressors, conveyor belts, mills for milling, road traffic, blowers for the Maerz oven;
- measures, means and equipment for noise protection;
- the mills for milling are placed in closed enclosures, the hall for the milled lime being constructed from soundproofing panels that attenuate the dispersion of noise in the surroundings;
- housing of conveyors with belts, with soundproofing panels in the falling part of the limestone;
-the casing of the sieve for the limestone used in the Maerz oven with soundproofing panels;
- casing the double limestone bunker compartmentalized with soundproofing panels;
- housing of the upper part of the Maerz[1] furnace (limestone loading area) with soundproofing panels;
- lining the ceiling of the blower room with soundproofing panels and lining each blower separately with sound-absorbing panels;
- soundproofing walls are built that are meant to protect the neighbors of the site from the noise produced by motor vehicles traveling on the industrial road, which makes the connection between the site and the quarry.

4.Measures to reduce pollution and to supervision of pollutant emissions results from the lime industry

Of the recommended techniques for controlling emissions from the lime industry, the most important are:
- techniques for controlling NOx emissions[4]. NOx emissions depend on the quality of the lime produced and the shape of the oven;
- techniques for controlling SO_2 emissions. SO_2 emissions especially from rotary kilns depend on the sulfur content of the fuel, the shape of the furnace and the sulfur content required by the lime

produced. Selecting low sulfur fuels can therefore limit SO_2 emissions as well as lime production with higher sulfur content[7];
- techniques for controlling dust emissions[11]. Rotary ovens are generally equipped with electrostatic precipitators due to the relatively high exhaust gas temperatures. They are used at temperatures above 370-400^0 C. Electrostatic precipitators can influence the amount of dust by bringing it below 50 mg / Nm^3. A rotary lime kiln fitted with an electrostatic precipitator reaches below 20 mg dust / m^3 in normal operation.

Synthetic filters are also used, especially in preheated ovens where the exhaust gas temperatures are lower. Synthetic filters generally operate at temperatures above 180-200^0 C and can reduce dust concentrations to less than 50 mg / Nm^3. In some cases, even 5 mg of powder / m^3 can be reached daily with synthetic filters, but in this case the devices should be changed 1-3 times a year. The level of long-term performance of synthetic filters depends on the maintenance of the filter and how often the devices are changed. Emissions levels can be low, but costly.

The measures for monitoring the emissions generated by the technological processes for the manufacture of lime consist of monitoring the quality indicators of the wastewater discharged and the control of the emissions of pollutants into the atmosphere, which must be carried out periodically through specialized laboratories. Thus, it is necessary for water: monitoring of final effluents by analyzing quality indicators such as: pH, suspended matter, CCO-Cr, extractable substances with organic solvents, sulphates, carbonates. For air, it is necessary to monitor the emissions of combustion gases: CO, NOx, SOx and powders - at the level of limestone calcining furnaces, monitoring the emission of powders - at the level of dust systems. For the soil, it is necessary to monitor the soil in the enclosure, in the green areas, in the vicinity of the limestone silo, as well as in the vicinity of the fuel depot, the indicators to be followed are: pH, organic carbon, petroleum product, sulphates, carbonates. The results of the monitoring performed highlight the impact on the environmental factors air, soil and water, so that the areas adjacent to the industrial platforms carrying out lime activities are not affected [12].

Conclusion

The technological processes in the lime industry are generating emissions of pollutants into water, through wastewater and stormwater, emissions of atmospheric emissions, namely, flue gases: NOx, SO_2, CO, VOC, powders, as well. and different types of waste that can affect soil quality.

Emissions depend on the shape of the furnace, the operating conditions, the fuel used and the quality of the lime stone.

Gaseous pollutants from the lime industry, as well as powders, may act differently, by their effects on each individual, depending on their quality and concentration.

The main compounds or elements that can be found in the soil of the industrial lime producing area are due to the atmospheric emissions, the loss of raw materials during handling (in waste water, soil and basement) and the improper storage of the resulting waste.

There is also a potential risk of contamination of surface and groundwater as a result of insufficiently purified alkaline wastewater, with a high content of suspended matter and extractable substances.

In order to reduce the impact of noise and vibration sources on the environment, the appropriate measures must be taken to place the technological installations in tight spaces, which cushion their activities, the installation of soundproofing panels, and the housing of the conveyor belts.

Thus, it can be concluded that, in order to comply with the obligations and conditions imposed by the regulatory acts regarding the quantitative and qualitative management of the waters, the sustainable use of the resources, the protection of the environmental factors and the health of the population, the industrial units in which there are technological processes for manufacturing the water.

The lime must have means of treatment for waste water, filters for the retention of powders from the gases emitted into the atmosphere, soundproofing for the premises where ball mills operate and for other machines that produce noise.

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The particularities specific to the manufacture of nanopowders used in the industrial field

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Abstract. The paper presents the particularities of the manufacture of nanopowders that can be used in industry by conducting a study of the magnetic properties of nanocomposite materials. The research was carried out within the INCDIE ICPE-CA in collaboration with the Naval Academy in Constanța and with the Polytechnic University of Bucharest. Depending on the mechanical, electrical and magnetic characteristics of the nanoparticles, their area of application is analyzed. The paper presents methods of chemical synthesis of magnetic nanoparticles and their importance due to their homogeneity, size control and particle distribution. Many magnetic nanoparticles can be synthesized using precipitation reactions in aqueous solutions. The discovery of metal-carbonyl complexes by thermolysis results in nanopowders.

Keyword: *nanopowders, magnetic nanoparticles, simulation*

Introduction

Magnetic nanoparticles, due to their mechanical, electrical and magnetic characteristics, high strength, safety, light weight, durability, reliability, corrosion resistance and low maintenance costs, have been the object of the researchers. Their wide scope includes [1,2,3].

1. shipbuilding-panels, ceilings, formworks, sanitary ware, decorations, furniture
2. naval transports: cargo-tanks, water and fuel tanks, containers, boats, hydroplanes, cooling installations, containers, structures consolidation, boat body construction, decks, etc
3.telecommunications-antennas, support elements and housings for radar, enclosures for cables
4. electrical installations - pallets of capacitors, motor stators, dials for circuits
5.cables for supporting and anchoring military bridges, as well as for elements of the structure of resistance, panels, tie rods for diagonal post-tensioning of marine platforms - polymer composites reinforced with fibers
6. Aeronautical, space and military applications

Due to the development of new preparation techniques, magnetic nanoparticles smaller than 10nm in size, with narrow size distributions and different compositions can be manufactured by a variety of methods.

Magnetic particles with nanometric dimensions have interesting properties that can be attributed either to the extrinsic properties of individual particles, such as finite size, or to surface effects and coupling between particles.

The fundamental understanding of the chemical, electrical, optical and magnetic properties of nanomaterials has been particularly important in the last two decades [2,4].

Magnetic nanoparticles represent a specific class of nanomaterials, composed of at least one magnetic element. These materials can be used in a variety of forms: in solution as ferrofluids for audio speakers, as aggregates of particles in magnetic storage media, as functionalized particles for biosensor applications, in the form of compact powders for energy generation or convection, in medical applications including targeted (magnetic) delivery of drugs and contrast agents in magnetic resonance imaging [4-29].

The study of the magnetic properties of nanomaterials is important for research in the field of nanoscience and nanotechnology.

Cobalt and iron have an internal energy level that is not completed, so that each metal atom has a permanent magnetic moment equal to power with the number of unpaired electrons [30].

Methods of chemical synthesis of magnetic nanoparticles

As with other types of inorganic materials, magnetic nanoparticles are obtained in such a way that they have controlled properties (by manipulating the processing parameters).

As methods of synthesis of magnetic nanoparticles we have: physical vapor deposition [31], mechanical (grinding) [32,33] and chemical synthesis in solution [34-37].

Mechanical nanostructures can be obtained by grinding alloys. The chemical methods of producing magnetic nanoparticles are preferred due to their high homogeneity at the molecular level, efficiency of production costs, control of particle size and particle size distribution, morphology and conglomerate size. Also, the modification of the surface is easy to perform, allowing the functionalization of the nanoparticles. Researcher Turkevich established the reproducible procedure for the preparation of the metal colloids and proposed the mechanism for the formation of nanoclusters, based on nucleation, growth and agglomeration [38,39,40]. Its model has been modified following the development of analytical techniques and thermodynamic and kinetic studies. According to this model, monodispersing is a consequence of the careful separation of the two stages: the nucleation stage and the subsequent growth stage.

For the metal particles, nucleation is the result of complex interactions between factors such as reaction conditions and the difference between the metal salt reduction potential and the reducing agent. The reaction conditions include the addition rate, the removal rate, the reaction temperature, the reaction time and even the stirring speed.

As a result of van der Waals forces and the tendency of the system to minimize the total surface energy, the nanostructured particles agglomerate. This can happen during synthesis (during the drying process), during handling and / or post-processing. Surfactants (any substance that influences the surface or interfacial tension of the environment in which it is dissolved) are used to prevent particle agglomeration to control dispersion during chemical synthesis, by reducing interactions between particles (by increasing repulsion forces). Stabilizing agents can also be used to control particle size and shape [41-44]. The chemical synthesis techniques used to form magnetic nanoparticles are shown in the diagram presented in figure 1[3].

Some techniques are used combinatorially or through a series of cross-field reactions. The dashed line indicates the demarcation between the syntheses using organic and aqueous solutions. Ground-gel and hydrothermal reactions lead to the production of oxide nanoparticles. This is due to the fact that the synthesis medium is an aqueous solution, without a source of reduction.

Many magnetic nanoparticles can be synthesized using precipitation reactions in aqueous solutions. These reactions can generate a wide range of magnetic materials, including ferrites with spinel or

perovskite structure, metals and respectively metal alloys. Precipitation allows large quantities of particles to be obtained, but their size distribution is large.

In order to make the metal nanoparticles, different reactions are used. These reactions must take place under mild conditions (low temperatures), avoiding the formation of mixed oxide systems and for which a rigorous surface control can be performed.

The reduction of transition metal salts is the easiest and most widely used method for the preparation of metal nanoparticles. The most commonly used reducing agents are borohydride derivatives. This method provides an easy synthesis pathway for Fe, Co and Ni nanoparticles, as well as for Fe / Pd alloy, but has the disadvantage of including boron in particles that undergo a modification of the magnetic properties.

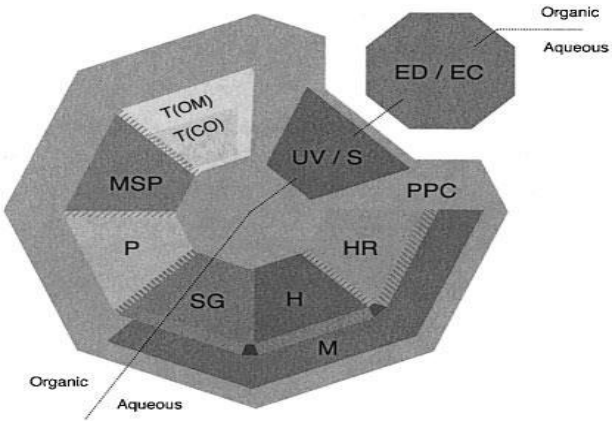

Figure 1. Schematic diagram of the chemical synthesis techniques used for the synthesis of magnetic nanoparticles, where: PPC: precipitation; H: hydrothermal; HR: reduction with hydride; M: microemulsion; T (OM): thermolysis - decomposition of organometallic compounds; T (CO): thermolysis - decomposition of carbonyl compounds; UV: photolysis; S: sonolysis; SG: ground – gel; P: polyol; EC: electrochemical; ED: electrodeposition; MSP: process made through a multitude of syntheses

The decomposition of metal-carbonyl complexes by thermolysis results in the production of nanopowders, nanostructured materials and nanoparticles in solution. The size and shape of which can be controlled by the reaction medium.

$Co_2(CO)_8$ thermolysis of organo - metal compounds in solution, in the presence of trioctylphosphine oxide (TOPO) results in cobalt nanoparticles. Rapid thermolysis at high temperature (1810 °C) of the same precursor in the presence of organic molecules containing long alkyl chains and capable of serving as surfactants or ligands (oleic acid, phosphoric trioctyl acid or trioctylphosphine oxide) allows to obtain spherical monodisperse nanocrystals in the 3-17 nm range.

The decomposition of $Fe(CO)_5$ by thermolysis results in obtaining metal nanoparticles whose size and shape can be controlled by the reaction medium. This process has recently been extended to the preparation of bimetallic and even trimetallic nanoparticles.

Metal-olefin compounds, by gentle decomposition in molecular hydrogen, lead to metal nanoparticles.

The method of microemulsion is to obtain a microemulsion of water in a nonpolar environment (eg: petroleum ether) using a non-ionic surfactant (eg poly-oxyethylene-nonyl phenol ether).

Even though the reaction rate is very high, no particle agglomeration occurs (if the stirring continues for several hours, flocculation phenomena may occur but the introduction into an ultrasonic bath allows the reduction to the original size).

Emulsions are dispersed systems consisting of two insoluble liquids one in the other, of which one is in a state of advanced dispersion. The dispersion of one liquid in the mass of another liquid can be

affected by mechanical mixing. A liquid-liquid dispersed system cannot be called an emulsion unless it has a certain solubility. When emulsifying, the mechanical work spent increases the surface energy of the system. The higher the stored energy, the more unstable the emulsion, tending to shrink the surface of the system by joining the droplets as they come into contact due to the Brownian motion.

Simulation of magnetic nanoparticles and their influence on the properties of the material

For the first part, several two-dimensional numerical models were made using the FEMM program. It was considered a magnetostatic regime. In order to model the material, a square-shaped sample (side = 0.1μm) with particle inclusions (inclusion radius = 10 nm) was considered - figure 2. The sample was placed in a homogeneous field. In order to obtain this homogeneous field, the values of the magnetic vector potential on the borders were imposed.

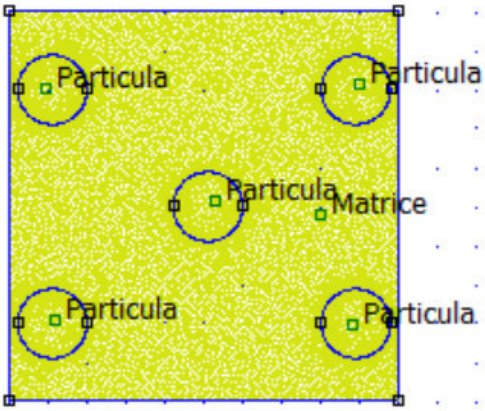

Figure 2. Problem geometry and mesh

The matrix is characterized by the relative magnetic permeability $\mu_m = 1$. For the inclusions, the permeability $\mu_r = 1000$ was considered. The presence of inclusions influences the lines of the magnetic field, and their concentration modifies the magnetic properties of the material. In general, the lower the concentration value, the higher the accuracy.

For the simulations two inclusion concentrations, 25% and 50%, were considered. The analysis focused on the calculation of the induction of the magnetic field of the material for 2 cases: in the first case the number of inclusions was varied while the concentration was maintained constant, in the second case the position of the inclusions in the sample was varied.

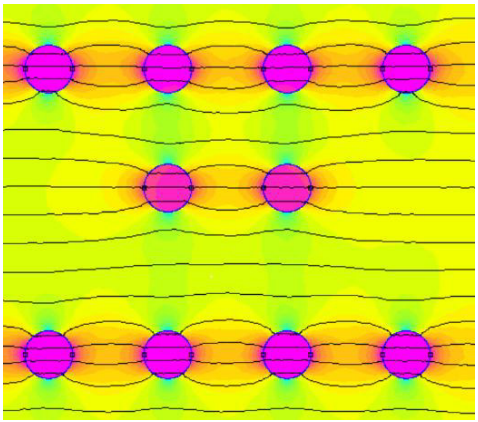

Figure 3. Magnetic field induction lines and color map

Several points were considered. The magnetic induction values were calculated in each of these points. Of these values, in Table 1 are presented the values obtained in four points (close to the boundaries of the calculation domain) for the cases where the inclusions are centrally located.

Table 1. Magnetic field induction values B[T]

	1 particle	2 particles	5 particles	10 particles
P1	1.67	1.73	1.69	1.86
P2	2.4	2.33	2.33	2.02
P3	0.96	1.61	1.32	1.89
P4	1.6	1.73	1.69	1.89

The differences between the induction values between the centrally placed and the randomly placed inclusions are about 9% if we have 2 particles and between 2% and 5% if there are 5 particles. The differences are larger when the particles are placed on the edges. These differences are explained by the fact that when the particles are dispersed the interaction between the particles is minimal.

The 2D simulation was performed for a small number of particles. In the industrial field, nanopowders are successfully used for a lot of applications (electric machines, sensors, electromagnetic actuators, etc.), whether at low, medium or even high frequencies. The particles are in some cases covered with insulation, which should be perfect, which means that the turbulent currents should flow only inside the particles, with no other current paths. However, due to the pressing process, the insulating layer can be destroyed, which means that contacts can occur between the particles. These contacts influence losses through turbulent currents. For smaller samples of certain sizes, the losses through turbulent currents are due to the particles only, with no additional current paths. In contrast, if the sample sizes increase, macroscopic currents can no longer be neglected. This means that the losses through turbulent currents depend on the geometry of the samples – figure 4 [47].

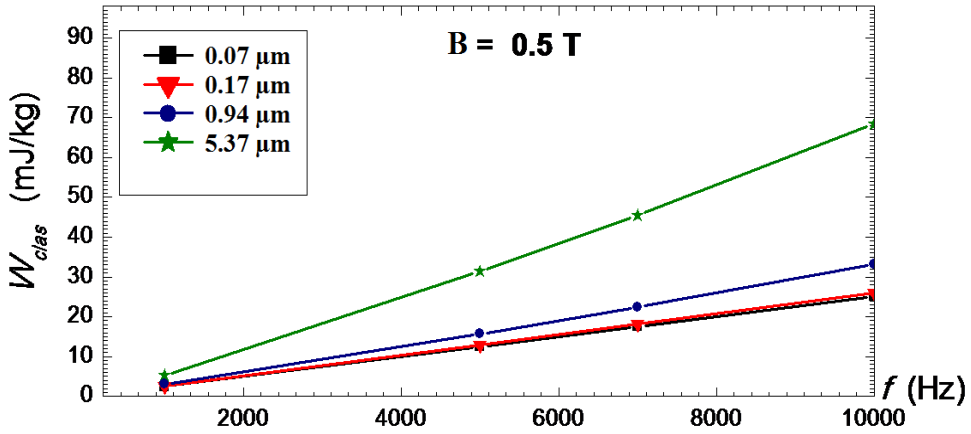

Figure 4. Classical losses Wclas dependency on the frequency f, for different contact lengths

It can be observed that for the small dimensions of the contact between the particles the differences between losses are almost indistinguishable.

Conclusions

The solution synthesis offers several advantages: soft conditions, easier control of the particle size and composition, possibilities to modify the surface in order to obtain a stable dispersion in different solid or liquid mediums.

The particle size and their dispersion state determine the properties of nanometric powders, nanostructured materials and nanoparticles in solution. Following the analysis of the methods of synthesis of the nanometric magnetic particles, it was decided to perform laboratory syntheses through reactions in the liquid phase (reduction of the transition metal salts). For magnetic nanoparticles, which need to be incorporated into magneto-bioelectronic devices, chemical processing must control the composition, microstructure, phase purity and particle morphology as well as particle size control, thus reducing particle aggregation and size distribution.

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Implementation of an environmental management system in a company for computers and electronic devices repairing

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Abstract. The paper presents the conditions, objectives and stages necessary to implement an ISO 14001Environmental Management System in a company for computers and electronic devices repairing. Implementing ISO 14001 standard establishes a set of rules for a high performance Environmental Management System. The company works in computers and electronic devices repairing and its purpose is to improve the organization environmental performance by using efficiently the resources. The applied system concern environmental activities and aspects that the organization can control and influence, including the requirements imposed to be fulfilled. The company environment policy had to formulate environmental objectives, according to the legislation. The environmental results are obtained in accordance with the quality, health and occupational safety policy and with the strategic direction of the organization.

Keyword: *management, computers, performance*

1. Introduction

The work includes the stages of Environmental Management System ISO 14001 implementation decribed for a company for computers and electronic devices repairing. It has experience in the field, being established in 2010, by transforming a service department affiliated to a household appliance suppling company into a separate company. Its mission was to work for mother – company and for others, the main activity being to repair computers and electronic devices and the strategy was to become the number one player in the market for electronic, household appliance and IT services and repairs in south-eastern Europe.

Now, the company has almost 300 employees, of which 100 are service technicians at the headquarters, 50 are field technicians, spread in the country and around 50 people provide the call center and customer relations. They have good experience in service and professional training to repair most used long use products: mobile phones, tablets, IT, electronics, small and large appliances.

The company offers services of consultancy, diagnosis and quick repair of the breakdown, both for warranty products and for post-guarantee products, offering also a repair assurance to the last ones. The firm's portfolio covers 62 brands and it provides consulting and repair services for almost 30,000 customers per month.

The ISO 14001 standard is an international standard that establishes a set of rules for a high performance Environmental Management System. It helps to improve the environmental performance

of organizations by the efficiently use of resources and it helps to win the stakeholders trust. This system can be applied to those environmental activities and aspects that the organization can control and influence, the the requirements imposed to be fulfilled must allow to formulate the policy and the environmental objectives, according to the legislation [1].

The process-based approach of the company involves the definition and the systematic management of processes and their interaction, in order to achieve the results in accordance with the quality, health and occupational safety policy and with the strategic direction of the organization.

The PDCA cycle (Plan - Do – Check – Act) represents a method of organizing and carrying out management activities, for continuous improvement of the quality management system. Its application allows to ensure that:

- the processes are properly managed and have adequate resources;
- opportunities for improvement are determined.

The procedure for applying the PDCA (Plan - Do - Check - Act) cycle at company level covers:

− *the planning phase:*

- it establishes the system objectives and its processes and the resources to obtain the results, in accordance with the client's requirements and the organization's policies;
- it identifies and treats risks and opportunities.

− *the performing phase:*

- it implements what it has been planned;

− *the verification phase:*

- it monitors and it measures the processes, the resulting services, in relation to policies, objectives and requirements and planned activities.

− *the action phase:*

- it acts to improve the performance, by doing the changes to be adopted or abandoned, depending on the previous phase results. If the verification phase results don't show significant improvements in clients' requirements, corrective action measures are established and another PDCA cycle must be started.

"*Risk-based thinking*" is one of the key changes contained in 2015 ISO 9001 revision, taking into account the qualitative risk (and quantitative, function the organization context), by defining the formalism degree necessary to plan and to control the quality management system, also its component processes and activities. Risk-based thinking allows the company:

− to determine the factors that could cause its processes and its integrated management system deviations from the planned results;
− to implement preventive controls to minimize the negative effects;
− to maximize the improvement opportunities.

The main purpose of the implementation of an Integrated Management System is to act as a prevention tool, by planning actions for dealing with risks and opportunities. Thus it will determine a basis for increasing the system efficiency, achieving improved results and preventing negative effects.

The results that will be obtained allow the organization to attract customers, to develop new services, to reduce losses and improve productivity, to increase the quality of services for customer satisfaction.

2. Influence factors and analyses of company's activities

2.1 Porter model

For a good development and efficiency of the company's activities it is necessary to follow and to analyze all the factors in order to capitalize the favorable ones action and to prevent the negative impact of the unfavorable factors action - over the company's activity. That is why it was adopted the *Porter model*, which proposes an approach based on the company's perspective within its industry area. This approach is called "*The model of the five competing forces*": current competition, potential competition, customers, suppliers and substitution products [2] (Fig. 1).

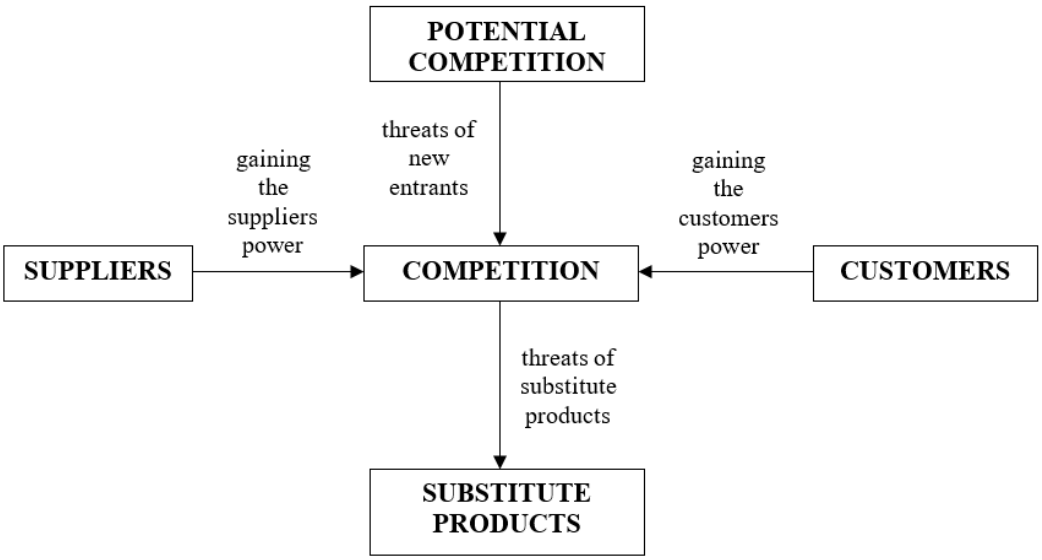

Figure 1. Porter model [2]

These five competitive forces determine the competition intensity and the firm profitability within the industry area [3]. Michael Porter's strategic approach concludes that the power of each factor from the 5 analyzed, as well as their combination, characterizes the company field of activity, according to the competition intensity and it determines the sector profitability, measured by the long-term return of the invested capital.

Because the analyzed company is specialized in the repair of home appliances, electronic and IT equipment, the strategic approach is according to the competition nature and intensity, in this field of activity. In this case, the Porter model is based on the analysis of the 5 factors influence:

1. The analysis of the customers negotiation capacity;
2. The analysis of the suppliers negotiation capacity;
3. The analysis of the degree of threat of some substitute products / services;
4. The analysis the entries of new competitors in the field of activity;
5. The analysis of competition between companies in the field of activity.

It is appreciated that the company performance in this field of activity is due to the competitive advantage over the competitors, with a moderate degree of risk and profitability, and the diversification may be necessary to strengthen the image with global aspirations, by acquiring new organizational knowledge. So, the analyzed company focuses on obtaining superior performance, becoming industry sector leader, in terms of: the services quality to be offered, the post-guarantee services and the facilities offered to customers, the technology used, the delivery time, the ability to adapt to environment changes and to the customers demands. The risk is low from the point of view of competition and from the point of view of substitution activities; considering these conditions, the market's absorption capacity is low in relation to the service offer.

Technological developments have a strong impact on this industry sector and the company has to adapt and specialize continuously. The area of strategic interest is represented by the Romanian and European market, the significant clients being Emag, Flanco and Altex [4], [5].

Considering Michael Porter strategies, the most suitable for the analized company is the differentiation strategy, the target established is to obtain a superior performance toward a leading position in the market. The company advantage is the ability to adapt to the environment and field changes.

2.2 PEST analysis

In order to adopt and implement marketing strategies that will work for the business profitability, the responsible managers must know the firm environment. For this they use *PEST analysis*, a very powerful tool for analyzing strategic situations in a successful business. When they do environment scanning, managers' decisions are influenced by PEST factors: Political, Economic, Social, Technological, Ecological and Legislative.

The environmental factors analysis is performed on a single level, respectively the national / international level. The differentiation between the national level and the international level is insignificant in globalization conditions, both the demand and the offers. Considering the company's field of activity, Table 1 presents the four possible subsystems of influencing factors: politico-legal, economic, socio-cultural (including demographic) and technological. The key factors selected are marked with (*).

Table 1. PEST analysis of the company.

Political and legal	
Selected Key factors	*Comments*
legal regulations of Labour legislation (Labour Code) *	- Political-legal factors determine a not attractive investment climate for the analyzed company. - Possible changes in labor law and very slow legal procedures block projects development and the direct access to utilities, generating uncertainty for the growth strategies development. - The products repairs field is regulated at a set period of time, which can not exceed 15 calendar days from the customer notification date related to the product lack of conformity. - The taxes and fees system can be considered uncertain and turbulent, due to the appearance of new taxes and the frequent modification of the existing ones.
investment policy (Fiscal Code) *	
governmental stability *	
the taxes and fees system *	
legal requirements for health and occupational safety *	
waste management	
European legislation	
consumer protection	
Economic	
Selected Key factors	*Comments*
economic growth *	- Consumer confidence is an important economic factor; a positive image can have long-term economic effects - a satisfied customer will bring other customers and thus it will increase customers number, also the company reputation. - The increase of the economy minimum wage has a direct impact on the human factor expenses, especially when the company needs qualified personnel. - Improving the infrastructure by investments creates the premises for better consumption management, but it could create cash flow problems. - It is possible the European funds accessing is
relatively low possibilities to access the European funds	
labour cost *	
utility prices *	
taxes	

	much too complicated when the company does not have specialized personnel.
”leu-euro” constant exchange rate	- The gross domestic product has a relatively high impact because if the GDP is high, consumers are tempted to replace the products and not repair them.
consumer confidence *	
gross domestic product (GDP)	
Socio-cultural	
Selected Key factors	*Comments*
attitude for health and occupational safety *	- The health and safety of human resourse is an absolute priority for the company, the employees work in a safe environment.
young staff *	- Communication deficiencies exist in the company due to the large number of employees, but it is a factor that is worked daily and has experienced an improvement.
employees have communication deficiencies *	- The low mobility of the workforce is an asset for the company, the employees being stable at the workplace, they do not migrate, only changing the positions, from a hierarchically lower level to a higher one.
company image at local and national level *	- Population education is one of the socio-cultural factors with influence on the company; the population with a higher level of education and a growing economy chooses to repair products, places greater emphasis on reducing waste and conserving the environment.
labour mobility *	
population education	
Technological	
Selected Key factors	*Comments*
technological equipment	- The company’s technological equipments are high performance and they facilitate the technicians work in products repair, but their change influences the company’s expenses.
technological evolution and technological wear *	- The technological evolution is the company’s greatest impact factor, because it indirectly forces to a continuous improvement.
product life cycle *	- The products life cycle increases with the products repair, because only the defective parts are recycled, which cannot be reused for other products.
information and communication technology *	

2.3 SWOT analysis

Concerning the main elements of a SWOT analysis related to the company for computers and electronic devices repairing the strengths, weaknesses, opportunities and threats are:

- Strengths:
  - well known company at national level;
  - awarness on the national market;
  - good visual and commercial appearance (website, layouts, posters, flyers);
  - well-defined and efficient operational standards and procedures;
  - good management team experience in management;
  - team experience and stability in the process;

  - good experience of the creative and product management team that develops the services;
  - strategic location;
  - wide category of repairable products.
- Weaknesses:
  - adequate Human Ressources in the company
  - company site is played only in Romanian and it must be improved.
- Opportunities:
  - potential of the international market;
  - increasing the international market;
  - increasing the education level of the population;
  - adoption of more drastic environmental regulations;
  - national and international territories not covered by technicians.
- Threats:
  - competition;
  - technological evolution;
  - raising the minimum wage at economy level;
  - increasing taxes and fees can affect the company financial situation.

3. Environmental policy and implementation of an Environmental Management System for the analyzed company

The company has implemented a quality, health and occupational safety, environment and information security management system, in accordance with ISO 9001: 20015, OHSAS 18001: 2008, ISO 14001: 2015 and ISO 27001: 2013 standards.

The company top management is committed to allocate the necessary resources for the continuous implementation and improvement of the environmental management system, in order to prevent pollution.

The company employees and the company comply with the legislation in the field of environment, health and occupational safety, for pollution reduction [6].

In order to achieve these commitments, the following objectives are considered:

- Permanent application and improvement of the environment management system;
- Staff awareness by training in environmental area;
- Insurance of the sustainable development regarding the environment, within the organization, by reducing the resources consumption and a suitable organization waste management;
- Pollution prevention

Starting from Environmental Policy, the specific objectives were elaborated and being permanently monitored. The Environmental Policy is applicable organization all levels, being known and respected by all personnel working for the company and on its behalf - according to ISO 14001 standard. For a suitable implementation of an Environmental Management System, there are some reference documents related to the Environmental Policy:

- SR EN ISO 9000: 2015 - Quality management systems. Fundamental principles and vocabulary.
- SR EN ISO 9001: 2015 - Quality management systems. Requirements.
- SR EN ISO 9004: 2010 - Quality management systems. Guidelines for performance improvement.
- SR EN ISO 14001: 2015 - Environmental management systems. Requirements
- SR OHSAS 18001: 2008 – Health and occupational safety management systems. Requirements;
- OUG 195/2005, Environmental protection.

For the implementation of an Environmental Management System at the analyzed company level, there are some distinct steps presented in a procedure:

a. Planning to identify environmental issues

The identification and evaluation of the environmental aspects of the activities, products and services performed within the organization is carried out in order to establish the general objectives and the environmental targets, also the elaboration of the environmental management program, in order to minimize the environment impact and prevent pollution. These points are accomplished in the implementation phase of the environmental management system and whenever significant changes occur in the organization's activity (new processes, technology changes, raw materials, equipment, legal requirements and other environmental requirements).

b. Identification of environmental aspects

The general manager, taking into account the technological options, the financial, operational, logistics requirements and stakeholder views, allocates the necessary resources and designates the team to be responsible for identifying and evaluating the organization environmental aspects, the team coordinator being Risk and Safety Manager, respectively Technical Director. The team also includes the personnel that carry out activities that can generate an impact on the environment.

An evaluation questionnaire is established and completed, specifying:

1. basic areas to be investigated: environmental policy, management, legislation, circumstances, current activities;
2. information to be asked as questions.

The environmental aspects are identified and recorded by direct observations, interviews with people within the organization, consulting the relevant documents, identification of activities and for each activity: inputs / outputs, quantity / control and their importance, using flow diagrams.

The environmental aspects to be categorize are: air emissions, evacuation of waste water, waste management, soil contamination, dangerous substances, use of raw materials, utilities and natural resources, other problems (noise, vibration, radiation, improper visual impact, health and labor protection).

c. Evaluation of environmental aspects

It is done by entering in a database the records made at stage I, in order to process this information and to obtain the List of environmental issues. The relevant criteria for the environmental aspects analysis and information processing (environmental aspects) are defined. The criteria are associated with a scoring system that allows the "quantitative" evaluation of environmental aspects. Table 2 and Table 3 present the criteria and scores used to analyze environmental issues.

Table 2. Criteria used to analyze environmental issues.

No.	Criterion	Notes			
		1	2	5	10
1	Impact size	Little	Medium	Big	Extreme
2	Duration of impact	Hours	Days	Weeks	Months
3	Production frequency	Occasional	Periodical	Permanent	-
4	Resource consumption	Little	Medium	Big	Very big
5	Ecological risk	Little	Medium	Big	Very big
6	Impact on employee health and safety	Little	Medium	Big	Very big
7	Compliance with legal requirements and other applicable requirements	Compliance	-	Noncompliance	-
8	Complaints	It does not exists	-	-	It exists

Table 3. Scores used to analyze environmental issues.

Criterion 1	Criterion 2	Criterion 3	Criterion 4
<10% of the organization surface	1-24 hours	< 3 years	< 1000 lei
10-25% of the organization surface	1-6 days	monthly, weekly	1001-5000 lei
25-50% of the organization surface	1-4 weeks	daily	5001-10000 lei
>50% of the organization surface	1-12 months	-	> 10000 lei

Criterion 5	Criterion 6	Criterion 7	Criterion 8
<10% affected environment	≤ 1% employees	100% applicability laws	0% claims for environment
10-25% affected environment	10% employees	-	-
25-50% affected environment	50% employees	serious violations of the law	-
≥ 75 affected environment	100 % employees	-	≥ 1 claims for environment

Each environmental aspect will obtain a note by summing the partial notes, corresponding to each criterion of the analysis, function the aspect definition interval. The score maximum value associated to the environmental aspects is 47 points, and the minimum value is 11 points. The threshold value accepted for environmental issues analysis was set at 25 points. The environmental aspects are ranked according the obtained score - by decreasing the environmental aspects list order. The list of significant environmental aspects is obtained by retaining the environmental aspects with scores equal to or higher that the 25 points threshold value. The list of significant environmental issues contains information on the associated flow chart number, the location / activity corresponding to the environmental aspect, the description of the environmental aspect, the associated environment impact, the obtained score.

The significant environmental aspects are grouped into four main environmental impact categories: Atmospheric emissions (EA), Waste management (GD), Management of dangerous chemical substances and preparations (GSP), Resource consumption (CR).

All the significant and insignificant organization environmental aspects will be permanently evaluated and it will be added new ones according the situation, in order to adapt the established objectives and programs to the organization realities and to improve the implemented system [7], [8].

In order to identify the organization environmental objectives and targets the following aspects are considered:

- the directions of action established by the quality, environment and safety policy;
- legal previsions and other environmental requirements related to the organization;
- the environmental analysis results, considering the significant environmental aspects;
- technological, financial, operational, commercial aspects of the organization;
- the stakeholders point of views.

The environmental objectives and targets are identified and proposed by the Quality and Environment Management Responsibles and by the heads of departments, also the achievement indicators and the corresponding fields from the "Environmental Management Program" are completed.

The list of significant environmental issues is used in analyzing, establishing and defining the appropriate environmental goals and targets that will lead to the elimination or control of the associated environmental impacts.

3.1 Evaluation of the Environmental Management Program

The Environmental Management Program is elaborated, in each year, by establishing the actions, deadlines and responsibilities necessary to fulfill the environmental objectives and targets. The Environmental Management Program is elaborated by the Quality and Environment Management Responsibles and it is approved by the General Manager. Also, there are estimated the required program implementation costs. The program is disseminated to all departments involved in its implementation and it is included in the Environmental Planning File.

3.2 Monitoring the achievement of objectives, targets and Environmental Management Program

Carrying out the actions of the Environmental Management Programs is controlled by the Quality and Environment Management Responsibles, by consulting the heads of departments and internal audits, regarding the terms and responsibilities given by the Environmental Management Program.

Quality and Environment Management Responsibles report the results to General Manager. In actions non-fulfillment case, the situation is analyzed by the General Manager, who reshapes the terms and takes the decision regarding the program revision.

Yearly, the management analyzes carried out reports with all indicators associated to the environmental objectives and targets. The information regarding the accomplishment of the Environmental Management Program actions are included in the input data for the management analysis sessions.

3.3 Updating the environmental objectives, targets and Environmental Management Program

The Environmental Management Program is updated whenever major changes occur in the organization (development of new processes, activities, products, changes of processes and technology, significant capacity expansion or reduction, activities expansion or relocation, changes of laws and rules), but at least annually, within the management analyzes, aided by the internal or external audits. Their review is based on:

- an analysis regarding the stage of achievement of the foreseen objectives and targets;
- significant environmental issues arising from the new investments or from a new environmental analysis;
- change of products or technologies, with implications on the environmental impact.

The review responsibilities and activities are identical to those provided for the document's elaboration. After update, the new Environmental Management Program is disseminated to the departments with responsibilities in its implementation; they will file it in the Environmental Planning File.

4. Conclusions

Implementing ISO 14001 standard establishes a set of rules for a high performance Environmental Management System. The company works in computers and electronic devices repairing and its purpose is to improve the organization environmental performance by using efficiently the resources.

The applied system concern environmental activities and aspects that the organization can control and influence, including the requirements imposed to be fulfilled. The company environment policy had to formulate environmental objectives, according to the legislation. The environmental results are obtained in accordance with the quality, health and occupational safety policy and with the strategic direction of the organization.

Each year, the Environmental Management Program is elaborated, by establishing the actions, deadlines and responsibilities needed to be fulfilled. It is mandatory to monitor the achievement of

objectives, targets and Environmental Management Program. Yearly, the management analyzes carried out reports with all indicators associated to the environmental objectives and targets.

The company for computers and electronic devices repairing has implemented an Environmental Management System, after that the financial results and the relationships with the partners have been improved. It is obvious that any company that implements such a system and obtains the certification has a win –win situation, related to customers and suppliers, who gain confidence in the company.

The entire process within the company lasted two months, being followed by the audit; as an audit result, the company obtained ISO 14001: 2015 certification, also the suggestion to pay particular attention to the employees training. Critical points to monitor and to improve are mentionned: decreasing the number of wastes, all employees training, monitoring the changes regarding the environment and documented them, promoting the implementation of the Environmental Management System.

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Some aspects of quality and risk management in natural gas measurement

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Abstract. The paper refers to some general aspects regarding the natural gas measurement. In this paper, we try to find methods for checking the quality and risks for gas meters. It is trying to find answers to the question of how we could design and operate a gas meter so that the measurement is as accurate as possible. A process has been proposed to identify, analyze and control the emerging risks. The desirable quality of the measuring instrument requires a rigorous analysis of all aspects that could adversely affect. It also shows the interdependence between quality and risk, one can not exist without the other. Based on these principles, the following papers propose the approach of case studies on the innovation of a new type of natural gas meter, focusing on the quality of the new product and its ability to accurately measure and prevent unauthorized consumption.

Keyword: *risk management, natural gas*

1. Introduction

In this paper, we try to find methods for checking the quality and risks for gas meters. It is trying to find answers to the question of how we could design and operate a gas meter so that the measurement is as accurate as possible.

Measurement technique is part of the science of applied metrology and has as its object the theoretical and practical aspects of measuring a certain size or a certain range of sizes or those of a particular field of activity. The essence of measurement technique is to create and develop measurement methods and tools that can take, process and transmit quantitative information as close to the truth as possible.

The science of measurement is based on the fact that the process of knowing the surrounding world is based on the experiment, that is the qualitative or quantitative evaluation.

In the modern economy, measurement is a matter of great responsibility and importance, present in all activities. For example, scientific research is inconceivable without the use of precise measuring tools, and the design and development of new products requires them to be tested in exploitation conditions with measured performance. [1]

Annual gas consumption increased in 2016 compared to 2015, reaching about 11.7 billion cubic meters, with an increase of about 2%, amid a slight increase in end-user consumption that the number recorded in 2016 compared to 2015, also an increase of about 116,000 customers.

In 2016, the total natural gas consumption at the Romanian market was 124.12 TWh. Out of this consumption, the final customers consumption amounted to 111.7 TWh, of which 80 TWh represented the consumption of non-household customers (71.65%), and 31.7 TWh represented the consumption of household customers (28.35%).

The total number of clients registered at the end of 2016 was 3596574, of which 188,253 non-household customers (5,23%) and 340,8321 household customers (94,77%). [2]

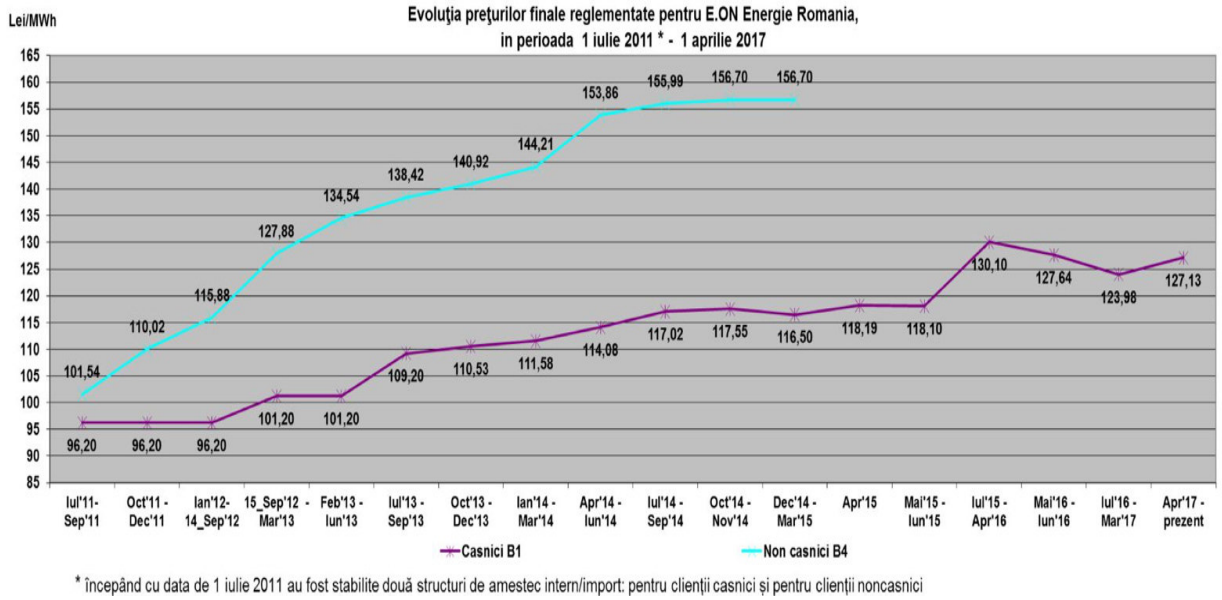

Figure 1. *Natural gas price evolution, 2011-2017. [Source: ANRE, 2019].*

Given the increase in gas consumption, the increase in the number of consumers, but also the increase in prices, consumers are tempted to intervene on measuring devices.

The desired quality of the metering device requires a risk analysis to identify existing or potential problems.

Risk management aims to manage threats that could have a negative impact on the company, so it is proposed to create a measuring device that highlights real consumption, and to alert the supplier quickly about the existence of interventions on measuring devices. [3]

2. Risk and quality management

2.1. Quality management

The concept of quality can be defined as the degree to which a product, through the totality of technical, economic, aesthetic and exploitation characteristics, satisfies the needs for which it was conceived.

Quality management is a set of activities aimed at achieving objectives, through the optimal use of resources.

A good quality management system must have the following features:

- To be established in writing;
- Ensure that the customers's requirements are met;
- Ensure that the organization's requirements are met;
- To be applicable to all activities of the organization.

Advantages of implementing a quality management system:

- Increase revenue and reduce costs;
- Crediblity;
- Improving the company's image;
- Differentiation from competition;
- Control all processes in the company;
- Customer Satisfaction.

The basic principles of Crosby's quality management are:

- Ensuring compliance with requirements, quality means meeting consumer demands, but these requirements must be clearly defined and measurable;
- Quality assurance through prevention, quality must not be controlled, it must be done;
- Promoting the concept of "0 defects", Crosby believes that we can not operate with acceptable levels of quality;
- The quality measure is represented by the costs of the non-satisfaction of the requirements, in his opinion, the quality does not cost, the non-quality is the one that costs.

Crosby's approach is that the basic principle of quality is that of defect prevention described in the following programs:

- **To do everything right the first time and every time** - is based on the work done well for the first time, and there is no room for other levels or quality categories;
- **Zero defects and day zero defects** - the main objective of the quality improvement process is to obtain products / services without defects. 0 defects do not mean that the products are perfect, it means that every person has to perform his / her duties at the first moment and every time, and the failure to fulfill the attributions is unacceptable for their activity, and each activity is done according to the given specifications.

The quality improvement process begins with the four quality truths: quality is compliance with the requirements; the quality system means prevention; the performance standard achieved at organization level is zero defects; quality measure is the price of nonconformity.

Rinne believes that quality management has the following basic functions:

- Planning;
- Checking;
- Keeping under control. [4]

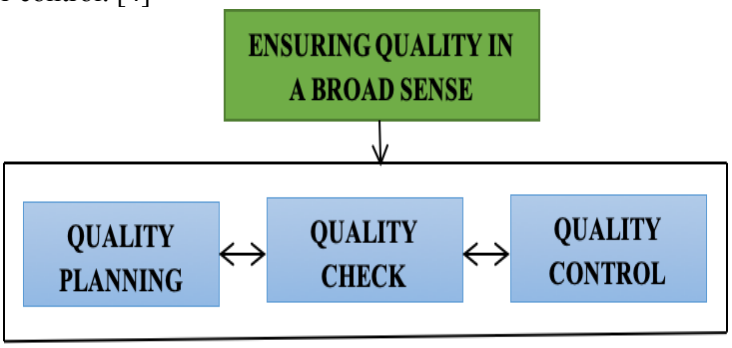

Figure 2. Functions of quality assrance in a broad sense
[Source: Olaru (1999), Quality management]

Total quality is a set of principles and methods organized in a global strategy to mobilize the entire company to achieve better customer satisfaction at a lower cost.

Total quality management can be highlighted as a new philosophy, a new culture model of the company, which orientates the client to all its activities and processes and optimizes them, so as to bring long-term benefits or can also be highlighted through the aspects technical and social, considering that motivation and training of staff is more important than technical aspects.

The principles of quality management are fundamental rules for the management and operation of an organization, which aims to improve continuously, focusing on customer satisfaction, but also on the needs of shareholders and employees:

- **Customer Orientation** - the success of any organization depends on the customer, therefore, all needs of customers, whether current or future, must be understood, satisfied. The organization must come with products beyond the customers expectations;
- **Ledearship** - an organization is successful when the organization manages to mobilize staff to achieve the set goals. Employees will understand what the company's goals are and will be motivated to achieve these goals, the activities will be evaluated, coordinated and implemented in a unitary manner. Lack of communication between different hierarchical levels will be less.
- Staff commitment - success is mainly due to the staff of the organization. It is very important the total involvement of the staff regardless of the hierarchical position or the kind of work performed, in order to achieve the best performance and the continuous development of the organization. By applying this principle, employees are motivated and involved in the work of the organization, are rewarded according to their participation in the organization's success, and their creativity is freely expressed and can be used for the benefit of the company;
- **Process-based approach** - any activity that uses resources to convert inputs into outputs can be considered a process. For a good functioning, the organization has to conduct its activities and resources as processes, identify and manage processes and relationships between them. Managing and developing activities establishes a process leader. By this method the results are improved and predictable, the costs are reduced but also the efficiency of resource use increases;
- **Improving** - it must be a permanent goal of every organization. Improvement is done through employee training on how performance performance can be improved by regularly evaluating established criteria to see where they can be improved by transforming continuous improvement of products / services into a target for each employee;
- **Decision-making based on evidence** - all decisions taken by an organization must always be based on data analysis that can be demonstrated as true. By applying this principle, it is possible to re-analyze and change decisions and opinions, to make realistic substantiated decisions;
- **Management relationship** - this principle is based on the importance of the resources acquired from the suppliers, they must rise to the quality level expected by the organization. A mutually beneficial relationship develops both for suppliers that ensure a high level of quality and for the organization. This type of win-win relationship between the organization and vendors enhances the ability of both entities to create value.

In the concept of total quality, the client is sovereign, and the object of total quality is to exceed the expectations of the clients.

The overall quality management concepts are excellence, exceeding customer expectations and zero defects.

Reaching objectives is done by motivating and training employees, setting measurable indicators and using old and new methods and tools. Another very important aspect is the involvement of top managers, employees, and suppliers.

Total Quality Management translates into practice a new method of organizing quality activities, which integrates inspiration, statistical control, quality assurance and quality management. [5]

2.2. Risk management

Risk management refers to translating a bussines aspect into all possible scenarios, so risk management becomes a process of identifying, analyzing and responding to the potential risks of a firm.

Risk management involves 5 stages of work:

- Risk planning;
- Risk identification;
- Risk analysis (qualitative / quantitative);
- Establishment of strategies for risk approach;
- Risk monitoring and control.

First of all, risk management involves risk planning. Individuals who respond to each risk are established, regardless of hierarchical levels and risk categories. Errors are not accepted in risk planning because these errors can lead to disastrous consequences.

The next step in risk management involves identifying all risk sources that could affect your business in any way.

Identifying sources of risk can be done through a Brainstorming session, through which multi-category specialists need to discover all the vulnerabilities of the project. The end of the meeting is reflected in a list of possible issues that may arise along the way. The main purpose of this risk identification process is to avoid situations where the manager can get when he is surprised by an unwanted event. In practice it is quite difficult, almost impossible to determine absolutely all sources of risk. Urmatorul pas il reprezinta analiza riscului, care este un proces de examinare a riscului atat calitativ cat si cantitativ. There are aspects such as: if an unwanted event occurs, which repercussions it has on the firm. Depending on the probability and magnitude of the risk, the manager may or may not take into account this risk.

The next step in the risk management process is to develop strategies for addressing risks identified and analyzed previously.

The risk of accident can be transferred to an insurance company.

The main purpose of this risk analysis is to shelter the company from unpleasant events.

The last step is monitoring and control. This stage include the last phase of the management process, here operations are carried out which can again reach the first stage, the risk planning.

In practice, it is quite difficult to identify all the risks, so the main goal of the risk monitoring and control phase is to announce the emergence of new risk situations, preventing the surprise managers with unpleasant events.

The identification process aims at discovering all possible sources of risk in order to reduce or eliminate the effects they can produce.

Risk identification is achieved through:

- Questionnaires;
- Brainstorming;
- Journals;
- Behavioral Patterns;
- Charts;
- Flow charts;
- Periodic meetings with the staff involved.

The main advantage of a risk management program is economic efficiency: managers are aware of the risks to which the organization is exposed and administer properly so that they do not materialize.

The role of risk management in an organization is to help understand the risks to which an organization is exposed so it can be managed. [6]

2.3. Risk-quality correlation

The quality-risk correlation represents the mutual relationship that is manifested between quality and risk, two fundamental notions in the production processes that can not exist without one another.

The quality-risk correlation is the measure of the relationship between the two quality and risk concepts.

Figure 3. Risk-quality correlation
[Source: Unitbv.ro]

The role of the two quality and risk management systems is to create the necessary conditions for the activity to unfold the first time, becoming at the same time:

- A way of continuing training of staff;
- A way of highlighting quality costs;
- A way of analyzing the activities;
- A way of correcting and adjusting activities;
- A way of measuring global risk;
- A modern and performing leading style.

Quality and risk theory applies to both products and services, with the idea being that it is easier to sell products than services, and an unsuccessful service from the start leads to 90% of the cases to the final loss of the customer.

For any organization, quality and risk integration should become key priorities.

Industrial excellence is the achievement of superior quality products/services offered in a shorter time and at a lower price.

The policy that governs industrial excellence is overtaking the expectations of its own employees, competitors and customers.

Industrial excellence is trying to achieve at the same time three aspects:

- maximum quality;
- minimum time;
- maximum results.

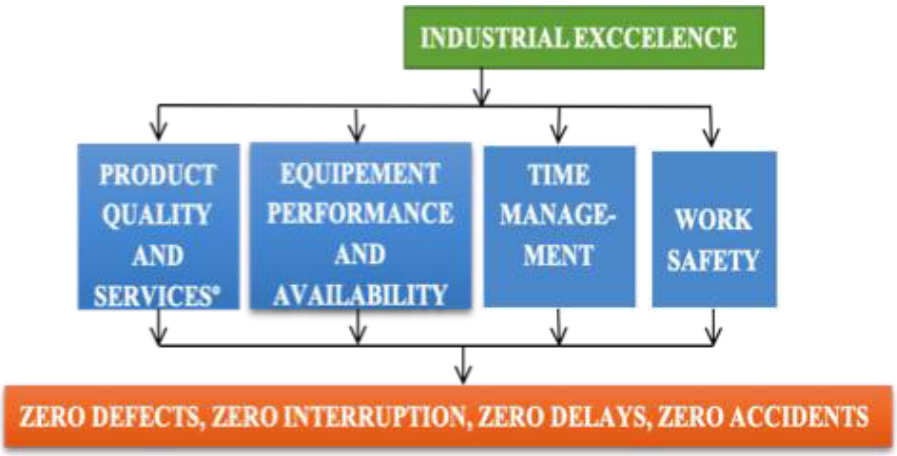

Figure 4. Industrial excellence
[Source: Unitbv.ro]

3. Methods of quality verification

A very important activity in quality assurance is quality analysis. Quality analysis activity is done by analyzing current non-conforming states in order to identify ways of intervening on the problem.

There are many ways to check quality, but are generally used: brainstorming, the cause-effect diagram, quality circle method, matrix methods, multivoting methods, the structured problem-solving cycle, the Pareto diagram method. [7]

The product is the one that ensures functionality, solves the problem and generates revenue. Product quality is the most important element because it depends on the quality of the whole project.

Part of product quality assurance refers to the complince of standard procedures for doing it, but they do not have to be in the form of rigid rules followed with holiness on the grounds that they would be more important than the quality of the product.

Man is subjected to mistakes, and it is therefore necessary to introduce protection procedures to verify the product as it is being mastered, and the management process as it is enforced.

This measure is necessary to ensure that the product is executed correctly each time and with 0 defects. There is a big difference between production and project activity in terms of quality assurance and control. Millions of products are manufactured in production, and quality assurance can be done on samples using statistical control techniques that determine if production deviates from the original specification.

In the case of a project, we can not do a destructive test because we only produce one product. If I mistaken him once, I mistaken him irretrievably, and wrong once means wrong every time. That's why it's important to make the right product from the begining.

There are three simple steps to verify the quality:

- Let's check what we're doing;
- Compare what we accomplished with what was planned;
- Take action to recover any delays.

3.1. Pareto analysis

Pareto's analysis is based on the assumption that 80% of all quality events are the result of only 20% of all cases and that 20% of events are the result of 80% of the causes.

This analysis teaches us to discover those few and vital issues instead of identifying and solving the vast majority of the causes that do not result in only a small part of our problems.

As we eliminate vital causes one at a time, we can focus on the next vital cause, but that has a much diminished effect.By this method you can quickly obtain high efficiency cost efficiencies.

3.2. Six Sigma

Six Sigma is a management methodology that aims to increase quality by determining and removing the causes of defects so as to ensure customer satisfaction.

Six Sigma is a management methodology based on 5 simple steps: define, measure, analyse, improve and control.

Figure 5. Six Sigma
[Source: ttonline.ro]

This management methodology uses two statistical tools to improve quality: FMEA - Failure Mode and Effects and QFD - Quality Function Defiction, together with modern management methods. [8]

4. Conclusions

Based on the above, we can see that risk and quality management is a very important process in the manufacture of a product and that it is absolutely necessary to implement it within the company if we want to be successful.

We can see the interdependence between quality and risk, one can not exist without the other.

In the following papers, some case studies will be dealt with on the innovation of a new type of natural gas meter, focusing on the quality of the new product and on its ability to accurately measure and prevent unauthorized consumption.

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Aspects regarding the capitalization of remanufactured scrap in the automotive industry using a Paternoster system

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Abstract. Among the current challenges of the global automotive industry include changes in global markets that lead to a variety of products, regulation that drives pressure on new technologies, and competition from new competitors. This paper attempts to find answers to the question, how can we capitalize the semi-finished parts of the automotive industry that have emerged from the parameters demanded/imposed by the final customer or which have some visual / design defects, but which retain their functional role. In almost all cases, information and communication technology plays a major role in future strategies to meet the challenges mentioned above, which can stimulate the production process more efficient by using intelligent manufacturing approaches. Thus, this paper proposes to automate and maximize the capitalization of these parts, a Paternoster system for eliminating the logistics/storage space, reducing the handling time, increasing the efficiency and traceability of the scrap.

Keyword: *automotive industry, advanced technologies*

1. Introduction

In this paper, we try to find answers to the question of how we can maximize the use of remnants of the automotive industry in this era of advanced technologies, for trying to rebuild the parts with certain visual or design defects but retaining the role functional is a very old subject, even in the period immediately following the start of production. This problem has arisen even in traditional craftsmanship when our trees have realized that some of these products have defects, some of which are major, and can't be used for the purpose for which they were created.

With the passing of the years, the manufacture of products has evolved from handicraft to mechanical, automated.

Vehicles represent the pursuit of freedom of each individual. The relevance of the car industry to economic prosperity and its impact on jobs can be seen in all major areas of the market and countries. Interestingly, both developed and developing countries see this industry as the backbone for their own economy.

The automotive industry has wide-ranging effects across the economy, supporting a vast supply chain and generating a range of business services. In the European Union, 19.6 million automobile units are produced annually, the turnover generated by this sector accounting for 6.8% of EU GDP. [4] This sector employs around 13.3 million people or 6.1% of the workforce in the EU. Approximately 3.4 million jobs in the automotive industry account for 11.3% of EU employment. [4] The automotive

industry is the largest private investor in R & D in Europe, with nearly €54 billion invested annually. In 2017, over 8400 patents were granted to the automotive sector by the EPO. Worldwide, 98.9 million vehicles were produced in 2017.

A paternoster or paternoster elevator is an elevator for passengers consisting of a chain of open compartments, which moves slowly and without interruption in a loop up and down, inside a building. The same method is used for the storage cabinets that store large amounts of paper documents or small parts. [8]

Paternoster name ("Our Father", the first two words of the Lord's prayer in Latin) was first applied to this device because the lift is in the form of a loop and is similar to rosary beads used as an aid in reciting prayers. [9]

Peter Ellis installed the first lifts that could be described as a paternoster lift in Oriel Chambers in Liverpool in 1868. [6] In 1877, British engineer Peter Hart has obtained a patent for the first paternoster [1]. In 1884, in Dartford, England, the engineering firm of J & E Hall installed its first "Cyclic Lift", using Hart's patent, in a London office building. [5]

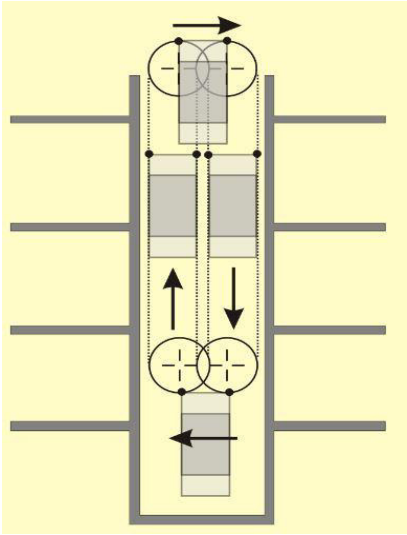


Figure 1. The 2D scheme of a Paternoster

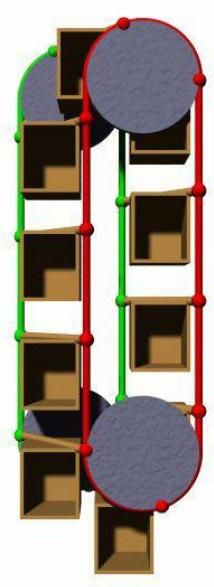


Figure 2. The operating principle of paternoster,[Source: Own work, author RokerHRO, 20.01.2019]

Paternosters lifts were popular during the first half of the twentieth century because they could carry more passengers than ordinary elevators. These were more common in continental Europe, especially in public buildings than in the UK. They are relatively slow elevators usually traveling at about 30 cm/sec (about 1 ft/sec) to facilitate starting and stopping. [11]

With the passage of time and the emergence of new technologies, this system has begun to grow and be developed in several areas, reporting on the first occurrence.

Lately, these systems have been developed in many areas and in various forms, based on the principle of operation of the first paternoster systems. [2]

2. Literature review

The automotive industry comprises a very wide range of companies and organizations in the design, development, manufacture, marketing, and sales of motor vehicles, being one of the largest economic sectors in the world.

1.1. Series production in the automotive industry

Manufacturing or manufacturing process is meant the physical or chemical transformation of materials, substances or components into new products or components through a series of processes.

The British Encyclopedia [3] mentions that "manufacturing is an industry that makes raw material products by using manual labor or machines, usually routinely carried out with the division of labor."

Manufacturing as a system of design processes and the sequence of actions needed to produce the product as it was conceived and designed in order to solve a problem or meet a need.

As can be seen in Figure 3, at the beginning of this year 2019, the European automotive market registered a slower start, with a decline of 4.6% over the previous year. [5]

This effect can be felt throughout the manufacturing sector in the automotive industry, and in the case of small producers, it is already becoming an alarming situation, for which they have to resort to various fireworks, such as reducing the number of employees, increasing the range of products, new smart technologies etc

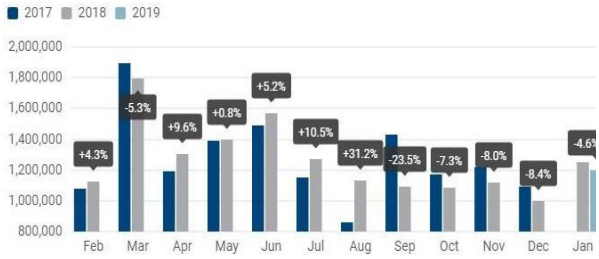


Figure 3. Car production in the UE, 2019 versus 2018. [Source: ACEA, 2019]

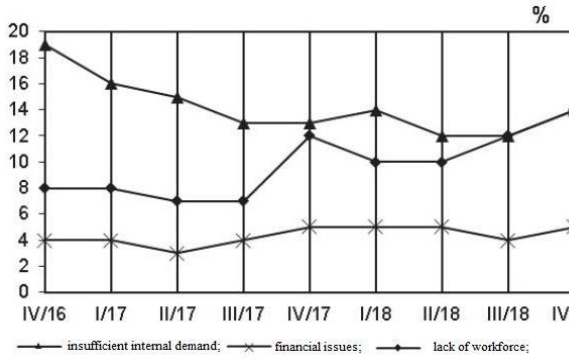


Figure 4. The main causes of production limitation

In Romania, according to the managers' opinions, the main causes limiting the processing activity are (Figure 4):

- Insufficient internal demand (14% of total cases);
- Lack of workforce (14% of total cases);
- Financial issues (5% of total cases).

1.2. General classification for parts of the automotive industry

Depending on the customer relationship criteria, the types of manufacturing can be structured into the following categories:

- manufacture on stock;
- custom manufacturing;
- mixed manufacturing.

There are many companies that combine the first two types and have mixed manufacture for strategic or competitive considerations. For example, the desire to be a unique manufacturer in its product line can lead a stock company to complete its catalog of offers by offering custom-made products. The desire to compete on a delivery rate criterion can motivate a custom-made manufacturing company to store key components and subassemblies by offering larger quantities of custom-made assembly. Receipt of an order initiates assembly and finishing product based on the customer's specifications.

Depending on the way of obtaining, the products from the automotive industry can be obtained:

- by injection of plastics;

- by machining (forging, casting, cutting processing, cold pressing, etc.)
- by sewing;
- by quilting; "cașerare";
- by pasting etc

1.3. Paternoster system

Paternoster is an excellent solution for optimal downtime. The particular reduction in collection time is seen in the sorting of batches, offering a quicker recovery.

The paternoster type system is very used in the storage/logistics area, for the simple fact that space is saved, the handling time of the objects placed in the paternoster cabins/containers decreases and the efficiency of the management used is increased.

There are storage machines, vending machines, as storage systems and computer-controlled transfer that significantly improve storage efficiency and processing of products.

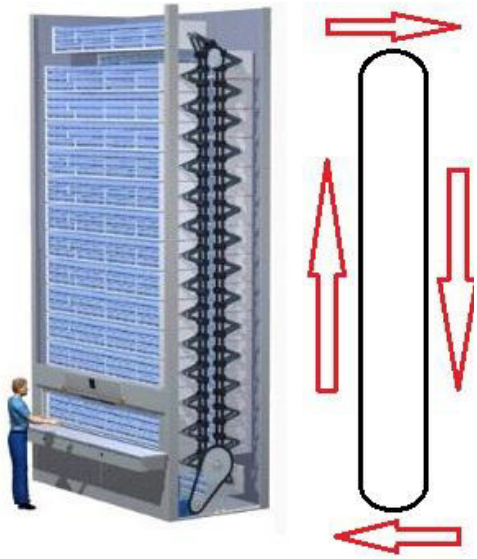


Figure 5. Operation of a paternoster

Figure 6. Paternoster system for large products

As can be seen from Figure 5, according to Paternosterkast, an automatic storage system saves up to 70% of the storage space, reduces choice errors and decreases the lifting time by more than 60%. The most efficient way to use the storage machine is to include warehouse management in the machine. This is suitable for use with a variety of storage systems such as storage machines, small parts racks, and pallet racks. [7]

These paternoster storage systems are currently used for both bulk and bulk products as well as bulky and heavy products. For example, in Figure 6, there is presented a paternoster system used for storage/logistics of products with large dimensions and masses, such as semi-finished products made of laminated bars or steel blocks. This system is equipped with 34 containers, and a container can be loaded up to a maximum weight of 4 tons, the entire system can be loaded with up to 136 tons of products. The same type of system can be seen in Figure 5, but with smaller dimensions and can be used in case of small products.

Control of these systems is permanently made from a computer that can be connected to a managed internet source such as SAP.

1.4. Quality and risk management for rebut items

Manufacturing process management- MPM is a process of defining and managing the manufacturing processes that will be used to manufacture, assemble, and perform the final product inspection. [12]

MPM is a process by which the manufacturing industries will use different types of technology to help produce products with different machine locations and different ways in which assembly lines could be placed. Production engineers use CAD data to define the different processes through which the new product will be manufactured. The MPM system is used to develop the sequence of operations, machine location planning, production line balancing and 3D design of human and robotic operations, as well as the delivery of machine programs and electronic work instructions at workshops. Production engineers assess different manufacturing scenarios, material flows, calculate production costs and the effects of changes on production lines. [13]

Statistical process control is a quality control method that uses statistical methods to monitor and control a process that produces serial products, such as a manufacturing process. Using this control during the manufacturing process makes it possible to determine whether the process is being carried out normally by providing only compliant products. Obtaining the necessary information for a statistical control is done by sampling n-size samples at defined time intervals and verifying one or more quality characteristics of the objects or elementary sampling units in order to ascertain whether during the manufacturing process these characteristics do not change significantly.

When applying statistical control, it is necessary to be able to act on the process by making appropriate adjustments to ensure that a normal process is carried out.

When applying statistical process control, the main tools are the control sheets, the Pareto diagram, the design of the experiments.

At statistical control, objects in the sample can be controlled by:

- quantitative, measurable characteristics such as dimensional dimensions; these variables are often distributed after the Gauss normal distribution, but a Poisson, binomial, etc. distribution is also possible;
- qualitative or attributive features such as the appearance of the product,
- the number of defects in the sample or the number of defects per sample elementary unit.

Another method used in quality analysis and control is the FMEA (Failure Mode and Effects Analysis), described as a procedure for product development and management of potential failure analysis operations under a fault probability classification system and which continues 3 main objectives:

- identifying and assessing the risk of potential product failure, flexible manufacturing system, and failure effects;
- Identification of actions that could eliminate or reduce the likelihood of a potential breakdown and development of control plans;
- Documenting the flexible manufacturing system and risk management;

Another way of analyzing product quality, from the design stage, is a more complex methodology, called DFMA (Design for Manufacture and Assembly), to provide guidance to the design team to simplify product structure, reduce manufacturing costs, assemble and quantification of improvements. In the practice of applying DFMA, the emphasis is on identifying, quantifying and eliminating unnecessary or redundant or ineffective elements in designing the product. [14]

DFMA focuses on three main directions:

- Reducing the number of components (parts, subassemblies) of an assembly;
- Redesigning simpler, modular components, easier to process and control, and even cheaper;
- Optimization of production and control technologies;

A product scrap, seen as a whole unit or unit is defined as a product resulting from the manufacturing process, which does not meet the quality set by standards, internal rules, contracts etc. and which can't be used directly for the purpose for which it was realized, representing an economic loss. A product considered to be a rebuttal following the manufacturing process can be recovered using a reshaping method to be brought to the quality set by the qualitative and standard conditions or can be recovered without intervening with any change to it, finding the defect by selling at a low price to less demanding customers.

3. Discussion

The longer the production line, the more it requires a larger number of people, processes and, of course, a longer time. The more people are needed, the higher the mistakes, the scrapping rate.

Therefore, we can see once again how the company loses money by paying extra people's wages, storing stocks, raw materials by repairing defective products, etc. It is not at all an appropriate solution to simply replace old machines with new ones, but replacing old machines with new ones that do not require human involvement (or require minimal involvement or supervision, although a worker who stays and looks at a machine does not add value) is a much more effective solution and, most likely and important, is a long-term solution.

It can be said that lately, eliminating the human operator from as many places on the production line has become a prime concern and even a "trend" in the idea of stopping as much as possible from the errors of the human operator.

Lately, many companies are very focused on the "zero defects" concept, but as nothing in this world is perfect, rebate products are always on the line of production due to the desire to increase the volume of products and to be in the prime plan with what's happening in the market. Technologically, it can be said that in many cases it is possible to achieve the "zero defect" target. However, it is a difficult threshold to overcome, large firms with high investment potential, accept the best 98% of good products. A target of 99% involves extremely high costs, much higher than 2% non-conforming products.

Focusing heavily on increasing product volumes, many manufacturers neglect more or less non-compliant products. Very few wonder what happens to scrapes that can mostly be reused after a reshuffle. If the costs of handling, storing, logistics of these scrapes were calculated, it would be economical and a substantial gain. In general, the criteria for classification for defects are analogous to the criteria for classifying the quality characteristics:

- nature - functional and structural, appearance, packaging;
- measurement possibilities (measurable / attributive);
- importance - critical, major, minor;
- after effect - allowing reshuffle;
- after the moment of occurrence, related to the product's lifetime: youth, maturity, old age;
- the character of occurrence: accidental; systematic;
- by cause, origin, the most important criterion for the removal of their occurrence;

Depending on the causes, defects fall into one of the six factors, namely: material, worker, machine, working method (technology), measurement, environment.

1.5. Suggestions for capitalizing remanufactured scrap

- Referring to scrapes that have appearance defects but which retain their functional role, they can be capitalized without interfering with their modification, reshaping them.

For example, there are manufacturers that produce components for the interior of cars. These components result from machining operations such as injection molding, hot pressing, sewing, gluing, taping, etc. For various reasons, defects such as lack of material in certain areas of the product, a bulge in a certain area, seams defects (deformed stitch, ruptured sewing material, "rare mesh", material wrinkling, seams missing etc.), discoloration of the material after the soldering operation, burns and scratches resulting from the make-up operation etc.

By reporting on the automotive industry, these products that have certain appearance defects can be redeemed by selling the final product to less demanding customers or to companies that provide certain services (taxi, courier, etc.) but with a re-valued sales cost finding defects.

- Regarding scrapes that have functional defects, but which through a certain reshuffling of the product, I can restore the functional state for which they were created, can be capitalized if the repair costs and the allocated time are small.

- If we refer to scrapes that have both aesthetic and functional defects, it is not appropriate to remedy them due to high costs, but can be redeemed by using under normal conditions that rebut for another purpose for which it was originally created.

For example, if we think of car safety belts, assuming that for some reasons they do not meet the qualitative standards set by the standards, these rebated belts can be reused for another purpose, such as the use of straps to secure goods in trucks or for palletizing goods.

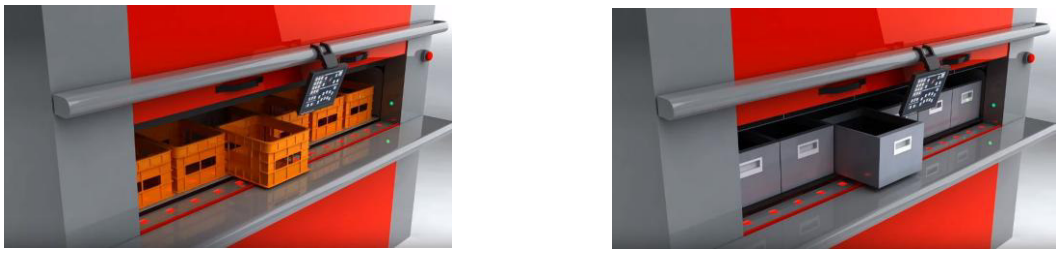
Figure 7. Type of Paternoster by Maxi Store

In Figure 7, there is shown a paternoster system, which is customized with different sizes and shapes of the racks in which the scrap can be stored and sorted, depending on the defect category settings that are introduced into the paternoster computer.

1.6. Possibilities of implementation of the redeemed scrap in the paternoster system

Taking into account that at present they are manufacturers in the automotive industry that use up to 90% of their waste, they are doing it in a classic way, and considering the possibility of implementing a paternoster management / logistics system, would save from the storage space, reduce time and handling costs, manufacturers would have an overview of the scrap for a certain period of time.

In Figure 8, there are exemplified some compartment models that can be customized according to the customer's need and operated manually or automatically (horizontally) to the loading position, to facilitate operator ergonomics and reduce the dead times



a. b.

Figure 8. Custom Paternoster by Maxi Store
[Source: Youtube.com]

The rebuttable parts can be recorded with the bar code that is unique to each piece. Later, when it is desired to "archive" some rebuttable pieces, it is possible to scan the bar code and somewhere in an observation field to introduce the defects of the product after the evaluation of the Technical and Quality Control Department, then its paternoster system store it on the "district/container" that has a certain defect category.

On paternoster shelves/containers, defects can be determined from its software, defects categories and subcategories, and when a product with an aesthetic defect is introduced, for example, the system knows where it can store. They can be customized in many ways, for example, depending on the category and severity of the defect, to reassess the value of these scrapes.

Nowadays, the big manufacturers that are in trend with technology, use a system similar to the one mentioned in the consumable products in the idea of recycling materials and reduce the future costs of acquisition. For example, the cutting plates used for machining when worn out are returned by human operators in an automated system that sorts them according to the chemical composition of the tiles, later being sent to manufacturers and reused as raw material.

4. Conclusion

Due to the speed of today's technology, it has begun to grow and grow in any field, and the rise in the labor shortage increases the need for technology development.

By implementing such a paternoster system, one of the causes limiting the processing activity, namely the lack of labor, mentioned in subchapter 2.1, would be stopped.

In the following papers, some case studies will be approached regarding the implementation of a Paternoster type system on certain remnants of the automotive industry in Brasov.

The purpose of implementing these systems is to maximize the use of these types of rebuttal, to have a traceability of the production flow trace of the semi-finished parts, to simplify existing procedures and documentation for capitalizing on these products, to reduce costs for sorting, logistics, inventory, storage of said scrap, to automate this process.

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Characteristics of education in entrepreneurial economy

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Abstract. Paper presents some aspects regarding entrepreneurial economy, short history concerning the fathers of entrepreneur concept, classic and neoclassic theories, the importance of education in entrepreneurial economy, and percent of GDP dedicated to education and innovative research; a short comparison between some economies (US, Germany, Sweden, Japan, a.s.o.), and Romania.

Keywords: *economy, entrepreneur, education, innovative research*

Introduction

The overwhelming majority of products (and services) now reach the consumer through the market, and any commodity and service exchange is mediated through money. Generally a market economy is a capitalist one, in which capital accumulation and investment in profitable activities play the central role. "... The so-called progress towards capitalism is, from The Middle Ages, the univocal criterion of modernizing the economy "(Max Weber).

Market operates according to the requirements of economic effectiveness under the law of supply and demand: any activity is justified on the market by its economic effectiveness that is by its profitability; an ineffective, unprofitable activity is eliminated from the market, better it is eliminated alone, unable to resist to competition.

The market economy can only be a free one in which economic agents can take by themselves the decisions most appropriate to their own interest, which they know best; interest which corresponds to the economic efficiency and, implicitly, the realization of the profit. The wrong decisions of owners are economically sanctioned - bankruptcy. On the other hand, the market economy also includes freedom of labour - based on the abolition of any personal dependence of one person to another - her right to engage or not in the conditions of a contract negotiated, for any kind of activity. The idea and the implementation of the contract are essential for a market economy, assuming equality before the law of the contracting parties as well as the equal obligation of all parties to comply with the terms of a contract freely assumed.

The concept of entrepreneurial economy

Entrepreneurial economy appears as a two-dimensional concept [1]:

- Static size - refers to business ownership at national level (Macro);
- The dynamic dimension - refers to the entrepreneurial behaviour in general.

Entrepreneurship contributes to the economic growth of any country. Internationally, entrepreneurship differs according to the levels of development economic and institutional structures of each country.

Over time, there have been many forms of entrepreneurship due to trends and development of existing technologies. In many countries, tax legislation, public sector development and tightening conditions market entry have boosted the decline of the small business sector.

Classic and neoclassic entrepreneurial theories

Entrepreneurial theories have existed for many years. They have contributed to the development and the formation of entrepreneurship as a science. Among the classical thinkers who have formulated the theories about entrepreneurship, the most known were R. Cantillon and J. B. Say [2].

Richard Cantillon (1680-1734) was the first economist who used the term of entrepreneur. His most important contribution was to recognize that the function of entrepreneurship exists in the economic system at both micro and macro level (i.e. within the business and economy).

Cantillon has identified three different forms of entrepreneurship:

- landowners, whom he called capitalists;
- entrepreneurs, whom they called referees;
- paid managers.

In a sense, the entrepreneur creates a balance between supply and demand. In conclusion, Cantillon's entrepreneur was, first and foremost, a speculator. He invite always to be alert and have relationships, look ahead and be willing to assume one risk, but not necessarily an innovative one. After Cantillon, the products and processes of a particular branch of activity were fixed and that's why improvement or innovation has not big importance.

Jean-Baptiste Say (1767-1832) believes that the entrepreneur has a central role both in the production and distribution of goods and services produced and consumed by society overall. He was the first economist who presented the difference between entrepreneur and manager. Unlike other economists, Say gives entrepreneurship a special position, important in the production and consumption system. Say removes attention from the role of entrepreneur, treating his work as a superior form. Say's entrepreneurs dedicate their time, talent, and resources to producing, distribution and consumption of goods and services. They coordinate both markets and businesses. Successful entrepreneurs need a rare combination of qualities and experiences. As a result, the surplus of income of a firm transformed into the reward (wage) of the entrepreneur perhaps must be very high[2].

Alfred Marshall (1842-1924) assigns a remarkable role to the entrepreneur, both at the level macro and microeconomic. In his conception, the most important contribution of the entrepreneur is the supply of goods as well as innovation and progress achieved simultaneously. Marshall used an illustration to explain his theory: "The business people who were road opener brought much greater benefits to society than their earnings owns, although millionaires died" [1].

Joseph Schumpeter (1883-1950) considered the entrepreneur as a leader and innovator or "the main engine of the economic system". In Schumpeter's view, the task the entrepreneur is deciding which goal is to be pursued and not to decide how this must be done. He neither assumes the risk nor provides the capital; these tasks are left to the banker (the investor) [5].

Schumpeter sees the entrepreneur as an innovator and a leader, but not as a bearer risk, nor as a capitalist or a manager. The innovator plays the role of engine of growth economics and removes the economy from its static equilibrium, pushing it to the state of a superior balance.

Frank Knight (1885-1972) argues that the entrepreneur also contributes to progress general economy. By pursuing his own goals, he will always improve existing technologies and ways of organization. Entrepreneurs have the responsibility to guarantee the pre-established remuneration for all stakeholders in the firm. They take decisions for which they are responsible and then guarantee fixed payments to production factors use. For this, enough capital (own or borrowed) is needed for

reimbursement of guaranteed services. The entrepreneur is finally rewarded with the remained profit, as well as with prestige and work satisfaction [5].

The importance of education in entrepreneurial economy

In entrepreneurial economy, ideas and knowledge being essential for innovation and innovation economic growth, investment in human resources is an important factor in maintaining economic and technological competitiveness. Training Highly Qualified Human Resources, from which feeds into the area of research and development (R&D), takes longer, but investment in education or other areas that support the process of lifelong learning brings great value and benefits in economy and society, not only in the short term, but also in the long run long. Building a solid human capacity that is so necessary for the entrepreneurial economy and to which it aspires at European level, is not possible without support through funding appropriate education and research.

In principle, the entire population of a country can be a potential source of human science and technology resources, but the higher - formal education is more consistent, the greater the possibility of employment in R&D activity [5].

If in most EU Member States the total number of researchers has increased between 2005 and 2015 in Romania was a contrary trend.

The situation in different European countries is uneven, with notable differences between large and small countries, between the north and the south. In northern European countries there is a growing concentration of human resources (i.e. Sweden, Denmark, and Norway). Also in this countries are created organizations specialized in innovation and technologic transfer (GTZ, VINNOVA).

Specialists in the field appreciate that countries with a low potential for researchers do not meet the minimum requirements of the economy based on entrepreneurial knowledge.

Recent developments in Sweden and Finland, which have stimulated an increase in the number of researchers at an already high level, is a good example for Romania, where it was found permanent diminishing of the number of researchers over the last decade.

In the experts' opinion, gaps are difficult to be recovered in the public sector, but especially in the private one [6]. Data shows that in European private firms they are only used half of the researchers compared to the US and Japan, where around 80% of researchers work in the private sector. This phenomenon is even more worrying than that notes that in European countries the evolution of the number of researchers is contrary to graduates with a qualification appropriate to the R&D requirements.

In the future, the economy based on entrepreneurial knowledge will stimulate even more increasing the need for people with a high technical and scientific qualification.

Education is entrepreneurship, and the teacher has the role of entrepreneur [5]. That every entrepreneur and teacher must take risks, they must not avoid them. At the moment these risks relate to the transition from a classical higher education system to a system of modern higher education.

In this passage, there are some distinct elements such as:

- in the classical form, students learn from the teacher, and in the modern version, they have to learn from many people in different fields (scientists, psychologists, engineers);
- until now the student has a passive role, in modern education it involves him into participate actively in the exchange of ideas;
- in the classical form, it takes the learning in the organization, it certainly must be replaced by the modern form of discovery learning;
- it is not to be neglected that the classical form promotes education by reaching the target, on when the modern form will promote education to reach the targets.

All this can be possible if Romanian universities will accept to implement as universities in the USA, Germany, Austria, New Zealand entrepreneurship. Unlike the Romanian space where there are often confusing terminologies, in Germany it is a clear distinction between the entrepreneur / entrepreneurial business and the investor [3].

The Entrepreneur / Entrepreneurial in Business is the one who comes up with the Idea, and the Investor comes with the Money. They can be the same person ("a cumulus of functions"), but the most common is the one in which are distinct individuals. The investor must believe in Idea, and the Entrepreneur /Entrepreneurial in Business must also come with a minimum amount, or guarantee with his possessions, to take part in taking the risk.

In order to achieve economic growth and the standard of living, Europe needs to stimulate innovation and entrepreneurship. Thus, on the one hand, the gap to competitors will become stronger, and on the other hand, even innovators and entrepreneurs will migrate to more favourable economic space, easy in a globalized world.

The phenomenon of aging of the population occupied in research, which is becoming more and more manifest accentuated in the developed European countries, has already begun to have a negative impact on this field. Young graduates and young researchers are looking for more careers perspective, activity and salary scales. The loss of some younger quotas, which have a greater capacity to adapt to the demands of the knowledge and renewal society continuous knowledge and professional qualification, will accentuate the phenomenon of aging of the population employed in science and technology. This trend is a serious problem at European level, affecting the dynamics of the new knowledge-based economy.

Although, according to surveys, scientists enjoy a good reputation, lack of the attractiveness of this area is, in the case of students, the major obstacle to the way the option for scientific activity.

If European countries have traditionally invested in all forms of education, it has been found that investment in tertiary education does not correlate directly with the number of graduates opting for the profession of researcher.

Some countries have successfully experienced strategies to attract and maintain R&D of a significant parts of the highly educated population, while in others, attractiveness for other professions or unemployment are factors with a strong influence on degree of occupation in science and technology.

Unemployment data highlights some subtle use of human resources potential for Science and Technology, S&T. There are about two million unemployed people in the EU countries with or adequate experience for S&T posts. Amongst the young researchers in Central and Eastern European countries there is a tendency for permanent residence in developed European countries or in the US, Canada, Japan, which have become an important attraction for both researchers from developed countries as well as from other parts of the world.

An important aspect of increasing the number of researchers capturing attention of experts at European level is to stimulate women' participation in R&D activity through attracting them in universities and then in R&D.

A human society based on entrepreneurial knowledge must have in its essence the concept of an educated person. The educated person is essential now! It must be able to influence the present, not to mention about modelling future. Knowledge is not cheap. All developed countries allocate about 1/5 of GDP production and dissemination of knowledge. Formal schooling, schooling young people before they get into work - takes about 1/10 of GDP. Organizations are spending another 5 percent of GDP on continuing training for the new employees, or even more. Also 3 to 5 percent in GDP are spent on research development, to produce new knowledge.

Knowledge formation is the largest investment in each developed country. Fifty years ago, people doing work based on knowledge and work in services accounted for less than one third of the workforce. Today, these people constitute three quarters if not four fifths of the labour force of the countries and their proportion is still in increase. One-third of the capital investment in developed countries was spent on equipment for the treatment of data and information: computers, faxes, e - mail, television with closed circuit. However, the number of people who work as civil servants, i.e. the number those to whom most of this equipment is destined has increased much faster than total production or GDP.

Importance of productivity

The lowest level of productivity is recorded in jobs at state companies. Over the state is the largest patron of services. In the United States, for example, 1/5 of the entire workforce is employed by federal, state and local governments, predominantly in routine office work. In the UK, the proportion is close to 1/3. In all developed countries, government employees represent a similar percentage of total labour force.

If we cannot learn how to increase the productivity of knowledge workers and services, developed countries will have an economic stagnation and severe social tensions. People can only be paid in relation to their productivity. Their productivity creates the common fund of values from which wages are then paid. If productivity does not climb, the more it decreases, the higher real incomes cannot be paid.

Knowledge workers, over time, have to bear a reduction in income if their productivity does not increase. Many service providers submit a job they claim some skill and relatively little education. If an economy, in which productivity service providers is low, trying to pay them wages well over which brings their productivity, inflation is beginning to erode real income for everyone. And no after a long time, inflation will then create serious social tensions. If the service providers would be paid, however, according to their productivity, the distance between their income and that of their "Privileged," i.e. knowledge workers, will gradually increase - creating tensions again severe social issues.

Much of the work in the service does not differ much from the work in product or distribute goods. This includes some features such as data processing, billing, answering customer inquiries, handling insurance claims, issuing driving books for motorists - in fact, nearly two-thirds of the work done in government offices and almost a third or more of all civil servant work in services, in enterprises, universities, hospitals and others. This is the fact "production work", which differs from the work done in a factory only in that is done in an office. But even this work must be "restructured" before become productive. It needs to be studied and restructured to make an optimal contribution and to achieve its objectives.

Working on productivity in the fabrication and movement of things, the task is a data base and determined. When Frederick W. Taylor began to study the load of sand with the shovel, he could take it for granted that the sand should be taken with the shovel. Much of it the work consisting in producing or distributing goods, the task is actually "proportionate machine ": the individual worker serves the machine.

In work based on knowledge and practically in any service work, the machine serves worker. The task is not given: it must be determined, and the question "What are the expected results of this work?" is almost never raised in any traditional work or scientific management study. But it's the key issue to make them productive knowledge workers and service providers. And it's a problem that demands risky decisions. Usually there is no correct answer; there are only choices and the results must be clearly specified if we want to reach productivity.

Entrepreneurial theories have existed for many years. They have contributed to the development and the formation of entrepreneurship as a science. Among the classical thinkers who have formulated the theories.

Conclusions

Successful entrepreneurs have the ability to see and "sweeten the details" and the also conceptualize. They are dissatisfied with the status quo and are anxious initiators.

Modern research has considerably refined the way self-confidence approaches. There exists widespread agreement between researchers and practitioners, alike, that effective entrepreneurs are looking for actively take the initiative. They are willing to put themselves in situations where they are personal responsible for the success or failure of the operation. They like to have an initiative to solve a problem or fill the gap where there is no leadership. They also like the situations where the personal

impact on problems can be measured. This is a natural action which oriented an entrepreneur. Successful entrepreneurs are adaptive and resilient. They have an unsteady desire to know how well they do. Realize that to know how much well do and how to improve their performance, they need to look and do use feedback. Searching for and using feedback is also the key to habit learn from mistakes, and respond to unexpected events. For the same reasons, these entrepreneurs are often described as excellent listeners and learners quickly. Entrepreneurs not afraid of failure; on the contrary, they are more focused on success. People who fear failure will neutralize any possible motivation to achieve. They will engage in an easy task, where the chance of failure is very low, or, in a difficult situation where they cannot be found if they fail. Learning through the iterative trial-error process is essential for the goal of becoming a successful entrepreneur, although it brings serious obstacles and disappointments, all of which are an integral part of the learning process.

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Correlation Models on Regional GDP Relative to the Insertion of Graduates on the Labor Market. Forecasts and Estimates

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Abstract. In the analysis we made turned its attention to finding a correlation between GDP and the rate of insertion of university graduates in the economic, regional levels. Analysis shows that there is a correlation between the degree of employability of university graduates and the regional gross domestic product. We hope that this study will be a significant contribution from the regional perspective to better knowledge of the complex relationship between education and employment, may serve to define the strategic role of training and grounding and directing future regional policies on employment and training.

Key-words*: recalibration, sustenability, educational system, market indicators, labor market, university graduates.*

1. Introduction

Labor, or rather lack of it, is a growing problem today. Even amid ongoing technological expansion, human resources remain the engine after operating an organization. Unlocking the potential of labor, creating conditions for increasing labor market participation and access to quality jobs are priorities for achieving economic competitiveness, sustainability and inclusion. Amid the difficult conditions caused by the economic crisis plus technological progress and, not least, the aging population, the Romanian economy is facing serious problems in the use of labor, with some distortions in the labor market, which translates the coexistence of a shortage of manpower in certain economic sectors or geographical areas with poor use of its overall.

Financial and economic crisis were manifested in fewer jobs and thus increasing unemployment, by limiting and slowing job creation, with direct consequences in blocking entry of young people into the labor market.

A major challenge in this regard is represented by the unequal distribution of employment, with significant disparities between regions. Despite positive developments in some areas of employment, inactivity rates remain high in less developed areas.

These problems are caused both by general economic context and the weak link of the education system with the actual demand of skills, lack of work experience, which leads to reduced levels of employability of graduates in the labor market.

The data provided by the National Agency for Employment (NAE), that the first 15 positions of the unemployed, who recently graduated from university, is constant between 2004 -2017, the following occupations: economists, specialists consultants in finance and investments, accounting specialists, etc. The inclusion in specialty graduated or in a related specialization depends on the degree graduated. Graduates of economics, for example, take up jobs rather related specialization graduated.

The reasons invoked graduates related to a post in a different specialization of the graduate, are linked mostly to the lack of availability of a post in the specialization. Almost 80% of graduates working in another field invoked this reason, other reasons having rather a marginal influence on the decision to engage in a particular job. Taking into account the proportion of those with higher education, we can determine the upward employment with higher education. This is ensured by the increase in activity, and GDP growth. The activity rate has the greatest impact on employment for the period under review, this is normal, mainly due to the direct link between the activity rate and the employment rate of graduates.

In research conducted, the author has turned its attention to analyzing the relationship model of insertion of graduates in the labor market and regional GDP.

The analysis made led to the expected results, namely finding a correlation between the degree of socio-professional insertion of graduates in the labor market and the regional GDP.

The research methodology used in elaborating scientific achievement is evidenced by the following:

- The proposal aims in research;
- Making a plan of analysis;
- Analysis and interpretation of data;
- Correlation performed using the proposed model.

To start scientific research sources used for research were studies and research based on a rich bibliography of articles and papers (attached work), consulting Web site and databases Eurostat, National Statistics Institute (INS), the National Prognosis (CNP), Statistical Yearbook, Eurostat, the National Agency for Employment (NAE), documents from the universities of South-Muntenia and participation in scientific and professional dedicated analyzed domain.

2. The purpose and objectives in research

The main objective of the survey is to radiography system capabilities of university education related to employers' expectations in relation to GDP.

This insight on key areas of interest (very valid) hopefully lead to finding and implementing action measures designed to put Romania on the path of sustainable development, which would be translated in the language of economics, the convergence of the GDP to the level of social insertion of young university graduates.

In this respect, we need to, firstly, a better use of the one of the main factors that are part of potential GDP, namely, labor as the only way to stimuli, sustainably increase economic.

3. Experimental results and discussion

To test the time evolution of GDP and of the evolution of regional employment rate (MMR) were used as models:

$$Y(t) = a + b \cdot t + \varepsilon; \quad t_{2004} = 0 \tag{1}$$

where a is the intercept (the intersection of the regression line with the axis OY), b is the slope of the regression line (derived from first order function) and the number of units that changes Y (t) in the modification by one of t, and the residual is variable.

To test the statistical significance of the regression model ANOVA was used methodology for a significance threshold of $\alpha = 0.05$ (95% Confidence Level).

In order to study dependencies between GDP and MMR in the first phase were analyzed time evolution of the two indicators. If GDP (Figure 1) highlights three distinct periods.

The period 2004-2008 is a period of significant upward trend GDP regression model are:

$$Y(t) = 39.68 + 20.2 \cdot t + \varepsilon \quad (2)$$

In view of the fact that R2 = 0.9953, rezltă the model (2) as well approximates the time course of GDP in the first period. The regression coefficient shows an increase of euro 20.2 million regional GDP so that in 2010 regional GDP volume was 2.29 times higher than in 2004.

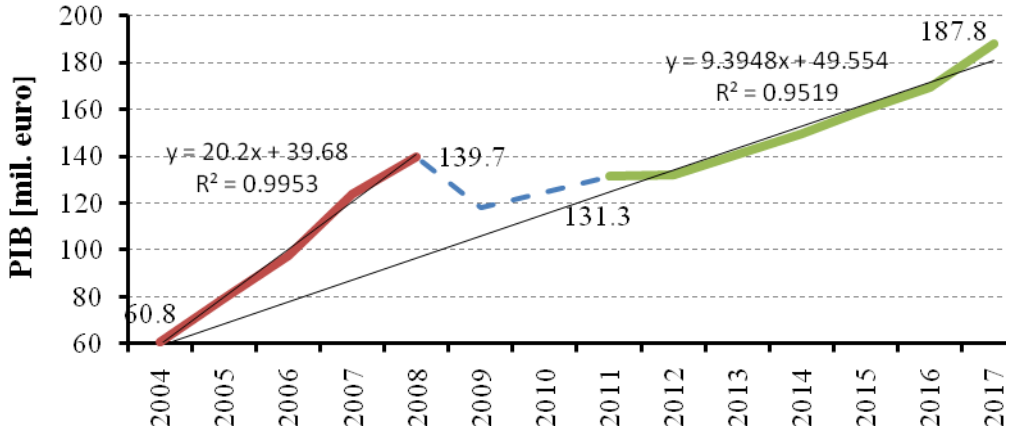

Figure 1. Evolution of GDP during 2004-2017

The second period, between the years 2008 - 2011 is a period of development characterized by alternating a drastic reduction in 2008-2009 and gradually recover in 2009-2011.

The economic crisis that started in 2008 led to a reduction in regional GDP 15.39%, from 139.7 million euros in 2008 to 118.2 million euros in 2009. Although the two years that followed were no increases in regional GDP, with 5.25% in 2010 compared to 2009 and 5.54% respectively in 2011 compared to 2010, in 2011, regional GDP in absolute terms continues to be lower than in 2008 by 8.4 million euros.

In the third period, 2011-2017, the regional GDP registered a bottom-up process with an average annual increase of about 9.4 million euros per year, making ICAT in 2017 was 1.43 times higher than in 2011 and 1.35 times higher than in 2008, since the outbreak of the crisis. Regional GDP evolution was linear regression model characteristics are shown in Table 1:

Table 1. Characteristics of the regression model corresponding GDP growth during 2011-2017

Multiple R	R Square	*F*	*Sig. F*	*Coefficients*		*t Stat*	*P-value*	*95% Conf. level*	
								Lower	*Upper*
0.975	0.951	98.854	0.00018	a	58.948	6.117	0.00169	34.178	83.719
				b	9.395	9.945	0.00017	6.965	11.824

Source: own determinations

Taking into account the values of the coefficients of the model, as well as the limits of the confidence intervals for a confidence level of 95%, it can be appreciated that in view of the PIP during this period can be described by three shape model (minimum, most likely, respectively, maximum):

$$PIB_{\min}(t) = 34.178 + 6.965 \cdot t + \varepsilon$$
$$PIB_{cmp}(t) = 58.948 + 9.395 \cdot t + \varepsilon \quad (3)$$
$$PIB_{\max}(t) = 83.719 + 11.842 \cdot t + \varepsilon$$

If MMR (Figure 2), it also highlights three distinct periods. Period 2004-2008 is, in this case, a period of increased employment at regional level. The regression model is:

$$ROR(t) = 57.29 + 1.27 \cdot t + \varepsilon \quad (4)$$

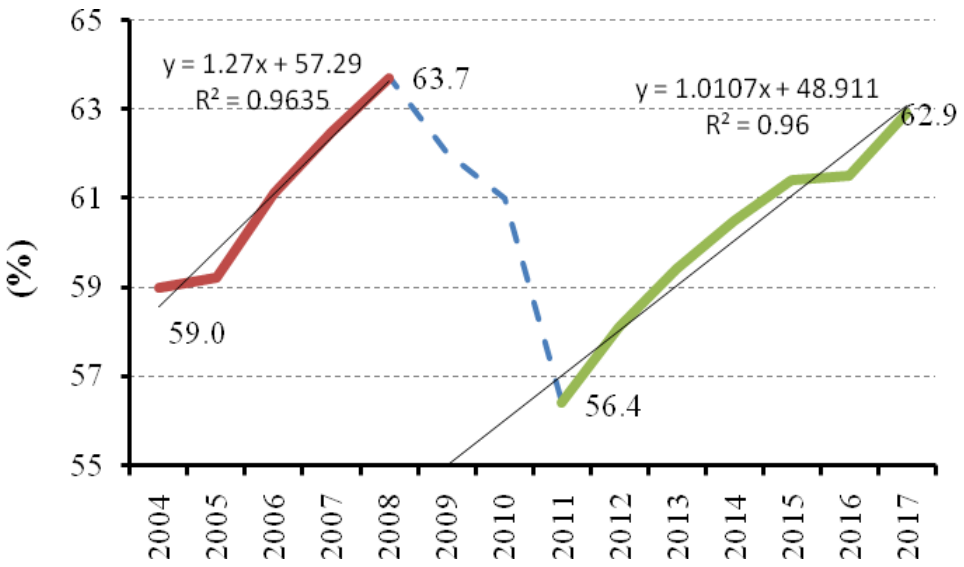

Figure 2. Evolution of regional employment rate

In view of the fact that R2 = 0.9635, shows that the pattern (4) as well approximates the time course of MMR in the first period. Given that ROR recorded an average annual increase of 1.27 percentage points during 2004-2008 is one beneficial regional where both GDP and ROR evolves upward.

In the second period, 2008-2011, the economic crisis has a strong negative effect on MMR. It decreases continuously with 2.66% in 2009 compared to 2008, with 1.63% in 2010 compared to 2009 and by 7.45% in 2011 compared to 2010. This significant decrease is ROR in 2011 to record the lowest values in the entire period, 2.6 percentage points less than in 2004.

Third Period 2011-2017 is characterized, in the case of MMR, through continued growth, with average annual growth of 1.01 percentage points. ROR is a linear evolution, the main characteristics of the needles of the regression model are presented in Table 2. Both the values of P-Sig.F and points out that the value is statistically significant regression model.

Table 2. Characteristics of the regression model corresponding ROR development during 2011-2017

Multiple R	R Square	*F*	*Sig. F*	*Coefficients*		*t Stat*	*P-value*	*95% Conf. level*	
								Lower	*Upper*
0.979	0.960	120.073	0.00011	a	49.921	53.072	4.49E-08	47.503	52.339
				b	1.011	10.9578	0.00011	0.773	1.247

Source: own determination

Given the limits of confidence intervals resulting in this case three models that highlight the lower, most likely and greater development of ROR for a 95% confidence coefficient (α = 0.05):

$$\begin{aligned} ROR_{\min}(t) &= 47.503 + 0.773 \cdot t + \varepsilon \\ ROR_{cmp}(t) &= 49.921 + 1.011 \cdot t + \varepsilon \\ ROR_{\max}(t) &= 52.339 + 1.247 \cdot t + \varepsilon \end{aligned} \quad (5)$$

Analyzing both traectoriile evolution of GDP and ROR during 2011-2017, and the characteristics of regression models (3) and (5) was tested dependence of regional GDP and ROR. For such it was used a linear model of the form:

$$PIB(ROR) = a + b \cdot ROR + \varepsilon \quad (6)$$

For the period 2011-2017 model characteristics are shown in Table 3. In view of the fact that Sig.F = 0.00243 <α = 0.05 that is statistically significant regression model. Also values P-value model highlighted that both coefficients are statistically significant, as evidenced by the values of the Lower and Upper confidence interval (within each interval have the same sign).

Table 3. The characteristics of the regression model of the form (6) corresponding to the period 2011-2017

Multiple R	R Square	*F*	*Sig. F*	*Coefficients*		*t Stat*	*P-value*	*95% Conf. level*	
								Lower	*Upper*
0.929	0.864	31.837	0.00243	a	-386.05	-3.984	0.01048	-605.525	-130.582
				b	8.678	5.642	0.00243	4.725	12.632

Source: own determinations

Three model variants characterizing the dependence of regional GDP and MMR are:

$$\begin{aligned} PIB_{\min}(ROR) &= -605.525 + 4.725 \cdot ROR + \varepsilon \\ PIB_{cmp}(ROR) &= -386.05 + 8.678 \cdot ROR + \varepsilon \\ PIB_{\max}(ROR) &= -130.582 + 12.632 \cdot t + \varepsilon \end{aligned} \quad (7)$$

Models (7) shows that the value changes by one unit ROR regional GDP values change with a value between 4.723 million euros and 12.634 million euros, the most likely value is 8.678 million euros. Given this and given the fact that the models (5) values MMR may be between 0.773 and 1.247 percentage points, the most likely value being 1.011 percentage points values could be expected forecast for 2018 are presented the decision matrix Aij in table 4.

Table 4. Decision matrix to estimate regional GDP in 2018

A_{ij}	GDP_min	GDP_cmp	GDP_max
ΔROR_min	191.452	194.515	197.565
ΔROR_cmp	192.577	196.583	200.571
ΔROR_max	193.692	198.633	203.552

Source: own determinations

The research carried out we can see that economic developments have a powerful social, as in social developments and results are reflected on the medium and long term economy.

Given this and given the fact that the models (5) values MMR may be between 0.773 and 1.247 percentage points, the most likely value being 1.011 percentage points forecast values for 2018 are derived from the GDP regional in year 2017 as follows:

$$PIB_{2018,x}(ROR) = PIB_{2017} + b_x \cdot \Delta ROR_x + \varepsilon \quad (8)$$

In the model (8) x corresponds to the three situations (min cm², max) and ΔROR is the projected annual mean change of MMR. In these conditions forecasted values for 2018 are presented in Table 5:

Table 5. Predicted values of regional GDP for 2018 (EUR million)

PIB_min	PIB_cmp	PIB_max
191.452	196.583	203.552

Source: own construction

The forecast shows that the most likely value is 196 583 euros milioade plus / minus 6.97 million euros (plus / minus 3.55%) for a confidence level of 95% (α = 0.05).

Given that the series of data on which the forecast is made very short, forecast, more or less true for 2019 is relatively unlikely. However, assuming the hypothesis (unlikely in the current social and economic context) that other factors influencing regional GDP developments do not change the values of regional GDP forecast for 2019 were determined by the pattern:

$$PIB_{2019,x}(ROR) = PIB_{2018,x} + b_x \cdot \Delta ROR_x + \varepsilon \quad (9)$$

2018 predicted values are shown in Table 6:

Table 6. Predicted values of regional GDP for 2019 (EUR million)

PIB_min	PIB_cmp	PIB_max
195.105	205.365	219.304

Source: own construction

Analyzing developments expected on the medium and long term, the development of Gross Domestic Product and employment of university graduates in the perspective of 2019, we consider that both GDP and employment rate higher level of education, Nestle regional fluctuated irregularly period.

4. Conclusions

Analysis aimed at regional level, the degree of labor market insertion of university graduates linked to the GDP.

Taking such a perspective, the forecast for 2019 is that it is based on the predicted values for 2018, values determined for a confidence level of 95%. Given this level of confidence for regional GDP figures forecast for 2019 is over 90% (0.95 * 0.95).

Precisely for this reason, incidence level of socio-professional insertion of young university graduates cause the creation of self, that maturity.

Also employment of labor will increase slightly in the future, mainly due to projected increase in GDP. I think it would be appropriate, for 2020, a smart, (characterized by strengthening knowledge through innovation, education and through a digital society), sustainable growth (by increasing competitiveness), an inclusive growth (through increased participation in the labor market and acquire new professional skills) and an optimal level of GDP investment in R & D.

In this respect, short-term, attention will be directed towards the development of human capital and increase competitiveness by linking education and lifelong learning with the labor market and ensuring better opportunities for future participation on a modern and flexible labor market. Medium and long term, by 2020, an important role will education and training.

5. Authors'contributions

The proposed solution as an indicator fails to provide the necessary support to validate the possibility that an optimum design work necessary to obtain vital advance the process of catching up with the developed countries.

This work complements the research in this field in recent years found to be of great value, but infinitely more effective together. Made personal contribution to research is to analyze the relationship model of insertion of graduates in the labor market and regional GDP.

6. Proposals and recommendations

For a positive impact regionally on university education harmonious correlation with the requirements of the labor market and gross domestic product, we suggest the following:

2. an integrated system that includes all real-time information from previous systems designed and universities;
3. providing a true picture of human capital developed by higher education;
4. implementation of educational policies of the European Union;
5. support to strengthen relations between universities, students, graduates and socio-economic environment, promoting the exchange of experience and contribution to the construction of virtual communities;
6. support the exchange of information between actors in higher education and socio-economic environment.

Higher education institutions must be in increasingly connected to the social environment and maintain regular contact with various communities and organizations who expect services clearly formulated, graduates with a high degree of specialization. In the research work we intend to draw attention to:

- supporting a flexible approach to university curricula in line with labor market demand;
- encouraging continuous learning based on intellectual and vocational development;
- promoting cooperation between business and education as key areas in socio-economic regeneration of the whole region;
- infrastructure development counseling and retraining;
- training programs to provide a much higher degree of adaptability to the new requirements of the labor market.

Also consider continuous adaptation and structuring appropriate university education system and training. The aim is to create an ideal framework for education and training opportunities for labor, while removing barriers to accessing them. The major impact will be to increase the level of integration of the labor force, reducing unemployment, creating new jobs, new business development and increased social stability. We believe that the increasing educational and vocational training, or to improve the conditions for lifelong learning, namely, access and the employment of university graduates, would require:

✓ development of tools for monitoring the route socio - professional university graduates,
✓ improving the quality of teaching by linking the educational offer, skills, competences and skills acquired by graduates of higher education with labor market needs;
✓ evidenced on professional development at different intervals of time after graduation, correlated with a number of socio-biographical and educational descriptors (feedback necessary for improvement of the university);
✓ regular monitoring of socio-professional insertion of graduates in order to improve the relevance of educational offer of higher education to labor market demand and improve the quality of students' training;
✓ developing and strengthening institutional capacity to perform these periodic surveys, the relevant timeframe;
✓ knowing capacity supply educational system and its correlation with the estimated requirements of the labor market;
✓ decision making at national and institutional level on the implementation of national policies on employment;
✓ responsibility of social partners in education issues;
✓ efficient investment in human resources (graduated) reflected by the higher education system results.

Thus regionally, these proposals may have the impact of increasing long-term employment, economic efficiency, and increased social stability.

The restructuring of the regional economy and globalization has created in the region analyzed situations where training an important part of labor is outdated or unsatisfactory, with implications in terms of unemployment and economic activity performance. However, economic changes have a radical effect on the nature of the work and training of labor.

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Recent developments of the right to self-determination before the International Court of Justice: The Chagos Advisory Opinion

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Abstract: The paper: ''Recent developments of the right to self-determination before the International Court of Justice: The Chagos Advisory Opinion wishes to tackle a very difficult and sensible subject, the right of peoples to self-determination. This case was specifically chosen because of its peculiarities regarding the subject and their developments going as early as the first principles of the International Court of Justice and reaching into present time. Through the analysis, key findings will be presented in order to grasp the fully extension of the principle and how it was developed over time, ultimately evolving into a basic human right.

Keywords: *self-determination, human right, Chagos*

1. Introduction

The principle of self-determination is a complex topic with has suffered many modifications through history, ultimately evolving into a "right". It rose in a delicate time and came as an answer to colonialism, but also presented the means to means to end it. Through time, this principle needed to be embodied and acknowledged by all countries as being one of the fundamental principles of international law and human rights. Even though this right has been presented and implemented into the United Nations Charter, going from the creation of the U.N and coming into today's time, there are still some cases in which this principle, right had been stopped in achieving its purpose

I find it both interesting and worrying the fact that a principle that was crystalized over 50 years ago is still perceived in different ways by multiple countries. I consider that in the light of todays time, there cannot be second guessing when we talk about a right that speaks of fundamental human rights. The right of people to self-determination needs to be an *erga omnes* feature and it must be respected in accordance with this fundamental principle of international law. Not only does this principle need to be protected, it also needs to be developed and evolving with today's international legislation. Even though this principle evolved into today's time to become a right, it seems that there still are some cases in which this right is not respected and the ones who suffer the most from it are the people of the respective territory. Because of these factors, I was driven into my research, more specifically into analysing the latest case presented in front of the International Court of Justice, namely *The Chagos Advisory Opinion.*

My research question: "*what are the recent developments regarding the rights of self-determination?*" is presented in strong connection with the case mentioned above because of its peculiarities in the matter discussed. Of particular importance is the fact that this case searches for an answer on a question that conceived its answer going back to early beginnings of the U.N. This case is the latest to be brought in front of the I.C.J, and concerns not only the right to self-determination but also the legal consequences of such a continuing unlawful act in regards to the people and territory of a Member State. For me, this case is of relevance because it presents a right that was embodied in the United Nations Charter, a right of which an administering power didn't consider to be important when achieving its purposes. In addition, I believe that an important connection is presented regarding the right of people to self-determination in connection with the process of decolonization and territorial integrity.

2.Events leading to the adoption of the request for the advisory opinion

"The Chagos Archipelago consists of a number of islands and atolls. The largest island is Diego Garcia, which is located in the south-east of the archipelago. With an area of about 27 sq km, the island Diego Garcia account for more than half of the archipelago's total land area.

Between 1814 and 1965, the Chagos Archipelago was administered by the United Kingdom as a dependency of the colony of Mauritius. From 1926, Governor Lowry-Cole listed the islands of the Chagos Archipelago as dependencies of Mauritius. The islands were also presented in several ordinances. The Mauritius Constitution Order of 26 February 1964, promulgated by the government of the United Kingdom, defined the colony of Mauritius in section 90(1) as "*the island of Mauritius and the Dependencies of Mauritius*

On 8 November 1965, by the British Indian Ocean Territory Order1965, the United Kingdom created a new colony known as the British Indian Ocean Territory ("BIOT") consisting of the Chagos Archipelago, detached from Mauritius, and the Aldabra, Farquhar and Desroches islands, detached from Seychelles.

On 16 December 1965, the General Assembly adopted resolution 2066(XX) on the "*Question of Mauritius*", in which it expressed deep concern about the detachment of certain islands from the territory of Mauritius for the purpose of creating a military base. It invited the "*administering Power to take no action which would dismember the Territory of Mauritius and violate its territorial integrity*".

On 20 December 1966, the General Assembly adopted resolution 2232(XXI) on the number of territories including Mauritius. The resolution reaffirmed that: "*any attempt aimed at the partial or total disruption of the national unity and the territorial integrity of colonial Territories and the establishment of military bases and installations in these Territories is incompatible with the purposes and principles of the Charter of the United Nations and of General Assembly resolution 1514 (XV)".*

Mauritius was Sir Seewoosagur Ramgoolam. Section 111, paragraph 1, of the 1968 Constitution of Mauritius, promulgated by the United Kingdom Government before independence on 4 March 1968, defined Mauritius as "*the territories which immediately before 12th March 1968 constituted the colony of Mauritius*". This definition did not include the Chagos Archipelago in the territory of Mauritius.

Between the years 1967 and 1973, the entire population of the Chagos Archipelago was either prevented from returning or forcibly removed and prevented from returning by the United Kingdom. The main moment of the forcible removable of the population of Diego Garcia was in July 1971"

On 11 April 1979, in a discussion on the detachment of the Chagos Archipelago, Prime Minister Ramgoolam told the Mauritian Parliament "*we had no choice*".

In July 1980, the Organisation of African Unity, OAU, adopted resolution 99 (XVII) (1980) in which it "demands" that Diego Garcia be "*unconditionally returned to Mauritius*".

In the same year, the Mauritian Prime Minister, at the thirty-fifth session of the United Nations General Assembly, presented that the BIOT should be disbanded and the territory restored to Mauritius as part of its natural heritage.

In July 2000, the OAU adopted Decision AHG/Dec.159 (XXXVI) (2000) expressing its concern that the Chagos Archipelago was "*excised by the colonial power from Mauritius prior to its independence in violation of UN Resolution 1514*".

On March 2015, the Arbitral Tribunal constituted under Annex VII of UNCLOS rendered an award in the Arbitration regarding the Chagos Marine Protected Area between Mauritius and the United Kingdom. In its award, the tribunal found that it lacked jurisdiction on Mauritius first, second and third submissions, but had jurisdiction to consider Mauritius fourth submission. With respect to the first submission, the Tribunal observed that "*the parties dispute regarding sovereignty over the Chagos Archipelago does not concern interpretation or application*" of UNCLOS

On 30 December 2016, the 50-year period covered in the 1966 Agreement came to an end, however, it was extended for a further period of twenty years, in accordance with its terms.

On 30 January 2017, the Assembly of the African Union adopted resolution AU/Res.1 (XXVIII) on the Chagos Archipelago, which resolved, among other things, to support Mauritius with a view to ensuring "*the completion of the decolonization of the Republic of Mauritius*". In the same year, on the 23rd of June, the General Assembly adopted resolution 71/292 requesting an advisory opinion from the Court.

Having recalled the events leading to the adoption of the request, I will continue by presenting the consideration regarding the jurisdiction and discretion of the Court.

3.The jurisdiction and discretion of the International Court of Justice

In accordance with the jurisprudence and applicable law of the Court, three requirements need to be met in order for the Court to give its advisory opinion. The first requirement is that only competent organ or organization can request the Court to exercise its advisory jurisdiction, the next requirement is that questions must be of legal nature and the third one refers to whether is it proper for the Court to exercise its jurisdiction.

Going further into the subject, the jurisdiction of the Court is one matter to tackle. When presenting their arguments in the written statements, when it comes to jurisdiction and the authorized organ or organization that presented the request, states mostly focus their attention on Article 65(1) of the Statute of the Court and Article 96(1) of the Charter of the United Nations.

In the case of the *Construction of a Wall* in 09 July 2004, in its advisory opinion the Court found that the view that it has no jurisdiction because of the political character of the question posed was not acceptable. The Court considered that the political aspects that derive from the question does not deprive it of its character as a legal question and therefore, it cannot deprive the Court of a competence that is expressly conferred by its Statute. The Court concluded that it has jurisdiction to give the advisory opinion requested by Resolution of the General Assembly.

The next matter at hand is the discretionary power of the Court. Regarding the ability of the Court to exercise its discretion in giving the advisory opinion. Even if the conditions for jurisdiction are met, the Court has interpreted Article 65(1) of its Statute as giving it discretion to render or refuse to render the opinion requested [1] However, the present Court has never refused to give an advisory opinion through the exercise of its discretion. As the Court has repeatedly stated: *"the reply of the Court, itself an 'organ of the United Nations', represents its participation in the activities of the Organization, and, in principle, should not be refused* [2]." The Court has further sustained that only "*compelling reasons*" should serve as a basis for the Court to exercise its discretion to decline to issue an opinion [3]. Further information's are discussed largely in the paper and are developed more in order to understand where the limits of this status of the Court are.

Both the United Kingdom and Mauritius, as well as other countries that wanted to participate to help the Court in making its final decision could do so by presenting their written or oral arguments. As a main conclusion regarding this aspect, the Court concluded that in the present proceedings they could not decline to answer the questions posed to it by the General assembly in in resolution 71/292 on the ground that its opinion would not assist the General Assembly in the performance of its functions. Because of the factors and circumstances mentioned, the Court does not consider that giving

the opinion requested would have the effect of circumventing the principle of consent by a State to the judicial settlement of its dispute with another State. The Court therefore cannot, in the exercise of its discretion, decline to give the opinion on that ground. In addition, in the light of the foregoing, the Court concludes that there are no compelling reasons for it to decline to give the opinion requested by the General Assembly.

4.The Advisory Opinion

After presenting the events that lead to the adoption of the advisory opinion and the strong cases made both against and in favour of the Court jurisdiction and discretion, the Advisory Opinion will be analysed through multiple stages. A clear analysis of the relevant time period and the rules that can be applied in regards to international law is needed, alongside the functions of the General Assembly with respect to the matter of decolonization and relevant cases that can offer a good insight in matters already acknowledged.

The main questions that were addressed to the Court in order to be settled[4]:

A) "Was the process of decolonization of Mauritius lawfully completed when Mauritius was granted independence in 1968, following separation of the Chagos Archipelago from Mauritius and having regard to international law, including obligations reflected in General Assembly resolutions 1514 (XV) of 14 December 1960, 2066 (XX) of 16 December 1965, 2232 (XXI) of 20 December 1966 and 2357 (XXII) of 19 December 1967."

B) "What are the consequences under international law, including obligations reflected in the above-mentioned resolutions, arising from the continued administration by the United Kingdom of Great Britain and Northem Ireland of the Chagos Archipelago, including with respect to the inability of Mauritius to implement a programme for the resettlement on the Chagos Archipelago of its nationals, in particular those of Chagossian origin? ".

In regards to the relevant time period for the purpose of identifying the applicable rules of international law, it has been judged upon that , the right of self-determination had already crystalized before the Chagos Archipelago was excised in 1965. The corollaries of that right had crystalized as well. As expressed in the Colonial Declaration, those corollaries included the right to "*territorial integrity*" and the right of peoples to "*freely determine their political status*", norms that the Court has suggested help to "*confirm and emphasize that the application of the right of self-determination requires a free and genuine expression of the will of the peoples concerned*"[5]

After the problem of the relevant time period has been settled, the arguments of both parts are presented. The view of the two main actors and their response to the questions presented on this topic are again the main focus. To sum up, the United Kingdom underlines some of the most important aspects that were presented in their arguments. The fact that the elected representatives of Mauritius agreed freely to the detachment of the Chagos Archipelago in the 1965 Agreement in connection with the reaffirmation of the Agreement in the Chagos Arbitration are elements that are highlighted by the UK. Also, they consider that there was no settled practice or opinion juris to support Mauritius argument that paragraph 6 reflected customary international law. Finally, an international law right to self-determination did not come into existence or bind the United Kingdom until after the end of the 1960s and therefore had no impact on the lawful completion of Mauritius decolonization in 1968.

As for Maurtius and their arguments, one important argument that stands out in Mauritius statement is the fact that Central to the right of self-determination is the requirement that the future of a Non-Self-Governing Territory is to be determined by the free expression of the will of the entire people of the territory. Such an expression of will was lacking in respect to the excision of the Chagos Archipelago from Mauritius. The reluctant and forced acquiescence, at the Constitutional Conference in 1965, of the Mauritian representatives – who were compelled to accept the excision only when it was presented to them as a foregone conclusion and as the inescapable price of independence – can be no substitute for a free expression of the will of the people.

For the reason presented above, and many others well described by other countries, Mauritius respectfully submits that it is clearly only one answer regarding the first question: the process of

decolonisation of Mauritius was not lawful completed when Mauritius was granted its independence in 1968 and it remains incomplete today.

After the first question presented to the Court was analysed, the next part of the trial focused on the countries answers with respect to the second question. As was in the case for the question above, the arguments are focussed on Mauritius and the United Kingdom. In very short terms, the response of the United Kingdom in regards to the second question was not developed because they consider the response to be in close connection to the second question, which they already consider not to be fit to present in front of the Court. Furthermore, the United Kingdom recognized the legal consequences that were drawn out in the 2015 Chagos Arbitration Award.

As for Maurtius and their arguments with respect to the second question, in the final remarks of their argument, Mauritius concludes that the failure to complete the decolonisation carries the legal consequence that the continuing wrongful act must come to an end and Mauritius decolonisation must be completed immediately. This can only be achieved when the administering power has fully withdrawn its administration from the Archipelago and Mauritius is able to exercise its full rights of sovereignty. In addition, the administering power must recognise Mauritius sovereignty over the Chagos Archielago. The period of time in which this must come to competition, taking into account the principle of the colonial arrangements which must be brought to a speedy end, should be less than a year given the other, more complex examples offered.

After all arguments are exposed, the decision of the Court is presented in strong connection with the present findings. In the final remarks regarding its opinion regarding the first question, the Court concludes that, as a result of the unlawful detachment of the Chagos Archipelago and its incorporation into a new colony, known as the BIOT, the process of decolonization of Mauritius was not lawfully complete when it acceded to independence in 1968.

Having found that the decolonisation of Mauritius was not conducted in a manner that was consistent with the right of self-determination, the Court concludes that it follows that the United Kingdom's continued administration of the Chagos Archipelago constitutes a wrongful act entailing the international responsibility of that State. In accordance with the situation, the United Kingdom is under an obligation to bring an end to its administration of the Chagos Archipelago as rapidly as possible, thereby enabling the complete decolonisation of Mauritius and its territory in a manner that is consistent with the right of peoples to self-determination.

In regards to the aspect of the resettlement on the Chagoes Archipelago of Mauritian nationals, including those of Chagossain origin, this issue is considered to be relating to the protection of the human rights of those concerned, which needs to be addressed by the General Assembly during the completion of the decolonization of Mauritius.

To sum up and offer a response to the second question relating the consequences under international law that arise from the continued administration by the United Kingdom of the Chagos Archipelago, the Court concludes that the U.K has an obligation to bring to an end its administration of the Chagos Archipelago as rapidly as possible, and that all Member states must co-operate with the United Nations to complete the decolonization of Mauritius.

5.Conclusion

In conclusion, I want to pin point out some important aspects that are better developed in the paper, which will share some insight on the topic.

From my point of view, this case was of particular relevance to the topic because it involves a right that was seen by many to have been crystallized a very long time ago. Even though there are fewer and fewer cases in regards to this topic, it seems that there are still some examples that have their roots in the beginning of the United Nations. This case shows how, even if the right of self-determination has been acknowledged in multiple occasions in the past decades, it still needs to be not only developed, but protected in order for such an event not to happen again. Moreover, this case shows how an administering power, even if presented with several occasions and requirements to cease its

governance over the territory and the people living on it, refuses to do so and also seeks to not respect an international legislation procured by the international institution, from which it is a part of.

Another interesting factor is that even though there was an understanding of a long going bilateral dispute, which was previously searched in other cases, the matter still is analysed as an issue of self-determination and also human rights. The applicable law and time frame are two other important elements that rose from this case as particular because the question was posed to General Assembly resolutions that were prior to independence. Furthermore, probably the most important element regarding this research was the fact that the consent was given under duress.

Through the findings, it is clear that Mauritius had little to no chance in achieving its full independence, with the Chagos Archipelago, and thus accepted the terms presented to it. The problem of the unlawful removal of the people of the Chagos Archipelago and in particular those of Chagossian origin is another peculiar aspect in this case. Moreover, this case is of upmost importance it was the first time when such a continued administration of a territory in seized in the present day. This cases, offers a new pillar in the construction of self–determination as a true *erga omnes* right. The echoes of this case will still be present in the coming years, as it shows the fact that it doesn't matter which state you are, the right of self-determination of peoples must be respected and conducted accordingly.

In conclusion, after addressing all this issues and having in mind all the findings, the Court offered their advisory opinion and in doing so concluded that the process of decolonization was not lawfully completed and that the United Kingdom must bring its continued administration to an end as rapidly as possible. So what is the relevance of the case in regards to self-determination, decolonization and territorial integrity? For starters the fact that it depicts a continuous unlawful administration of a territory for more than over 50 years is an intriguing factor when almost every case regarding self-determination were either resolved by the time of the implementation of the United Nation resolutions or in the years that follow.

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Research on consumer spending in Romania

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Abstract. This article proposes the research of the consumption expenditures in Romania in relation to the income. Thus, with the help of the data provided by the national bases, respectively the National Institute of Statistics on the evolution of the total consumption expenses, of the food expenses and the evolution of the incomes, it was possible to determine the influence that they have on the consumption, respectively the expenses. By making two simple linear regression models it was possible to determine the equation of the function in which both total consumption expenditure and consumption food expenditure could be expressed according to the level of income.

Keywords. *Consumer spending, food consumption, income, Romania*

Introduction

Food consumption is an essential determinant of the nutritional adequacy and general health of a country's population. A healthy population provides human capital and productive workforce essential for fueling growth and productivity. Currently, about one-eighth of the world's population suffers from hunger, most of the hungry people living in poor countries where poor public health related to food deficiency is one of the main obstacles to economic growth. Although food expenditure in poor countries represents most of the total consumption expenditure, food intake is insufficient and is aggravated by the disappearance of food access between different socio-economic groups.[1]

Increasing the diversity of food consumption in certain geographical areas has important implications for the world and regional trade in agri-food products and for the development of the economy in general. [2]

Food products have always been an important component of Romania's social and economic good. Major changes induced by the process of transition from an order to a more market-oriented economy have given greater importance to food policy. The dramatic increase in food prices and the decrease in real incomes for most of the population had major consequences on the importance assumed by food in household consumption expenditure. [3]

Compared to other European countries, the current level of consumption of different categories of food, such as dairy products, meat products, bakery products, processed fruits and vegetables, fish products, seafood, processed potatoes is quite limited in Romania. However, the purchasing power is increasing in the current period, as well as the increase in consumption registered in Romania, it is also expected to see an increase in the purchase of all types of food. [5]

Material and method

This paper aims at a socio-economic analysis of consumer spending in Romania, with an emphasis on food. For this, in the first part of the paper, with the help of the statistical data taken from the national databases (National Institute of Statistics), a quantitative and qualitative analysis of certain indicators will be performed, such as: total consumption expenses, food expenses, total income obtained by to a household and the number of members of a household. In the second part of the paper we will try to determine the reciprocal influences between these indicators, thus, also with the same data, we will analyze from a statistical point of view the relations of interdependence between this variable, with the help of the correlation coefficient and with the help of the simple linear regression model.

Results and discussions

Considering the objective of this paper, respectively, to study consumer spending in Romania, especially those related to food, an analysis of the statistical data on their evolution will be carried out in the first part of these sections.

Before analyzing the consumption food expenditures, it is proposed to study the total consumption expenditures in Romania in order to be able to create an overview on this aspect.

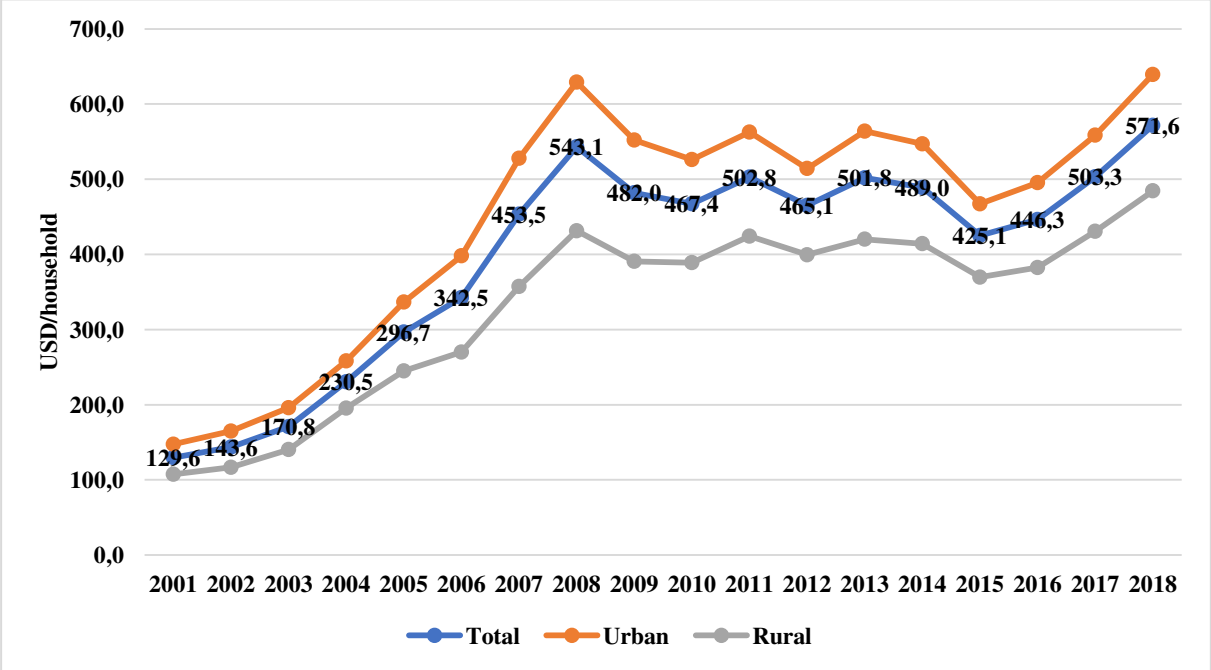


Figure 1. The evolution of the total consumption expenditure in Romania by residence area
Source: own processing based on NIS data, http://statistici.insse.ro:8077/tempo-online/

Figure 1 shows the evolution of the total consumption expenditure in Romania at national level and by residence area, between 2001-2018. As you can see, there is an overall growth. If, in 2001, the consumption expenditures on a household were about 130 dollars, they increased until the year of Romania's accession to the EU (2007) constantly every year, reaching 543 dollars per household, in the following period they fluctuated from year to year, and in 2018 the total consumption expenditures in Romania reached about 572 dollars. The average annual growth rate of 9.12% is recorded throughout the period. On average, there is a total national consumption value of $ 398 per household. As can be seen, also in figure 1, analyzing according to the area of residence, both urban and rural expenditures follow the same trend, but at different levels, urban expenditure is higher than the national average, and from rural being below the national average. On average, in the urban area, more is spent by 12.8%, and in the rural area, it is spent by 16.7% less than the national average.

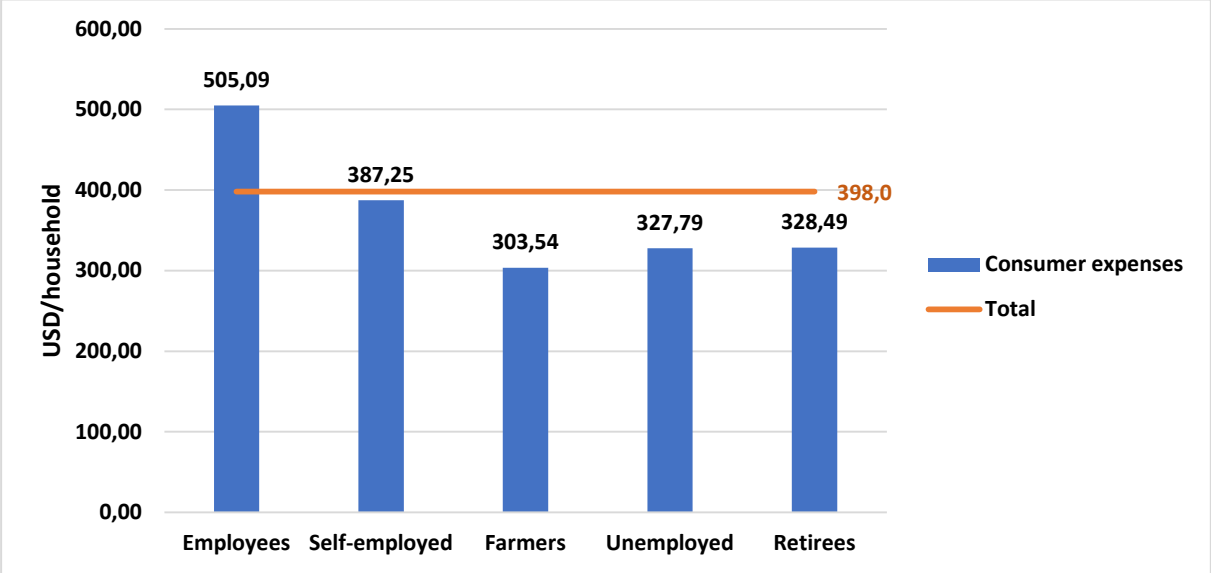
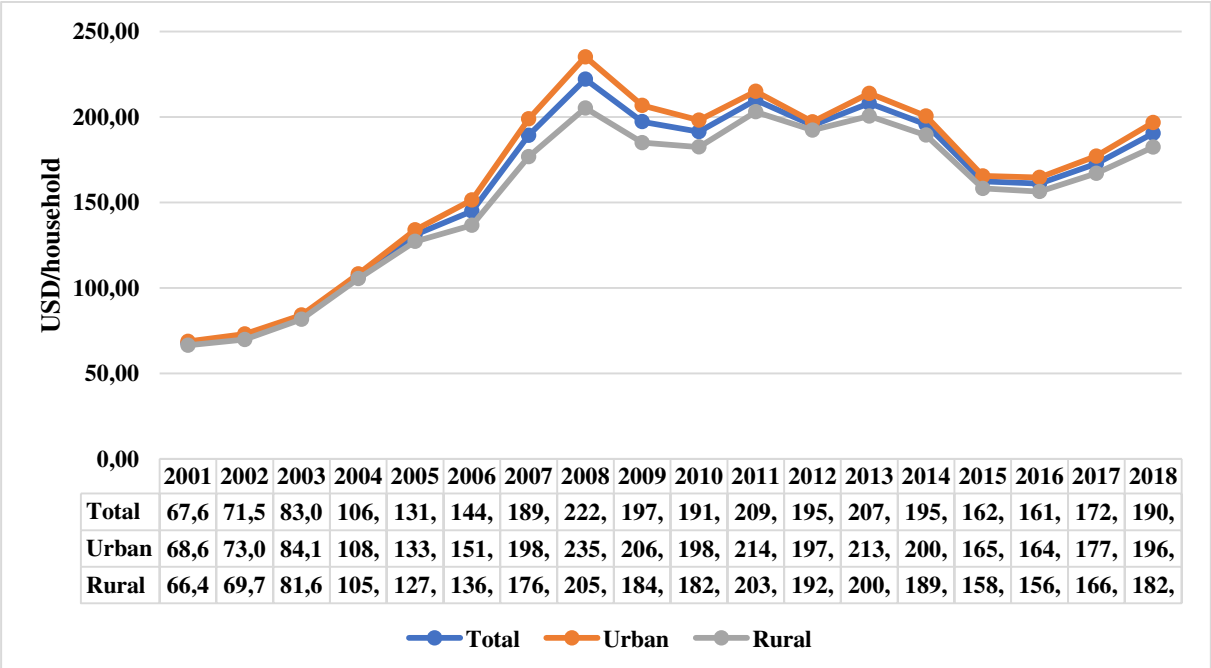


Figure 2. Average total consumption expenditures according to occupational status
Source: own processing based on NIS data, http://statistici.insse.ro:8077/tempo-online/

Figure 2 shows the levels of consumption expenditures, compared to the national average, according to the employment status. Thus, as can be seen the only status that exceeds the national average is that of the employees, they spend on average, between 2001 and 2018 about $ 505, being above the average by 26.9%. The total consumption expenditures of self-employed workers are below the average of 387 dollars (by 2.71%), those of agriculture are the lowest being about 304 dollars (below the average with 23.7%), those of the unemployed being $ 328 (below average 17.65%), and those of pensioners being $ 328.5, being lower than the national average by 17.5%.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total	67,6	71,5	83,0	106,	131,	144,	189,	222,	197,	191,	209,	195,	207,	195,	162,	161,	172,	190,
Urban	68,6	73,0	84,1	108,	133,	151,	198,	235,	206,	198,	214,	197,	213,	200,	165,	164,	177,	196,
Rural	66,4	69,7	81,6	105,	127,	136,	176,	205,	184,	182,	203,	192,	200,	189,	158,	156,	166,	182,

Figure 3. Evolution of consumption food expenses in Romania by residence area
Source: own processing based on NIS data, http://statistici.insse.ro:8077/tempo-online/

Figure 3 shows the evolution of consumption food expenditures in Romania, at national level and by residence area, thus their tendency is similar to that of total expenditure, thus, if in 2001 there was an expenditure with food of $ 68 per household , in 2008 it reached the maximum of $ 222 per household this period of time being known as an economic ascent in conjunction with Romania's entry into the EU, which opened the market more and more. In 2018, there is a level of food expenses per household of $ 190. Thus, during the period there is an average growth rate of 6.27% per year, and an average value of food expenses of $ 161 per household. Similarly, food expenditure in the urban area is higher (by 3%) and those in the rural area are lower by 4%.

Realizing the ratio between food and total expenses, it can be appreciated that, on average, during the analysis period, food expenses represent about 40.5% of the total. A surprising situation can be seen in the weighting according to the residence areas, in the urban area the share of food expenses is 37%, and in the rural area the weight is 46.7%, surprising considering that the population from the rural area could to self-insure the consumption of some foods, but considering the low level of other categories of expenses (the total expenditures in the countryside being of 332 dollars) the weight of the food becomes significant.

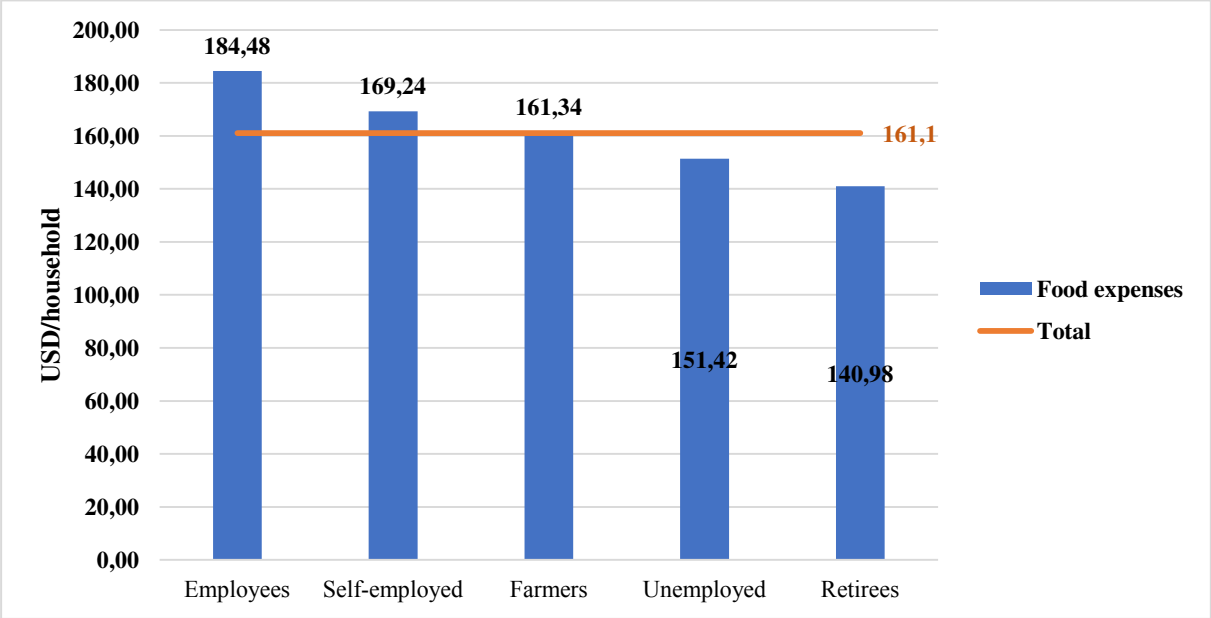
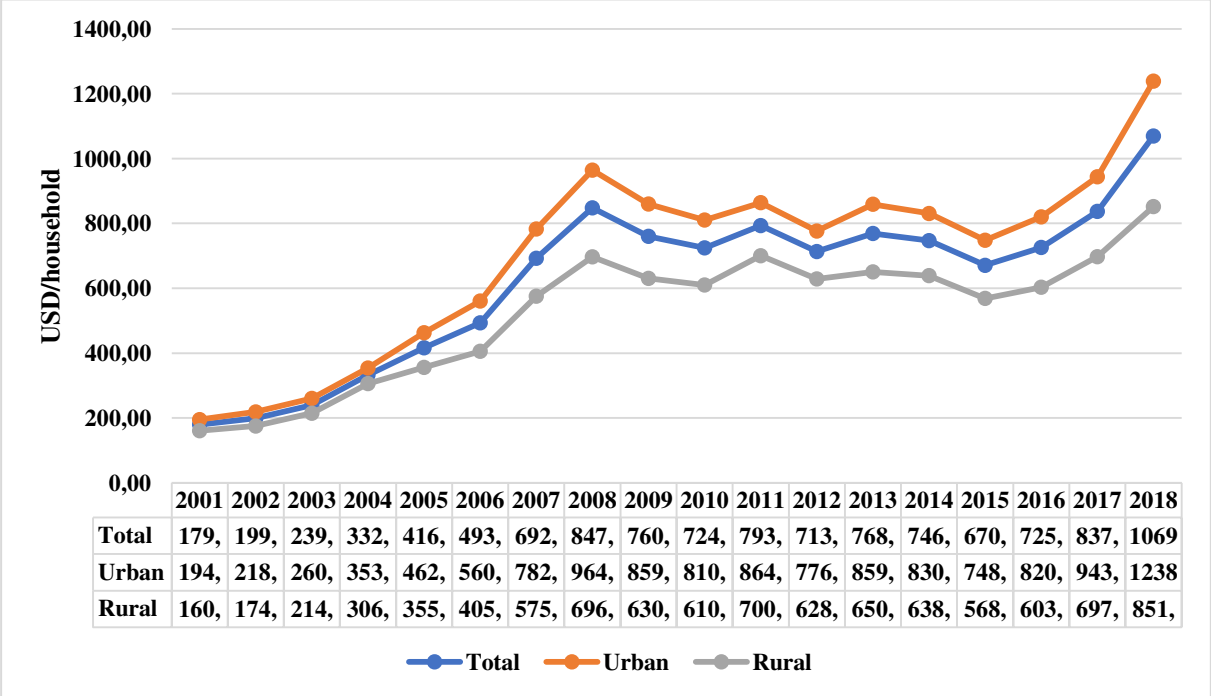


Figure 4. Average food consumption expenditures according to occupational status
Source: own processing based on NIS data, http://statistici.insse.ro:8077/tempo-online/

Figure 4 shows the average value over the entire period taken into consideration of the food expenses according to the occupational status, thus, the group of employees assigns on average $ 184.5 per household, being the highest value, above the national average with 14.5%. The second place is the self-employed workers who spend about $ 169 a month on food for the household, being above 5% on average, and very close to the average are the farmers whose food expenses are only $ 161.34. 0.15% more than the national average. Below average are unemployed people who have a level of food expenses of $ 151 (6% below average) and pensioners with $ 141, respectively 12.5% below average.

In order to be able to analyze the dynamics of consumer spending, it is further proposed to analyze the incomes obtained by a household.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total	179,	199,	239,	332,	416,	493,	692,	847,	760,	724,	793,	713,	768,	746,	670,	725,	837,	1069
Urban	194,	218,	260,	353,	462,	560,	782,	964,	859,	810,	864,	776,	859,	830,	748,	820,	943,	1238
Rural	160,	174,	214,	306,	355,	405,	575,	696,	630,	610,	700,	628,	650,	638,	568,	603,	697,	851,

Figure 5. Evolution of total household income in Romania by residence area
Source: own processing based on NIS data, http://statistici.insse.ro:8077/tempo-online/

In figure 5 it is proposed to analyze the evolution of the total income in a similar way to the one of the expenses, thus, we can observe a very similar trend, of growth, starting from a value of about $ 180 per household, reaching 848 dollars in 2008 and to the maximum recorded in the last year, of 1070 dollars. On average there is an annual growth rate of 11% and an average value of income of $ 622.8 per household, being higher than that of expenses (with about $ 225). Similarly, the value of urban incomes is higher than the average, with 11.9%, and the rural income is lower than the average, with 15.5%.

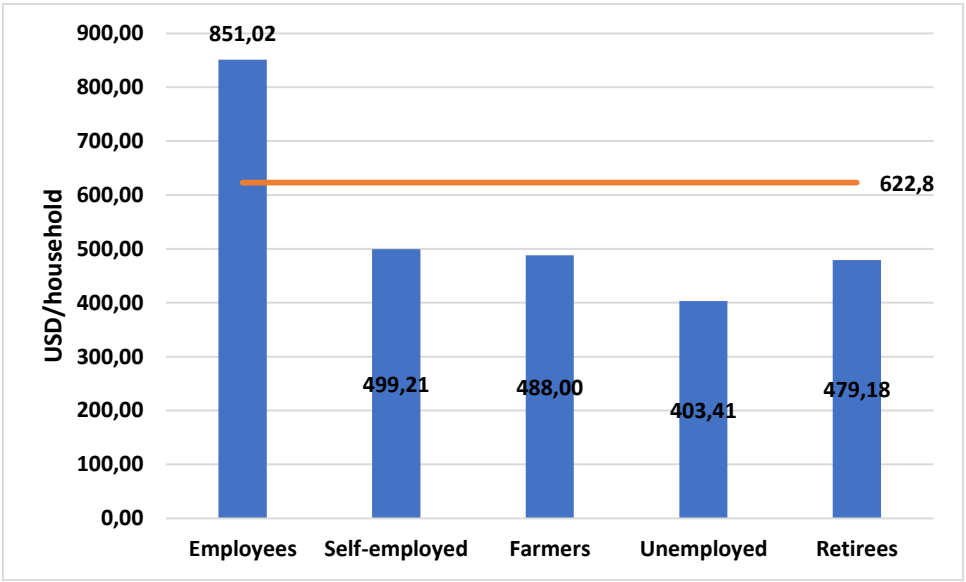
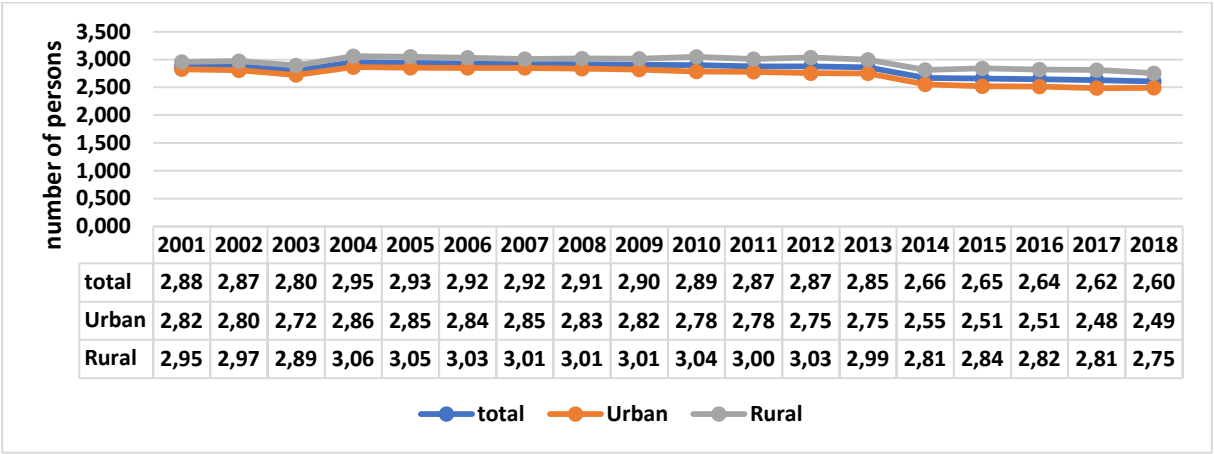


Figure 6. Total average income according to occupational status
Source: own processing based on NIS data, http://statistici.insse.ro:8077/tempo-online/

Analyzing according to the occupational status, only employees (as in the case of expenses) register a value higher than the national average, being 851 dollars, respectively 36.6% higher. Self-employed workers have a total income of $ 500, with an average of 19.85%. Farmers earn $ 488 (below average 21.65%), unemployed people also average $ 403 (below average 35.23%), and retirees record income around 479. dollars, being below the average by 23%.

It is considered appropriate in this research and the analysis of the number of household members, thus proposing a similar analysis of this indicator.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
total	2,88	2,87	2,80	2,95	2,93	2,92	2,92	2,91	2,90	2,89	2,87	2,87	2,85	2,66	2,65	2,64	2,62	2,60
Urban	2,82	2,80	2,72	2,86	2,85	2,84	2,85	2,83	2,82	2,78	2,78	2,75	2,75	2,55	2,51	2,51	2,48	2,49
Rural	2,95	2,97	2,89	3,06	3,05	3,03	3,01	3,01	3,01	3,04	3,00	3,03	2,99	2,81	2,84	2,82	2,81	2,75

Figure 7. Evolution of the number of members of a household by residence area
Source: own processing based on NIS data, http://statistici.insse.ro:8077/tempo-online/

From figure 7 it can be seen that the number of members, regardless of whether it is the national one or the members of the residence, registered a similar tendency, respectively slightly decreasing. Thus, if in 2001 a household comprised about 2.88 members, 18 years later, the average household comprised 2.6 members with a decrease of 9.7%, with an average annual rate of -0.59%. Different from the situation presented so far is that, the largest number of members per household is in the rural area, on average 2.95 persons (4.5% more), and in the urban area a household has, on average, 2,725 members, 3.5% less than the national average (of 2.82 members per household).

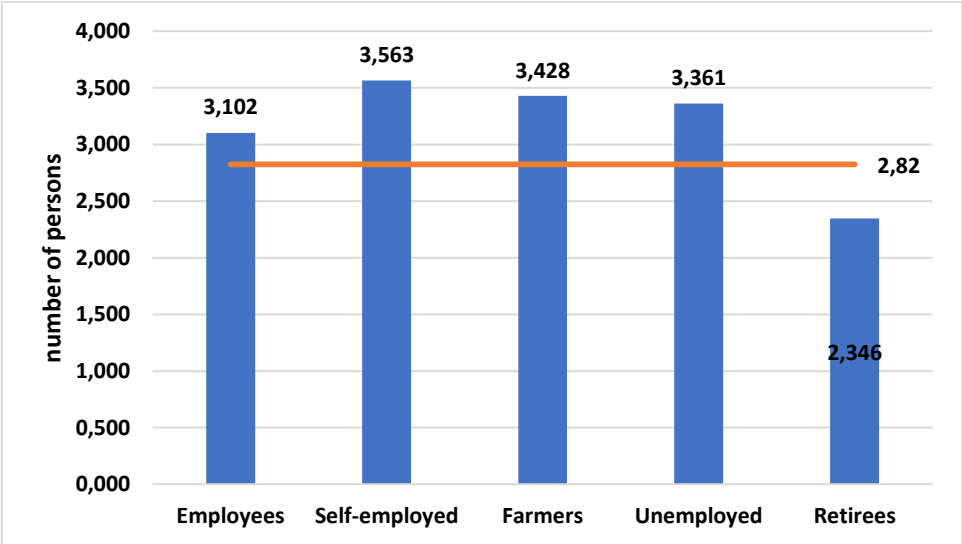


Figure 8. Average number of members according to occupational status
Source: own processing based on NIS data, http://statistici.insse.ro:8077/tempo-online/

Regarding the number of members of the household according to the occupational status, as can be seen in figure 8, most occupations have households with more members than the national average, apart from the category of pensioners who are on average about 2.35 per household. with about 17% below average.

In order to be able to determine the influences between these analyzed indicators, it is further proposed to determine the correlation coefficient (Pearson) in order to be able to determine the level of the links between these variables.

Tabelul 1. Determination of correlation coefficient between variables

		Total_expenses	Total_Food_Expenses	Total_income	No.Members
Total_expenses	Pearson Correlation	1	.968**	.986**	-.361
	Sig. (2-tailed)		.000	.000	.141
	N	18	18	18	18
Total_Food_Expenses	Pearson Correlation	.968**	1	.919**	-.153
	Sig. (2-tailed)	.000		.000	.543
	N	18	18	18	18
Total_income	Pearson Correlation	.986**	.919**	1	-.451
	Sig. (2-tailed)	.000	.000		.060
	N	18	18	18	18
No.Members	Pearson Correlation	-.361	-.153	-.451	1
	Sig. (2-tailed)	.141	.543	.060	
	N	18	18	18	18

**. Correlation is significant at the 0.01 level (2-tailed).

Source: own calculations using SPSS

Analyzing the correlation coefficients it can be observed that between the total expenditures, the food and the income, there are very close relationships, with correlation coefficients being registered between 0.919 and 0.986, thus it can be seen that these relations are strong.

On the other hand, it is surprising that the number of members of a household is not correlated with any of the indicators mentioned above, with very high values of the indicator Sig (signifiance), and negative correlation coefficients, so when the number of members decreases, income and / or expenses increase, which is very unlikely.

Thus, following the determination of the correlation coefficients, it is proposed to determine the equations by simple linear regression analysis for 2 models, respectively between total consumption expenditures and total incomes, and the second model between consumption food expenditures and total incomes.

Tabelul 2. The simple linear regression model between Total Expenses and Total Income

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.986[a]	.972	.970	24.59353

a. Predictors: (Constant), Total_income

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	51.687	15.817		3.268	.005	18.155	85.218
	Total_income	.556	.024	.986	23.534	.000	.506	.606

a. Dependent Variable: Total_expenses

Source: own calculations using SPSS

By developing the first statistical model in the SPSS program, one can observe a directly dependency relation between the total expenses and the total income, registering a correlation coefficient (R) of 0.986 and a coefficient of determination of 0.972 (thus the variables are explained in proportion of 97%). Also the statistical model is valid, the Sig value being lower than the 0.05 threshold, and the confidence interval does not contain the null value.

By creating the model it was possible to determine the equation that explains the dependence between total consumption expenditures (dependent variable) and total income (independent variable)

Total_expenses = 0,556 * Total_income + 51,687

Thus, when the total household income increases by one unit ($ 1), the total consumption expenditure per household increases by 0.556 units ($ 0.556).

Tabelul 3. The simple linear regression model between Food expenditure and Total income

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.919[a]	.845	.836	20.05585

a. Predictors: (Constant), Total_income

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	48.939	12.899		3.794	.002	21.595	76.284
	Total_income	.180	.019	.919	9.346	.000	.139	.221

a. Dependent Variable: Total_Food_Expenses

Source: own calculations using SPSS

Similarly, analyzing the linear regression between the dependent variable (consumption food expenditures) and the same independent variable (total income), we note a correlation coefficient of 0.919 which denotes a strong relationship between variables and a coefficient of determination of 0.845 which means that the variables dependents are explained in proportion of 84.5%. The value of Sig being less than 0.05, and the confidence interval not having reached the figure 0 can be considered that this model is significant (valid).

Thus, it was possible to determine the equation of the right, respectively to determine the consumption food expenses according to the total income.

Total_Food_Expenses = 0,18 * Total_income + 48,939

It can be appreciated that, when the income increases by one unit (1 dollar), the consumption expenses of a household increase by 0.18 units, respectively by $ 0.18, in this case.

Conclusions

In this paper, we wanted to analyze the consumption expenses, both of the total ones, but especially of the food expenses in Romania. In the last 18 years, consumer spending has increased considerably, especially in the first part of the period, respectively until Romania's accession to the European Union, and in the last period, they have fluctuated, but also with an increasing tendency.

Analyzing the consumption food expenditures, they followed a similar trend with the total consumption expenditures, the first ones having a share of, on average, 40.5% of the total ones. Increasing expenditures, both total and food, can be attributed to the increase of the quantities purchased, the increase of prices (or inflation), the change of the way of life or the increase of the incomes.

Of these alleged reasons that could lead to the evolution of consumer spending, considering that the demographic development could not be a reason, simply because the population of Romania is declining, but also by the present analysis which shows that the average number of households is decreasing, it was considered appropriate to analyze the evolution of average incomes per household.

This indicator has registered trends similar to those of consumer spending, but with a faster average annual rate, thus the level of incomes being higher than that of expenses.

Both the level of expenditures (either total or food), as well as the level of incomes were higher in the urban area (by 3-12%) than the national average, and in the rural area they were lower by 4-16% than the average per the country.

By analyzing the correlation coefficients, it was possible to determine 2 statistically viable models, linear regression models, which could analyze the total consumption and food expenses according to the total income. Thus, when the total average income per household increases by one-unit, total expenditures increased by 0.556 units, and food expenses increased by 0.18 units.

Both from this analysis and from the table of correlation coefficients it can be observed that the influence of external factors on food expenditure is small, considering that from the budget allocated to expenditure, per household, the category of food is the most constant, according to the theory of the agri-food economy. .

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Considerations regarding drug interactions at smokers

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Abstract. This paper presents the way in which it can affect cigarette smoke, through its chemical composition, the action of a drug and its therapeutic efficacy in the treatment of smokers patients. This interaction can reduce the effect of drugs, the result of drug therapy can undergo severe changes in smokers. The most clinically important drug interactions with smoking may be depending on their effect: pharmacokinetic, pharmacodynamic, and carrier interactions. Since tobacco use is the most important health risk, which can be avoided, drug-drug interactions are identified. an important responsibility and task of the doctor and pharmacist.
Keywords: *drug interactions, cigarette smoke, smoker, nicotine*

Introduction

Smoking is one of the most harmful habits of the population, almost a widespread practice nowadays, which does not find any basis in any necessity and whose extension can hardly be explained historically, psychologically and afterwards. criteria. This defect is the most important cause of premature death in the European Union, causing annually the death of over 700.000 people, the death occurring in most cases about 14 years earlier.

The onset of smoking occurs in a significant proportion of cases in people who ignore or underestimate the effects of smoking. Psychological studies have highlighted regarding the initiation of smoking the role of the tendency to assert personality, especially in the periods when the individual poses such problems, ie at puberty. and adolescent.

In cigarette smoke there are over 4000 substances, over 65 of them being cancerous, among the most important being nicotine, polycyclic aromatic hydrocarbons, carbon oxide, acetaldehyde, acetonitrile, hydrocyanic acid, ammonia, amines, nitrosamines, aldehydes, ketones, alcohols, phenols, metals. Thus, smoking can affect both the pharmacokinetics and pharmacodynamics of drugs in therapeutic doses in the case of smokers having to be adjusted.

Tobacco use is most often associated with various forms of cancer, cardiovascular and respiratory diseases in a higher percentage than problems with alcohol, drugs, hypertension, excess weight or high cholesterol. The enzymes that tobacco smoke induces can increase the risk of cancer by increasing the metabolic activation of carcinogens.

By adopting the public health policies of the last years, the law that prohibited smoking in closed public spaces, determined the important jump of Romania from 12 positions, from the 19th place to the 7th place, in the European classification of tobacco control policies - European Scale Tobacco Control. The direct effects of this policy have reduced the number of hospitalizations associated with diseases exacerbated by passive smoking [1,2].

Drug interactions

Mortality among male and female smokers in the United States is approximately three times higher than among similar people who have never smoked.

Smoking reduces life expectancy and decreases longevity. The life expectancy of smokers is reduced in relation to the number of cigarettes smoked, so that the early cessation of smoking and the long duration of practice will reduce longevity proportionately.

The negative effects of tobacco continue for a long time approximately 10 years and after quitting smoking (fig. 1).

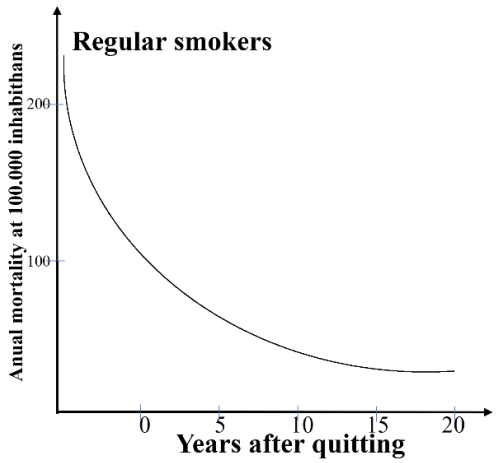

Fig.1 The evolution of mortality in former smokers

In the case of chronic smokers 90-98% of the inhaled nicotine is retained in the lungs and constitutes together with the tar resulting from burning, one of the main causes of lung cancer growth. In the table 1 is presented the affected organ or system and the type of disease.

Table1. The affected organ or system and the type of disease.

The affected organ or system	***Type of Disease***
Respiratory system	lung cancer, laryngeal cancer, reduced respiratory capacity, pneumonia, chronic bronchitis, pulmonary embolism, asthma
Cardiovascular device	tachycardia, cardiac arrhythmia, HTA, poor blood flow, heart attack, angor pectoris, arteritis, phlebitis
Brain and Nervous System	cerebral embolism
ORL	laryngitis, pharyngitis, sinusitis, respiratory allergy, esophageal cancer, neck cancer
Digestive system	tongue cancer, gastric cancer, gingivitis, digestive enzymes destruction, stomach hyperacidity, gastritis, duodenal ulcer, stomach ulcer, colon cancer
Excretory system	kidney cancer, bladder cancer, prostate cancer

In the case of drug administration in smokers there can be two types of interactions: pharmacodynamics and pharmacokinetics, the latter having consequences on the absorption, distribution, metabolization and elimination of drugs [3].

Pharmacodynamic interactions are mainly caused by the effects of nicotine, a major component of cigarette smoke. It enters the body by digestive, respiratory and skin pathways.

Once penetrated into the body, it is rapidly distributed in the blood, and may also cross the blood-brain barrier. In the table 2 is presented the nicotine content in the different sources.

Table 2. The nicotine content in the different sources

Source	Nicotine content (mg)
Cigarette	13-32
cigar	15-40
Fag-end	5-7
1 nicotine nasal spray	0.5
1 gram of snuff	12-16
1 nicotine patch	8.3-11

The metabolism of nicotine occurs in the liver (about 80-90%). Elimination occurs mainly by the renal route, but can be eliminated mainly by lungs, sweating, milk, saliva, about 10-20% is eliminated as such, the rest in the form of metabolites (cotinine, as such or hydroxylated). Acidic urine accelerates the elimination, in the case of alkaline urine a resorption occurs in the kidney. It acts at the level of central cholinergic receptors only 7 seconds after inhalation, positively influencing adrenaline activity.

Nicotine, alpha 3 pyridyl-N-methylpyrrolidine, is a toxic pyrrolidinic alkaloid, a characteristic tobacco substance, which imprints both a series of physical properties (color, odor) and a dominant part of the harmful one, being present in tobacco in proportion of 0.7-3.5% [2,3].

Nicotine produces addiction 6-8 times higher than alcohol, but as high as cocaine. 95-100% of smokers are addicted. Nicotine, regardless of the route of administration, enters the body through diffusion, inhaled smoke reaches the pulmonary alveoli and all constituents are absorbed. 80% of nicotine is destroyed in the liver, the remaining 20% is fixed on nicotinic receptors through which it exerts its multiple effects. In order to measure nicotine dependence the Fagerstrom test is used this test has the advantage that it shows an exact correlation between the test answers and the determinations of plasma and urinary cotinine.

At high doses nicotine is a depolarizing agent of nicotinic receptors. In addition, it results in increased dopamine levels in the brain, due to the inhibition of MAO (monoamine oxidase) responsible for dopamine metabolism. However, it is uncertain whether this action can be attributed to nicotine or other components of cigarette smoke (carcinogenic hydrocarbons). This action on dopamine is similar to that of cocaine and heroin, which is why people smoke: maintaining a high level of dopamine, which causes a feeling of pleasure. Nicotine and its metabolites have been studied for the treatment of diseases such as: Alzheimer's disease, Parkinson's disease. Current research has shown that nicotine alone cannot develop cancer, it does not have mutagenic properties but by increasing the activity of acetylcholine, it leads to blocking apoptosis (programmed death) by which the body destroys certain types of cells, death or mutants, thus developing in cancer cells [4].

Nicotine acts on the sympathetic and parasympathetic vegetative ganglia. Central mechanisms of sympathetic stimulation include activation of chemoreceptors and direct effects on the brainstem and spinal cord. Peripheral mechanisms involve the release of catecholamines from the adrenal glands and vascular nerve endings. These effects are associated with increased levels of circulating catecholamines and, consequently, increased heart rate and blood pressure after smoking. Nicotine also causes coronary and cutaneous vasoconstriction.

In animal studies, nicotine induces the activity of several enzymes, including CYP2E1, CYP2A1/2A2 and CYP2B1/2B2, in the brain, but this effect is not clinically known. It also induces

CYP2A1/2A2 in the brainstem and hippocampus and causes inhibition of CYP2A1/2A2 in the cortex and thalamus. Nicotine is metabolized in the liver by CYP2A6.

The polycyclic aromatic hydrocarbons result from the incomplete combustion of all the organic substances in the cigarette being numerous and varied.

Polycyclic aromatic hydrocarbons in cigarette smoke are responsible for the induction of cytochrome P450 (CYP) 1A1, CYP1A2 and possibly CYP2E1, CYP1A1, primarily an extrahepatic enzyme found in the lungs and placenta. The transcription factor, the Aryl hydrocarbon receptor, is activated by a ligand, which regulates the transcription of a wide range of genes, including those responsible for the activity of some enzymes involved in xenobiotic metabolism. These receptors are activated by polynuclear aromatic hydrocarbons, dioxins.

Carbon monoxide inhibits CYP enzymes also selectively inhibits CYP2D6 activity, but does not influence CYP2C and CYP3A activity. The most common effect of smoking on the elimination of drugs in humans is the increase of the rate of biotransformation, in accordance with the induction of drug metabolizing enzymes. [5].

Pharmacodynamic interactions

In the case of benzodiazepines, smoking decreases the hypnotic and sedative activity, the possible cause being the stimulation of the CNS by nicotine. When smoking cessation the dose should be reduced by 25% after one week, the possible cause being the increase in plasma levels. In the case of beta-blockers, smoking decreases the antihypertensive and anti-arrhythmic efficacy, the cause being the nice activation due to nicotine. In case of smoking cessation bradycardia and hTA occur, the dose will have to be low. The efficacy of inhaled corticosteroids may be reduced in patients with asthma who smoke. The pulmonary clearance of corticosteroids can be altered by increased airway secretions and permeability. In the case of oral contraceptives, smoking increases the risk of cardiovascular accidents for myocardial infarction, thromboembolism. Oral contraceptives are prescribed to women who smoke more than 15 cigarettes a day. At the same time, in the case of opioid analgesics, smoking decreases the analgesic effect, the doses should be increased in the case of smokers and the cessation of smoking will lead to acute respiratory depression. [5,6]

Pharmacokinetic interactions

As for caffeine, smoking increases the hepatic clearance by 60-70%. If stopped smoking increases the blood level of caffeine which will lead to severe tremor thus reducing the intake of caffeine by 50% from food sources. The effect of anticoagulants is decreased by increasing the metabolism that is influenced by smoking, so in smokers the dose of anticoagulant should be increased for the desired effect. Smoking will gradually stop because abrupt discontinuation leads to an increase in INR with a very high risk of bleeding. In the case of warfarin, the dose should be reduced by 14-23%, after careful monitoring of the INR. Nicotine through pharmacokinetic mechanism and having vasoconstrictive effect, decreases insulin uptake, and through pharmacodynamic mechanism may increase insulin resistance, thus smokers need to increase the dose in order to have a blood glucose between optimal values. In case of smoking cessation, hypoglycaemic seizures may occur, thus monitoring the blood sugar level and decreasing the dose. Theophylline is effected by smoking by increasing metabolism, increasing clearance by 58-100%, decreasing t1/2 by 63% and increasing volume distribution by 31%. The dose of theophylline should be increased to achieve the desired therapeutic effect. In case of smoking cessation the plasma levels increase (palpitations, nausea), the dose should be decreased (by 25-33%). Smoking can affect antipsychotic medication, in the case of clozapine the plasma level drops by 18%, in the case of olanzapine the plasma level decreases by 12% and the plasma level in the case of haloperidol - decreasing by 70%. Antipsychotic doses should be increased in order to have the expected effect. Cessation of smoking results in an increase in plasma level by 72% in the case of clozapine, an increase in t1 / 2 by 21% in olanzapine and an increase in plasma level by 23% in the case of haloperidol. Doses should be reduced after careful monitoring [2,4,6]. Plasma levels of tricyclic antidepressants (amitriptyline, imipramine, nortriptyline, clomipramine) decrease in smokers,

so the therapeutic dose should be increased. Stopping smoking leads to increased plasma levels, the dose should be decreased by 10-15% after one week.

Conclusions

There are proven connections and interactions in the administration of drugs associated with tobacco use. These are pharmacokinetic and pharmacodynamic in nature and may affect the therapeutic action of the drug and also the patient's health. Thus the smoker must take these aspects into account. Therefore, smokers who undergo drug treatment with a drug that interacts with smoking may require higher doses than non-smokers. And conversely, when smoking cessation, smokers may require a dose reduction of a drug that interacts with smoking. Dose adjustment for smokers and those who quit smoking should be discussed with the doctor and pharmacist for the best health status of the smoker.

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Hydroxyapatite - antibiotic applications in bone therapy

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Abstract. The aim of the current study is to prevent and reduce the number of bacterial infections in surgical implantation procedures. The hydroxyapatite is a calcium phosphate ceramic with important applications in the medicine and chemistry fields. The hydroxyapatite is a main mineral constituent of the hard tissues such as bones and teeth. The hydroxyapatite has remarkable properties including biocompatibility, bioactivity and ability to form a direct chemical bond with human hard tissues. Over the last decades, the biomedical orthopaedic and dentistry sectors have witnessed an unprecedented demand for a large variety and number of scaffolds, grafts, implants, and endo-prostheses. The increase in life expectancy, and the higher frequency of injuries and diseases are regarded as the main factors for this growing demand in orthopaedic and dental devices. The quality of life for millions of people has been drastically improved by using hydroxyapatite for bone repair and tissue regeneration. Recent findings in the realm of ion-substituted hydroxyapatite (HA) could pave the road towards significant developments in biomedicine, with an emphasis on a new generation of orthopaedic and dentistry applications, since such bioceramics are able to mimic the structural, compositional and mechanical properties of the bone mineral phase.

Keywords: *hydroxyapatite-antibiotic, nanocomposite, physicochemical characterization*

Introduction

Currently, there is an increased interest in tissue engineering and regenerative therapies, given the increased number of patients with different trauma or musculoskeletal disorders, correlated with increased life expectancy. Moreover, the need to speed up the process of healing bone fractures and to treat the various fractures has led to the consideration of a variety of drugs that determine the regeneration of bone tissue, in combination with tissue engineering; these include bisphosphonates. Reconstructive surgery is presently struggling with the problem of infections located within implantation biomaterials. Of course, the best antibacterial protection is antibiotic therapy. However, oral antibiotic therapy is sometimes ineffective, while administering an antibiotic at the location of infection is often associated with an unfavourable ratio of dosage efficiency and toxic effect [1].

Orthopedic surgery and trauma can cause infections. These complications occur only in 5% of cases, but the treatment is complicated due to the formation of the bacterial biofilm and the limited access of the drug to the level of the infected area in case of its systemic administration. Chronic osteomyelitis is a chronic inflammatory disorder, induced by a bone infection. This can affect a single portion of the bone or multiple areas such as bone marrow, compact bone tissue, periosteum or other adjacent tissues. Despite the new medical or surgical discoveries, this has remained a challenge as it

can persist for weeks, months or even years, requiring extended and complex management in terms of the nature of the surgery and the treatment with antibiotics needed. The standard surgical procedure involves removal of infected bone and soft tissue, a procedure described in the literature as "debridement", followed by antibiotic-based therapy administered systemically, orally or intravenously over an extended period (at least 4 or 6 weeks) with the possibility adverse effects and also the need to extend the length of hospitalization. Thus, the local treatment of bone infections became intensely studied. Reducing infections associated with implants plays an essential role in orthopedic surgery, as more and more people require implants (up to 200,000 per year in the United States (source: Joint Implant Surgery & Research Foundation 2010). The aim of the current study is to prevent and reduce the number of bacterial infections. Both pre- and postoperative systemic antibiotic treatment and amoxicillin containing bone cement (polymethacrylate, PMMA) are strategies commonly used to overcome infections. Infections remain a critical issue in total joint arthroplasty. The addition of antibiotics to bone cement has been shown to significantly improve antimicrobial prophylaxis in cemented joint arthroplasty. Prophylaxis comparable to local antibiotics was not yet possible in joint arthroplasty without cement. The purpose of the current study is to investigate the antimicrobial effect of two amoxicillin-hydroxyapatite (HA) coatings for cementless prostheses in mice [2-4].

Methods of analysis

Hydroxyapatite can be used as a coating for metal prostheses. Metal endoprosthetics not coated with Hydroxyapatite have good mechanical strength, but are low in osteoconductive and non-absorbable.

It is found both in the natural state (bones, teeth), but it can also be obtained synthetically (physical and mechanical properties alike).

Hydroxyapatite - $Ca_{10}(PO_4)_6(OH)_2$ is part of the calcium phosphate family and is a major constituent of human bones and teeth. Physical Properties: Pure hydroxyapatite is a white substance; natural apatites can have different shades: brown, yellow or green. Fine salt; at high temperatures (>900 degrees Celsius) it can take the crystalline form [5,6].

The pure hydroxyapatite powder was prepared by mixing appropriate amounts of $Ca(OH)_2$(0.1 M) and H_3PO_4(0.1 M) aqueous solutions to achieve predetermined Ca/P atomic ratio of 1.67 [10]. The suspension obtained was aged for 3 h and then filtered and washed with ethanol and triply distilled water. The obtained powder was calcined 1 h at 800 ºC in an electrically heated furnace in order to increase its crystallinity.

Due to its resemblance to natural bone tissues, synthetic hydroxyapatite has already been widely used for various applications, such as implant material or material for coating metal implants. Besides, the bismuth is one of the most investigated elements, being regarded as “the wonder metal” because of its diverse oxidation states. Its behaviour as smart optically active centres in diverse materials has been noticed in the last decades [7-9]. Due to these properties the bismuth compounds have important applications in areas of telecommunication, biomedicine, white light illumination and lasers. Webster et al. reported that the Bi^{3+} would be the best choice of dopant to enhance properties of HA pertinent for bone implant applications. Obtaining bismuth-substituted hydroxyapatite: 100 ml of aqueous solution containing $Bi(NO_3)_3$ $5H_2O$ and $Ca(OH)_2$ (with molar ratio Bi/(Bi + Ca) 0.01 ... 0.20) is mixed with 100 ml aqueous solution of H_3PO_4 0.1 M so that the molar ratio (Ca + Bi)/P 1.67 is present in the solution, the pH-value is kept constant at 10.5 with 1 M NaOH, the resulting precipitate is aged at 60°C for 24 hours under continuous stirring, then the precipitate is separated by vacuum filtration, washed with bidistilled water, dried in an oven at 90° C for 2 hours and calcined in an oven at 800° C for one hour. Hour, finally resulting in 0 nanometric powder. Finally, according to the example of preparation, a nanostructured biomaterial of hydroxyapatite type substituted with bismuth in different proportions, with the following characteristics obtained according to the invention:

- chemical composition: $Ca_{10-x}Bi_x(PO_4)_6(OH)_2$ where $x \leq 2$;
- degree of substitution $Ca^{2+} \leftrightarrow Bi^{3+}$: 0.1 .... 20% (% mass);

- yellow powder, intensity of ass rivers increasing with increasing bismuth concentration in substituted hydroxyapatite;
- crystalline powder, with the hexagonal crystallization system;
- granulation: 35 - 60 nm;
- porosity: 40 - 55%;
- pore size: 1.2 - 2.2 nm;
- the material exhibits an activity of antibacterial inhibition against the baits Escherichia coli and Staphylococcus aureus, the antibacterial inhibition increasing once the concentration of bismuth in the substituted hydroxyapatite increased;
- the material is radioopac, radioopacity increasing once I increase the concentration of bismuth in substituted hydroxyapatite [8-10].

Bismuth (Bi) doped HA was found to be cytocompatible with human osteoblasts [8], but induced certain levels apoptosis of human blood monocyte. Bismuth is normally not found in the human body, but when doping HA with Bi the adherence and differentiation could be enhanced. Bi-HA possesses the ability to induce the formation well-developed bone-like apatite layers after 1 month of immersion insimulated body fluid. Bismuth doping increased the dissolution rate of HA and elicited an antibacterial effect against *S. aureus*and *E. coli*, which makes Bi-HA a pertinent candidate for bone implant applications [8,9]. Excellent mechanical properties, antimicrobial activity against various pathogens, high osteoconductivity and in vitro biocompatibility was revealed. The in vivo investigations demonstrated the osteogenic potential of Bi-HA - polyurethane composite, with the authors advocating for a proper biomimetic microenvironment for bone regeneration with excellent cytocompatibility [5,7,10].

Hydroxyapatite synthesis/polyvinyl alcohol/sodium alginate/amoxicillin nanocomposite 2.5 g sodium alginate was added to 50 mL of water with mixing. Hydroxyapatite nanoparticles coated with polyvinyl alcohol were added to the solution and mixed. 2.5 g amoxicillin was added concomitantly with the solution and stirred for 2 hours. The sample was separated by centrifugation and dried at room temperature. The blocking efficiency of the drug was calculated spectrophotometrically at the wavelength of 231 nm (1):

$$(\%) = [(X - Y) / X] \times 100 \quad (1)$$

where X and Y are the initial and final concentrations of the drug

The efficacy of drug use is calculated using a standard chart for amoxicillin. Amoxicillin is prepared at different concentrations by serial dilution method. Amoxicillin is a penicillin antibiotic that fights bacteria.

Amoxicillin is used to treat many different types of infection caused by bacteria, such as tonsillitis, bronchitis, pneumonia, gonorrhea, and infections of the ear, nose, throat, skin, or urinary tract.

A standard graph is to take the OD at 231 nm. This standard chart is used to calculate the effectiveness of drugs

Drug release: an in vitro study

100 milligram of the sample was added in 100 mL of phosphate buffer saline (PBS) in a glass vial at 37°C at pH = 7.4. The drug release was analyzed for 30 days. The 5 mL sample was withdrawn at constant time intervals. The withdrawn buffer was replaced immediately with 5 mL of fresh PBS medium. Amoxicillin concentration in the collected samples was measured at 231 nm spectrophotometrically [10].

Conclusions

Hydroxyapatite plays a key role in bioceramic and biomaterial composites and is commonly used in reconstruction medicine and dental implantology.

Antibacterial activity of hydroxyapatite was analyzed against Bacillus subtilis, Klebsiella pneumoniae using the agar diffusion method. The antibacterial activity was done by the diffusion method well against Bacillus subtilis and Klebsiella pneumonia. These two organisms are important because they cause bone infections. The zone of inhibition against the two bone infections increases

the pathogens with increases in concentration. This shows very good antibacterial activity for nanocomposites loaded with drugs. Hydroxyapatite nanoparticles will also exhibit antimicrobial effect. The inhibition zone is almost equal to the standard drug Amoxicillin at lower concentration and is higher than the standard drug at higher concentration This is due to the sustained release of drugs from nanocomposite. It is very difficult to cure bone infections, especially infections associated with implants. Antibiotics such as Amoxicillin should be taken for a long time. A sustained release of drugs will be more effective in treating bone infections. Sustained release of the drug from the nanocomposite exhibits effective antibacterial activity. The layer-by-layer polymer coating on the drug amoxicillin is highly effective in sustained release of amoxicillin. The nanocomposite was synthesized for sustained release of amoxicillin. PVA and sodium alginate are coated layer by layer on hydroxyapatite nanoparticles. Thematic layer of polymer layer results in sustained release of amoxicillin. A sustained release of the antibiotic is observed from the nanocomposite for 30 days. The nanocomposite loaded with amoxicillin showed very good antibacterial activity, compared to the standard drug. This ensures that this nanocomposite can be used as a delivery system of antibiotic for bone infections.

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