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ADVANCED TECHNIQUE IN DIAGNOSTIC NON-GONOCOCCAL URETHRITES IN MEN BY PCR

Vladimer Papava¹, Leli Shanidze², Tamar Didbaridze³, Nino Khotivari⁴

¹Assistant-Professor TSMU Department of Urology. (Georgia)

²Manager of the GeorgianAustrian Medical Centre, Lab Doctor. (Georgia)

³Associate Professor TSMU Department of Microbiology. (Georgia)

⁴Assistant-Professor TSMU Department of OB/G. (Georgia)

Email: didbaridzet@yahoo.com

ABSTRACT

Sexually transmitted disease (STDs) are among common infections. Their clinical identification is difficult because STDs are often asymptomatic. Untreated infections with these pathogens can in time lead to serious consequences. Non-gonococcal urethritis (NGU), or inflammation of the urethra, is the most common sexually transmitted syndrome in men, with approximately 20-50 % of cases being due to infection with *Chlamydia trachomatis* and 10-30 % *Mycoplasma genitalium*. Other causes are *Ureaplasma urealyticum*, *Trichomonas vaginalis*, anaerobes, *E.coli*, *Staphylococcus aureus*, *Candida* spp. . We are focused on identifying causes of non-gonococcal urethritis (NGU) such *Chlamydia trachomatis*, *Mycoplasma genitalium*, *Trichomonas vaginalis* and *Ureaplasma* species by PCR and other bacteria by culture. We investigated 65 male patients ages 20 to 50 years with pre –diagnoses of urethritis who visited at TSMU the First University Clinic Urology department. Among this patients some of them had diabetes mellitus type II. Out of 65 patients, 30.27% ,24.6% ,22.5% and 12.63% were infected by *Mycoplasma genitalium* , *Trichomonas vaginalis*, *Chlamydia trachomatis* and *Ureaplasma urealyticum* respectively. 10% were infected by gram negative rods: *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Enterobacter aerogenes* ,gram positive cocci-*Staphylococcus aureus* and fungus *Candida* spp. The PCR for organisms that causes NGU is a valuable technique not just for bacteria and protozoae, for fungus *Candida albicans* as well, which in our case showed negative growth, but PCR was positive.

Keywords: Non-gonococcal urethritis, Polymerase chain reaction, urethritis, STD pathogens, bacteria

INTRODUCTION

Non-gonococcal urethritis (NGU), inflammation of the urethra, is the most common sexually transmitted illness in men. Urethritis can be infectious or non-infectious. Infectious causes almost always sexually transmitted (1,2). Sexually transmitted urethritis is traditionally divided into 2 categories: gonococcal urethritis and non-gonococcal urethritis (NGU). Since almost all urethritis patients have penile discharge, gonococcal urethritis can easily be distinguished from NGU by looking for gram-negative diplococci on a gram stain. If diplococci are identified, the urethritis is gonococcal; if no diplococci are identified, the diagnosis is classified as NGU. NGU is more common in men than women(3,4). Men may have a discharge (strange liquid) from the penis, pain when urinating, and itching, irritation or tenderness around the opening of the penis. Women might not have any symptoms and may not know they have NGU until severe problems occur (5).

The most common cause of NGU is *Chlamydia trachomatis*, which accounts for 15% to 40% of NGU cases. The second most common cause is *Mycoplasma genitalium*, which accounts for 15% to 20% of NGU cases; although widespread testing for mycoplasma is not available. Less common causes of NGU include infection with *Trichomonas vaginalis*, herpes simplex virus, Epstein Barr virus, and *Adenovirus*. Enteric bacteria is an uncommon cause of NGU that is typically seen in males who practice insertive anal intercourse (6,7). In almost half of all cases of NGU, an etiology is not identified. World Health Organization (WHO) statistics show that about 498.9 million new cases of *Chlamydia trachomatis* (CT), *Neisseria gonorrhoea* (NG), syphilis and *Trichomonas vaginalis* (TV) occurred worldwide in 2008 in adults between the ages of 15 and 49 (8). The number of patients with STIs is higher than the one reported in the statistics because of the asymptomatic form of the infection, the absence of partners testing, self-treatments and under-reporting the cases (9).

Sexually transmitted infections (STI) are currently on the increase worldwide. New molecular tools have been developed in the past few years in order to improve their diagnosis. Their clinical identification is difficult because STDs are often asymptomatic. Untreated infections with these pathogens can in time lead to serious consequences. It is documented that isolation of some of this bacteria from cultures is very difficult. Because there is a large number of STD pathogens which can generate coinfections, their simultaneous detection in a unique sample is very important(10,11,12).

Urethritis, epididymitis and chronic prostatitis occur in men with STIs. In both genders, STIs can cause infertility and they increase the susceptibility to HIV infection. In both sexes symptomatic infection appears to be the exception rather than the rule, up to 70% remain asymptomatic for a varying period of time(13,14) .The best modern approach to diagnosis of

STDs and asymptomatic STD agent carrier state is the detection of genomic nucleic acid of the STD agents. The most commonly used approach for achieving that is detection of agent's DNA by Polymerase Chain Reaction (PCR). PCR is a technique that allows specific amplification of DNA fragments using oligonucleotide primers, thermostable DNA polymerase and multiple cycles of temperature shifts (thermocycling). The primers are unique for each STD agent what insures specificity of detection. Enzymatic thermocycling produces millions of identical copies of DNA fragment "framed" by the primers. That insures extremely high analytical sensitivity of PCR(15,16).

MATERIAL AND METHODS

We retrospectively studied 65 men who visited TSMU the first university clinic urology department pre-diagnoses of urethritis. Two urethral swabs and first void urine (FVU) were collected according recommendations for PCR. One swab and urine were sent by Universal Transport Medium (UMT) to Georgian-Austrian clinical-diagnostic laboratory for PCR test and the other one for culture to TSMU the first university clinic bacteriology laboratory. DNA extraction was carried out by modified in CMDB method of DNA extraction from clinical samples. DNA extraction kit contains Lysis buffer, Sorbent, Washing buffer and Elution buffer. The Lysis Buffer (LB), containing a chaotropic agent (guanidine chloride), when added to specimen disrupts cell and microorganisms and solubilizes their proteins and nucleic acids. The Sorbent (S), containing charged silica particles, captures nucleic acids through ionic binding. The "contaminants" (proteins and some other molecules) are washed out by the Washing Buffer (WB) and centrifugation. Then DNA is eluted ("released") from Sorbent using the Elution Buffer (EB). This DNA is PCR-ready i.e. it is free from impurities which can inhibit PCR. For PCR 3 ul of DNA were used. PCR assay was done based on three major processes: sample preparation, nucleic acid amplification of DNA using specific primers directed to pathogenic agent's DNA and detection of the amplified products on agarose gel. We conduct our research with the German and USA production equipment. Namely, "BIO-RAD" Bio-Rad CFX Series (2016) "TECHNE" Prime Thermal Cyclers (2017).

Specific oligonucleotide primers were used. For Amplification were used specially developed in CMDB PCR buffer with high range pH capabilities.

PCR was performed in 15µl of reaction mixture containing 9µl of 5×PCR buffer, 2.5 mM MgCl₂, 200µM dNTP, 1.25 units of Taq polymerase, 20pmol of each primer and 3µl of sample DNA. The reaction mixtures were placed in thermal cycler. The thermal profile involved an initial denaturation step at 94C for 3min followed by 30 cycles of denaturation at 94C for 1min, primer annealing at 58C for 1min, and primer elongation at 72C for 1min. The cycling was followed by a final extension step at 72C for 10min. Aliquots of amplified samples (10µl) were analyzed by electrophoresis on a 1.5% agarose gel stained with ethidium bromide.

Bacteriological investigation of urethral discharge were done by routine microbiological testing. Identification of bacteria was performed by API system (Biomerieux, France).

RESULTS

Out of 65 patients, 30.27% ,24.6% ,22,5% and 12,63% were infected by *Mycoplasma genitalium*, *Trichomonas vaginalis*, *Chlamydia trachomatis* and *Ureaplasma urealyticum* respectively. 10% were infected by gram negative rods: *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Enterobacter aerogenes* ,gram positive cocci-*Staphylococcus aureus* and fungi *Candida* spp.

CONCLUSIONS

M. genitalium was more prevalent than *C. trachomatis* and is the most common cause of NGU in our study. It causes a syndrome similar to chlamydial urethritis. The PCR for organisms that causes NGU is a valuable technique not just for bacteria and protozoae, for fungi *Candida albicans* as well, which in our case showed negative growth, but PCR was positive.

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ALTERNATIVE TREATMENT OF RECURRENT YEAST INFECTION

Nino Khotivari¹, Tamar Didbaridze², Vladimer Papava³

¹TSMU Ob/Gyn department, assistant professor, MD, PhD (Tbilisi, Georgia)

²TSMU Microbiology department, associated professor, MD, PhD (Tbilisi, Georgia)

³TSMU Urology department, assistant professor (Tbilisi, Georgia)

Email: nino.xotiwari@yahoo.com; didbaridzet@yahoo.com; vld100@inbox.com

ABSTRACT

Vulvovaginal candidiasis is considered to be a reversible process when at least three or four episodes of clinical and bacteriological candidiasis are present within a year, that are unrelated to antibiotic therapy. Although more than 50 percent of women over the age of 25 develop vulvovaginal candidiasis for some time, less than 5 percent of these women are at risk of recurrent infection. The etiology of recurrent vulvovaginal candidiasis is associated with resistant *Candida albicans*, frequent antibiotic therapy, contraceptive use, sexual activity, and hyperglycemia. We studied bacteriological smear analysis in 30 women, who visited TSMU the First University Clinic Ob/Gyn department, who had *Candida albicans* with a sensitivity to fluconazole. In the group I - 15 Women were treated with oral fluconazole 150 mg once daily for I, IV, VII days of menstruation and in group II - 15 women in the control group received the same treatment and additional - Fluconazole 150 mg was also given on the first day of the next three menstrual periods. None of the women had not experienced a further recurrent infection approved with bacteriological study.

Keywords: *Candida*, women, vulvovaginitis, treatment, recurrent infection.

აბსტრაქტი

ვულვოვაგინალური კანდიდოზი ითვლება მორეციდივე პროცესად, როდესაც ერთ წელიწადში მისთვის დამახასიათებელი კლინიკური სიმპტომები არის ბაქტერიოლოგიურად დადასტურებული მინიმუმ სამი ან ოთხჯერ, რაც არ უკავშირდება ანტიბიოტიკოთერაპიას. მიუხედავად იმისა, რომ 25 წელზე მეტი ასაკის ქალთა 50 პროცენტზე მეტს უვითარდება ვულვოვაგინალური კანდიდოზი გარკვეული პერიოდის განმავლობაში, ამ ქალთა 5 პროცენტზე ნაკლებია განმეორებითი ინფიცირების რისკის ქვეშ. მორეციდივე ვულვოვაგინალური კანდიდოზის ეტიოლოგია უკავშირდება რეზისტენტულ *Candida albicans*, ხშირ ანტიბიოტიკოთერაპიას, კონტრაცეპტიული საშუალებების გამოყენებას, სექსუალურ აქტივობას და ჰიპერგლიკემიას. ჩვენს მიერ შესწავლილი იქნა ვაგინალური ნაცხის ბაქტერიოლოგიური გამოკვლევა 30 ქალში, რომლებმაც მომართეს თსუ პირველი საუნივერსიტეტო კლინიკის მეანობა-გინეკოლოგიის დეპარტამენტს, რომელთაც აღმოაჩნდათ *Candida albicans*-ი, ხოლო მგრძნობელობა ფლუკონაზოლზე. 15 ქალს ჩაუტარდა მკურნალობა ორალური ფლუკონაზოლით 150მგ დღეში ერთხელ მენსტრუაციის I, IV, VII დღეებში, ხოლო საკონტროლო ჯგუფში 15 ქალს ჩაუტარდა იგივე მკურნალობა და დამატებით შემდეგი სამი მენსტრუაციის პირველ დღეს ასევე დაენიშნა 150მგ ფლუკონაზოლი ორალურად. საკონტროლო ჯგუფში არცერთ ქალს შემდგომი 1 წლის მანძილზე არ გამოუვლინდა შექცევადი ინფექცია ბაქტერიოლოგიური კვლევით.

საკვანძო სიტყვები: *Candida*, ქალები, ვულვოვაგინიტი, მკურნალობა, მორეციდივე ინფექცია.

INTRODUCTION

Vaginal candidiasis is a very common yeast infection of the vagina. Vaginal candidiasis may also be called vaginal thrush. The fungal yeast that causes most cases of vaginal candidiasis, *Candida albicans*, normally lives in some places in the body, such as the mouth and vagina, in a certain balance with other microorganisms, such as bacteria. However, some factors or conditions may result in an overgrowth of *Candida albicans* and result in vaginal candidiasis. Women at risk for vaginal candidiasis include those taking strong antibiotics, especially for a long period of time. Antibiotics kill bacteria, which can alter the balance of microorganisms in the vagina, as well as in the mouth, and other places in the body. This can result in a proliferation of yeast and vaginal candidiasis. This can also cause yeast infections or thrush in

the mouth (oral thrust) and the digestive tract (gastroenteritis). Pregnant women and those with weakened immune systems are also more likely to develop vaginal candidiasis and have recurrent bouts of yeast infections. Women with weakened immune systems include those with HIV/AIDS or those taking steroid medications or chemotherapy, which all suppress the immune system. People with diabetes are also more likely to develop vaginal candidiasis because the elevated level of sugar in the body provides food for yeast and encourages its overgrowth. Other people at risk include the very young and very old.

Classic symptoms of vaginal candidiasis include vaginal itching and a thick vaginal discharge. For more information on symptoms and complications, refer to symptoms of vaginal candidiasis.

Making a diagnosis of vaginal candidiasis includes performing a complete medical evaluation and history and physical examination, including a pelvic exam.

Vaginal candidiasis can be successfully treated with a treatment plan that includes lifestyle changes and medication. For more information on treatment, refer to treatment of vaginal candidiasis. ...more »

Vaginal candidiasis: Candidiasis, also known as a "yeast infection" or VVC, is a common fungal infection that occurs when there is overgrowth of ... more about Vaginal candidiasis.

Vaginal candidiasis: Fungal infection of the vagina, sometimes called thrush. More detailed information about the symptoms, causes, and treatments of Vaginal candidiasis is available below.

Reproductive tract infection is an important public health problem worldwide especially in developing countries (1). Globally, the World Health Organization reports an estimated 357 million new cases of curable reproductive tract infection or sexually transmitted infections which occur annually in adults. These infections can be symptomatic or asymptomatic (2). Common symptoms reported are vaginal discharge, itching, irritation, unpleasant odor and discomfort. These infections cause pelvic inflammatory disease, spontaneous abortion (5), low birth weight, infertility, premature rupture of membrane and miscarriage have also been linked with BV. This study focused on the most common infection - vulvovaginal candidiasis. VVC is caused by commonly *C. albicans*, *C. glabrata* and *C. tropicalis* (7). Vaginal colonization have been attributed to a number of factors, including pregnancy, prolonged use of broad spectrum antibiotics and poor personal hygiene. On physical examination, the patient with vulvovaginal candidiasis usually has vulvar erythema and a thick, white to yellow discharge in the vaginal vault. More than 50 percent of women older than 25 years have one episode of vulvovaginal candidiasis, but fewer than 5 percent of these women experience recurrent infection.

Vulvovaginal candidiasis is considered recurrent when at least four discrete episodes occur in one year or at least three episodes occur in one year and are not related to antibiotic therapy. Recurrent vulvovaginal candidiasis is distinguished from persistent infection by the presence of a symptom-free interval. Antibiotics are often implicated as a cause of recurrent vulvovaginal candidiasis. Diabetes mellitus is often considered a predisposing factor for recurrent vulvovaginal candidiasis. Contraceptive methods may also promote recurrences of vulvovaginal candidiasis.

Classic symptoms of vaginal candidiasis include vaginal itching and a thick vaginal discharge. For more information on symptoms and complications, refer to symptoms of vaginal candidiasis.

Making a diagnosis of vaginal candidiasis includes performing a complete medical evaluation and history and physical examination, including a pelvic exam.

Vaginal candidiasis can be successfully treated with a treatment plan that includes appropriate medication.

MATERIAL AND METHOD

We studied reproductive age 30 women, who had recurrent yeast infection (3 and more clinical episodes a year). Their vaginal samples yield *Candida* spp by bacteriological investigation. All samples were cultured on Sabouraud agar. After 24-48 hour incubation all 30 cultures were positive for *Candida* spp 10^5 - 10^8 CFU/ml. Antifungal susceptibility testing was done by manual ATB Fungus (Biomérieux, France) on following agents: Flucytosine, Fluconazole, Itraconazole, Voriconazole, Amphotericin B. All of them showed high susceptibility to fluconazole.

We used the different treatment regimen for 30 women with recurrent VVC. In group I (15 women) -oral fluconazole 150mg a day administered (sensitive to fluconazole species) from the beginning of menstrual period, on the first, third and the seventh day. In controlled group II (15 women) we used the same scheme of treatment, but additionally 150 mg fluconazole orally on the first day of the next 3 menstrual periods.

RESULT

After this treatment regimen we have no recurrent infections in this controlled group for 1 year. Complications determine the most appropriate regimen of treatment. With our treatment regimen Gastrointestinal side effects occur in 7 patients, diarrhea has been noted in 3 cases, vomiting in 3 and abdominal pain only in 1, and headache in 3 cases.

CONCLUSION

The optimal treatment regimen for recurrent vulvovaginal candidiasis has not yet been defined. Consequently, treatment must be individualized based on a comparison of effectiveness, convenience, potential side effects and recurrence incidence. Our treatment regimen is most effective in treatment of recurrent VVC.

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CLINICAL - GENEALOGICAL ANALYSIS OF MUCOVISCIDOSIS

¹Lamiya Guliyeva, ²Ajdar Mikailov, ³Aytakin Hasanova

¹Azerbaijan Medical University, I Department of Internal Diseases. Azerbaijan.

²Azerbaijan Medical University, Department of Therapeutic and Pediatric Propaedeutics. Azerbaijan.

³Azerbaijan Medical University, Department of Medical Biology and Genetics. Azerbaijan.

Email: aytakin_hasanova@mail.ru

It has been discovered that a low diagnostic level resulted in revealing the cases of mucoviscidosis, primarily in the families having affected or deceased sibs. This dependence on diagnosis results in a significant shift in a sample which evades correction. This error of the sample was precluded when families to be analysed were selected by the first effected child. Segregation analysis of 42 families by Weinberg's proband method has revealed a complete concordance with autosomic recessive inheritance as the portion of the affected was $25.0 \pm 2.21\%$. This approach has made it possible to handle the incomplete sample as unselected for which the correction techniques applicable to a complete sample can be used. It is quite possible to assume that this diagnostic dependence can influence the results of segregation analysis of other hereditary diseases with broad clinical polymorphism.

Autosomal-recessive type of inheritance of mucoviscidosis is admitted by the majority of investigators (Danks et al., 1965; Crow, 1965 and others).

Earlier, however, some authors discovered the increase in the number of the affected persons in families with mucoviscidosis (Baumann, 1958; Roberts, 1960; Bemheim et al., 1961; Mastella and Montenovesi, 1964). On this basis a dominant form of mucoviscidosis, beside the recessive one, was postulated.

Analysis of the data obtained by Baumann (1958), Roberts (1960), Steinberg and Brown (1960) showed that the observed deviation was due to the inadequate statistical analysis of the obtained information.

Using more adequate statistical methods, Brunecky (1972) also failed to find full accordance with the expected 25% and pointed out that even the slightest increase in the ratio of affected persons must be explained.

In the present report we wish to analyse the causes leading to non-random samples of clinical materials not submitted to correction.

In the work the results of the clinical-genealogical analysis of 106 families ascertained by living or dead children with mucoviscidosis are used. Thirty-six families with one child each have been excluded from the analysis as they were considered to carry no information.

The obtained sample of families was estimated as an incomplete one with the method for single ascertainment (Cain C. 2012; Krasovski S. A. et al., 2012;).

The incomplete method for single ascertainment has not shown the correspondence to the autosomal-recessive type of inheritance, as the ratio of affected persons was $42.1 \pm 4.5\%$.

The significant increase in the ratio of affected persons in the sample may either suggest a different type of inheritance or the existence of some additional factors which had their influence on the sample (Kapustina, T. 2001.; Dumo C. et al., 2002).

The absence of the inheritance of the disease through generations, and, as a rule, the absence of the disease in semi-sibs contradicted the dominant type of inheritance (Erlinge D.2011). Consequently, some additional factors distorting the sample which could not be studied by the existing correction methods had to be sought.

First of all we have carried out the analysis of the accordance between the observed parts of families with different numbers of affected children expected to belong to an autosomal-recessive type. The results are given in Table 1.

Table 1. Comparison of the observed and expected distribution of the families with different numbers of children at by the registering method for single ascertainment of the affected persons with a recessive disease

No.of children in the family	No.of affected children	Probability of detecting the affected persons in a family	No. of families		Deviation of found from expected number	χ^2	Degree of freedom	p
			expected	observed				
2	1	0.75	33	30	<1.10	1.1	1	0.30
	2	0.25	11	14	>1.27			
3	1	0.5625	11.25	6	<1.87	5.6	1	0.012
	2	0.375	7.5	9	>1.20			
	3	0.0625	1.25	5	>4.0			
4	1	0.4218	1.26	0	—	Calculations have not been made because of the small number of observations		
	2	0.4218	1.26	0	—			
	3	0.1404	0.42	2	> 4.74			
	4	0.0156	0.05	1	>21.73			

As is seen in Table I, the highest difference in distribution of the families found and expected is observed for the families with the greater number of affected children. Since the expected distribution already implies the greater probability of detecting families with numerous affected persons, the received inadequacy was the evidence of the existence of some additional factors distorting the sample.

It may be assumed that the reason for the distortion of the sample lies in the way of diagnosing mucoviscidosis. It is known that the child having affected site would sooner be found to have a disease. This factor cannot but be reflected in the shift of the sample towards the families with a greater number of the affected persons.

To test this assumption we have chosen the families ascertained by the first affected person. Only 42 such families were found in our sample with two and more children.

Table 2. The expected and observed frequency of the affected persons in 42 families analysed by a priori method

No. of children	No. of families	No. of affected children		Dispersion
		expected	observed	
2	36	41.14	42	4.392
3	6	7.78	7	1.578
Total	42	48.92	49	5.97

The correction of the results in these families by a priori method is given in Table II. The expected part of affected children has been calculated by the formula :

$$r_s = \frac{p \cdot s \cdot n_i}{1 - q^2}$$

$$\sigma = \sqrt{5.97} = 2.44; D/\sigma < 2\sigma$$

The results obtained show the random nature of choosing these families. Thus, using correction methods at incomplete registering, it is possible to study the proportion of the affected and unaffected children for establishing the type of inheritance.

The results of the segregation of the progeny by the family method of Weinberg are given in Table 3.

Table 3. Analysis of segregation of the progeny in 42 families with mucoviscidosis found by the first affected child (family method of Weinberg)

Total No. of children in the family	No. of families	No. of affected children	r(r-1)	r(s-1)	Dispersion
2	30	1	0	1	4.20
2	6	2	2	2	0.42
3	5	1	0	2	0.24
3	1	2	2	4	0.02
Total	42	49	14	56	4.88

$$P = \frac{\sum r(r-1)}{\sum r(s-1)} = \frac{14}{56} = 0.25$$

$$\sigma = \sqrt{4.88} = 2.21$$

Thus the obtained value $25 \pm 2.21\%$ is in accordance with the hypothesis of recessive inheritance and proves the approach to the estimation of the sample to be correct. The existence of the factor of diagnostic dependence in family forms may bring a distortion in segregational relations in the families with the diseases which do not have a full specific phenotype.

CONCLUSIONS

1. The genetic relations in families with mucoviscidosis found in the present clinical material do not correspond to the true segregational relations of the frequencies of the affected children.
2. One of the reasons which influence the increase of the frequency of affected children in families with mucoviscidosis on condition of incomplete detection is the diagnostic dependence in many cases upon the presence of the affected or dead sibs in a family.
3. The analysis of segregation in families found by the first affected child eliminates the diagnostic dependence and makes the sample random.
4. The established fact of diagnostic dependence upon the presence of the second patient in a family may be the natural cause of the deviation of segregational relations in some other hereditary diseases which are characterized by a wide clinical polymorphism.

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TYPES AND STRUCTURAL PECULIARITIES OF ECOSYSTEM

Lamara Qoqiauri

Academician of Georgian Economics Academy, Professor. Senior research Scientist-Coworker at the National Institute of Economic Research.

ABSTRACT

The work explores the different types of innovation ecosystems based on the territorial principle. The whole world innovation ecosystem, national innovation ecosystems, regional, as well as, local innovation ecosystems (Technopolymer) corporate, industrial and innovative individuals' ecosystems are characterized in this work. The article highlights important elements of innovation ecosystem such as industry, supportive infrastructure entrepreneurship, scientific field and venture investment market. The basic model of the interaction of innovation ecosystem entities is interesting, in which are represented the main relationships between innovation ecosystem entities.

Keyword: Industry, Venture Investment Market, Scientific Field, Venture Funds, Startups, Business Angels, Technoparks, the World Innovation ecosystem, National Innovation ecosystem, Local Innovation ecosystem.

ლექსიკონი

შრომში შესწავლილია ინოვაციური ეკოსისტემის სხვადასხვა სახეები ტერიტორიული პრინციპის მიხედვით. დახასიათებულია მთლიანად მსოფლიო ინოვაციური ეკოსისტემა, ეროვნული ინოვაციური ეკოსისტემები, რეგიონული, აგრეთვე ლოკალური ინოვაციური ეკოსისტემები (ტექნოპოლირები) კორპორატიული, სამეწარმეო და ინოვაციური ინდივიდუუმების ეკოსისტემები. სტატიაში დიდი ადგილი აქვს დათმობილი ინოვაციური ეკოსისტემის მნიშვნელოვან ელემენტებს: მეწარმეობას, მეწარმეობის მხარდაჭერ ინფრასტრუქტურას, სამეცნიერო სფეროსა და ვენჩურული ინვესტიციების ბაზარს. საინტერესოა შრომაში ინოვაციური ეკოსისტემის სუბიექტების ურთიერთშემოქმედების საბაზისო მოდელი, რომელშიც წარმოდგენილია ინოვაციური ეკოსისტემის სუბიექტებს შორის არსებული ძირითადი ურთიერთკავშირები.

ძირითადი სიტყვები: მეწარმეობა, ვენჩურული ინვესტიციების ბაზარი, სამეცნიერო სფერო, ვენჩურული ფონდები, სტარტაპები, ბიზნესანგელები, ტექნოპარკები, მსოფლიო ინოვაციური ეკოსისტემა, ეროვნული ინოვაციური ეკოსისტემა, ლოკალური ინოვაციური ეკოსისტემა.

INTRODUCTION

During recent years certain positive changes have been introduced in our country. The Government recognizes state innovative development in the innovative policy of the country to be one of the preferable tasks, which have been improved through modest practical activities. State-private partnership programs have been developed in the field of finances and infrastructure, technoparks and business-incubators have been opened, startup program is being developed widely and successfully, etc.

Innovation ecosystem is the complex interrelated system of different form of ownership, organizations, state institutions, legal agencies, social relations, services and practitioners. Innovators, innovative individuals or the persons creating, and distributing innovations, based on their own motivation or/and requirements make grounds to the innovation ecosystem. Theoretical problems of the above issues require studying of the significant elements of innovation ecosystem, as well as types of the ecosystem, per different signs of classification.

Types of Innovation Ecosystem

Following types of innovation ecosystem is distinguished according to the territorial principle [7].

Global Innovation Ecosystem.

Objective of global innovation ecosystem is implementation of progresses in the recognized fields of knowledge for implementation of global innovative projects to establish environment and conditions (digital world energy, biotechnologies, nanotechnologies etc.). Herewith, development of the global system of patents, and maintenance of balance between openness of new technologies and maintaining ownership rights on intellectual properties [6].

National Innovation Ecosystems is comprised of different institutions organizing innovative processes of fundamental studies and processing, prepositional and seed venture investments. They form innovative mentality of society, as well as

innovative entrepreneurship, for creation of generation of new ideas, and terms and conditions of their modern commercialization. As well as attracting creative and competent persons providing placement and understanding of national strategic preferences and their use in the determination and observation of the strategic objectives in the innovative global development.

Initially, the term National Innovation Ecosystem was used by the Dutch economist B.A. Lundvall and he characterized it as the elements and ties between them, which interact on the production of economically useful (economically required) knowledge, its distribution in course of distribution and application. Economical aspect is emphasized by the fact that these elements are placed inside the national borders [20].

This definition was specified (especially in terms of criteria of economic benefits of knowledge) by R. Neelson (1993), determining national innovation ecosystem as the systems of national institutions, impact of which conditions efficiency of innovative performance of the national firms [23].

In 1995, S. Metkalf offered another determination of the National Innovation ecosystem, in which the author tried to generalize and summarize all the opinions about this phenomenon. Metkalf considered the national innovation ecosystem as the totality of different institutions, which were entirely or separately making contributions to the creation and transfer of technologies, as well as provision of the frameworks, in which the state forms the policy of influence upon innovative process. The author determined national innovation ecosystem as the system of different interrelated institutions, manufacturing, finding and transferring knowledge and creating products used for the development of new technologies [21].

Above scientist present modern definitions of the national innovation ecosystem. For example, according to N. Beketov, national innovation ecosystem is characterized as by the research environment, on the one hand, which has stimuli in terms of cooperation, and certain industrial environment, on the other hand, which has stimuli in innovative directions. Knowledge adoption ability, having the mechanism of interaction of these two environments, providing transfer of knowledge, their transformation. Above particular technologies and orientation of the research environment is provided for the satisfaction of innovative requirements [1]; O. Golichenko presents following definition of the national innovation ecosystem: "This is the totality of national, state, private and public organizations and the mechanisms of their interactions, within framework of which activities for creation, maintenance and implementation directions of new knowledge and technologies are performed" [3]. N. Ivanova determines national ecosystem as follows: national innovation ecosystem is "the totality of interrelated organizations (structures) performing production of scientific knowledge and technologies and their commercial realization within the national borders and it is comprised of scientific and industrial parts (companies, universities, laboratories, Technoparks and incubators), as well as the complex of institutions of legal financial and social nature, providing innovative processes and of national political and cultural peculiarities [5]". In the works of V. Tretyak and S. Tikhono [14] there is the definition specified for the national innovation ecosystem. The authors determine it as the totality of institutions, rules and conditions providing origination of intangible assets within the framework of the national economy, which are called innovations in terms of national achievements, in the form of the intellectual property ready for commercialization."

Any innovation ecosystem is being formed by the joint efforts of the state (through the legislation performing prescribed macroeconomic policies), scientific field (fundamental studies, preparation of scientific personnel) and industrial environment (studies of applied nature, commercialization of technologies, production and distribution of innovative products).

Modern innovation analyzes and generalizes experience of national innovative system, develops new scientific achievements being able to accelerate formation of the self-developing national innovation ecosystem. Currently, the model of the national innovation ecosystem gained special scientific and practical interest, based on the complex and multilayer partnership of the three components: universities (science), business and government. From institutional point of view, application of biological analogy with the ecosystem allows presentation of this partnership in the form of social construction, which is characterized by the spiral molecule preferences of ДКН and giving the subject high adaptivity to the permanently variable external impacts. This model is known as the Triple Helix Model. Such definition was first used by G. Itskovitch [18] and L. Lidesdorf [19].

Thus, it shall be noted that innovation ecosystem of the country is comprised of the four subsystems, i.e. four micro-blocks: state, entrepreneurial field, knowledge producing environment and knowledge transfer mechanisms.

Regional ecosystems. Regional innovation ecosystems represent relatively developed element, as the territory simultaneously is the user of service of innovation products and the customer. The territory uses, and orders innovations directed towards creation of comfort conditions for achievement of competitiveness of the territory in regards with the problems for provision of innovative development of Mezodon – reflected in the competitiveness of human capital. Basic examples of the self-sufficient territorial ecosystems are well-known innovative ecosystems: "Silicone Valley", MIT (Boston), Cambridge, Harvard, Tomsk District, Tatarstan, Samara, Kaluga etc.

Grounds of the territorial innovative ecosystem are: universities and research institutions, being able to be the source for ideas, innovations, generators of new processing and innovative capital: small innovation entities, corporations and companies, manufacturing innovative products, the system of development of venture investments, and innovation union [6].

Local innovation ecosystems (Technopolis). There are multiple definitions of Technopolis. According to the most distributed definition, Technopolis (from Greek *techné* – art, skills, and *polis* – city) is one of the forms of free economic zone created for the purpose of activation and acceleration of the innovation processes and being able to use technical and technological innovations quickly and effectively. As a rule, Technopolis center forms regional center for processing and assimilation. Generally, the program of Technopolis activities is comprised of the scientific studies of the fundamental and applied nature, including their advancement for the purpose of introduction of their results into production.

Formation of innovation ecosystems of Technopolis was commenced and widely distributed abroad [12]. Obvious example of such transformation is national innovation ecosystem of China, where creation of Technopolis, which was main trend of state innovation policy, within the framework of the long-term general program for development and modernization of science and techniques of China, became the result of intensive aspiration for commercialization of universities (science), in terms of strengthening manufacturing component. Under the influence of the state policy, second network domain – the field of scientific and business representatives – Consensus Field was formed. Gradually, unilateral relations were transformed into the above Triple Helix relations.

Successful examples of the local innovation ecosystems may be political projects – innovation territorial centers “Innovative Scientific Society”, “Innovative Territorial and Entrepreneurial Cluster”. Projects are performed by the regional government, within the framework of the state programs.

It shall be noted that, in regards with the creation of the local innovation ecosystems, establishment of similar organization structure, such as Scientific Cities, which is comprised of the science of the applied and fundamental nature. It accumulates sectorial scientific and research and higher institutions. The state performs supporting activities for development of science and improvement of the social-economic environment. Infrastructure (technoparks, industrial parks) and organization grounds (special economic zones, cluster programs, forward-looking social economic development territories) required for commercialization of scientific studies and processing are created on some territories.

Corporate (sectorial) innovation ecosystems. Corporate innovation ecosystem [6] is developed in the form of the platform of the theory of open innovations, private-state partnership, as state assistance of innovation projects and risks distribution, organization of research activities inside the corporations and creation of small networks of innovation enterprises. Open innovations foresee permanent searching for the new competences, for innovation projects, which may be best performed outside the corporation, through partners, cooperation with universities, attracting innovation companies (startups) for realization, based on the holding of the intellectual property and preliminarily prescribed terms of application. As a rule, organization of the scientific-research activity of the corporation is performed by the head office (Spinoffs). Herewith, the companies participate in the educational processes of universities and represent improvement of technology processes, based on the gained knowledge.

Industrial innovative ecosystems. Idea of business ecosystems was initially formed by J.F. Moore in 1996 [22] (before Ch. Wesner offered the concept of innovation ecosystem in 2004), which are comprised of the companies and the network of suppliers, market intermediates, users and competitors formed by them. J. F. Moore states that relations between the companies are similar to the ecosystem existed in nature. By means of interactions (even if the companies are not partners, but competitors) much higher results may be achieved, then through actions of individuals. Such idea supported further development of the concept of ecosystem, in the narrower fields of industrial activity. For example, to describe digital business ecosystem [17], which essentially is the component of the industrial ecosystem. Under the modern conditions, they often speak about establishment of the large international companies and transnational companies, which are mostly specialized in the manufacturing of computers and software, ecosystem of their products, filling each other harmonically and creating benefit to the users from their joint use. In terms of the company creating ecosystem, the product is increasing attractiveness of products in the eyes of the user, as well as new opportunities of the economy (to use joint advertisement concept, products are intended for joint use and relatively unified target auditory). Increased loyalty and additional preventive factors to the brand, which are originated from the transferring to the competitive products. Ecosystem business becomes business development model of the company and key business-strategy element for most of the companies.

Innovative individual ecosystem. Individual level of innovation ecosystem is the innovative human (*Homoinnovaticus*) – the subject of innovative development providing generation and realization of innovative idea. He shall permanently upgrade his knowledge and self-education, to be mobile and have research and design competencies geographically and mentally, have partnership relations and trusted interaction [7]. To form individual level of innovation ecosystem it is required to reform educational system based on the understanding in-depth changes under the modern conditions of globalization, long-life education strategy, creation of the comfort terms and conditions for labor and life quality for the persons, providing innovation processes. These are researchers, analysts, experts, investors, business-angels, venture funding and innovation entrepreneurship managers, startup founders etc.

The problems of forming innovative human (*Homoinnovations*) were considered at the innovation forums: San Francisco (2010), Moscow – at the Forum of Innovation Discovery (2012, 2013, 2014). Main competences for innovation union were

established; basic of them are: opportunity for permanent improvement; striving for innovations, creative thinking, readiness for reasonable risk, creativity and convenience, team working skill and that of working in high-competitive environment, independence etc. Named signs of the innovative human was first presented and described by I. Shumpeter [15], subjects of innovation activities – when characterizing innovation entrepreneurs.

Significant Elements of Innovation Ecosystem

Significant elements of innovation ecosystem are:

1) Entrepreneurship, 2) entrepreneurship supporting infrastructure (material and nonmaterial), 3) scientific field, 4) venture investments market.

Entrepreneurship is the central element of innovation ecosystem, as the company performs processing and commercialization of new products, i.e. they implement completing stages of innovation chain. Moreover, the companies preliminarily determine, identify demand on the technologies, which is supplied by the scientific field, as well as the requirement for the qualified staff, which may be supplied by the higher institutions. According to the statistics, specific share of the industrial sector global wide in the total volume of the used knowledge amounts to 67%. Moreover, specificity of innovation activities is such that large companies, saying nothing about small innovation startups [1], are trying to create maximally favorable terms for the development of innovation projects, reducing their risks and accelerating achievement of the required marginal values of financial indicators (such opportunities are created by the technoparks, business-incubators and business accelerators – significant representatives of infrastructure. As well as the mechanism for venture funding). In such way, business plays the role of a liaison for all other elements of the system, and in case if national companies are not oriented towards introduction of innovation, it will be impossible to form innovation ecosystem in the country or/and the region.

Nature of interaction between small innovation companies and large corporations within the framework of innovation ecosystems can be determined with the fact that large business essentially plays the role of consumer for technological startups. This may be identified in two directions: on the one hand, the companies form demand on the innovation products of startups (in the sector business-to-business – B2B) and the technologies created by them. On the other hand, corporations may initiate transaction in direction to the absorption of more prospective innovation startups.

Example to such absorption is acquisition of photography of Instagram cameras and editing by the largest social network Facebook for 1 billion US Dollars, in April of 2012. Another example to such large transaction is acquisition of another popular service - navigation-cartography startup Waze by the Company in April of 2013.

- According to the importance of innovation ecosystem, another main element is scientific field, performing three significant functions in this field:
- produces knowledge (basic technology processing), used by the industrial domain;
- other subjects of innovation ecosystem, in the first place, offering companies and venture funds services, in the form of scientific and technical expertise and consultation.
- Performing professional training of engineer-technical staff and specialists in the field of economy funding, management and law and thus enriching innovation ecosystem with qualified human resources.

The infrastructure supporting the entrepreneurship is of special interest, which, as said above, is divided into the tangible and intangible (soft) components. Another one represents the set of different services, adopted in required small innovation startups. Such services may be comprised of the following:

- Consulting in different issues of activities of small enterprises (companies), including management, marketing, legal, financial, information technologies (IT) etc. issues;
- Design expertise allowing assessment of the market potential of idea or/and design, as well as its attractiveness in terms of investor;
- Assistance in transferring to the foreign markets (including to the recipient country through the network of friendly business-incubators – Soft funding), and service in the field of transferring technologies;
- Assistance in terms of protection and evaluation of intellectual property;
- Outsourcing service of innovative type, which accompany innovation activities of small enterprises (accounting, legal and other services);
- Development and design of websites, special software and mobile applications;
- Service in the field of advancement of new goods, and many others.

This service may be rendered by absolutely different companies – started with the private agencies, having no direct relations with the innovation ecosystems, and completed with the universities and even state agencies.

As innovation projects, formed and developed inside the innovation ecosystem, as a rule are exposed to the high risk level, there is separate market for their funding; it is venture capital market, which functions according to the special rules. Venture capital market is comprised of two sectors, they are: venture funds and nonformal sector, represented by the individual investors. Individual investors performing direct investment of their direct financial resources into the increasing small entities, are called informal investors or business-angels.

Venture funds are specialized in the large innovation startups (average volume of investments reaches up 4-5 million US Dollars), while business-angels prefer less complex projects, for which volume of investments amounts to 50-100

thousand US Dollars; amount presented in %s (as in case of ordinary banking credit), or often by share in charter capital. As an average, in case of success of a project, investor earns profit by selling his share after 3-5 years, which exceeds the initially invested capital multiple times.

Potentially successful idea and startup process is not large, for which funds and informal investors carry out serious expertise of the projects offered to them. Special attention is paid to the financial indicator, prospects of market niche, quality of presentation preparation and business-plan, as well as competences and motivation of the project team members. Interest in funding of the project is significant factor to the business-agents – often informal investors become themselves team members and render complex service to the project, in form of management, marketing strategy, signing agreements, business planning etc., further simplifying receiving funding by such firms from other sources, including venture funds.

Role of the state is quite specific. Different of the national innovation system, where state agencies manage entire mechanism of funding innovation activities in the country, inside the innovation ecosystem, there in fact is no clearly expressed leader, including the state. This latter actively participates in the process of forming innovation ecosystem, stimulated venture market in the country, creates and funds infrastructure for supporting entrepreneurship, however developed ecosystem of innovation becomes self-supportive and releases the state from the necessity of permanent control and implementation of large financial flows.

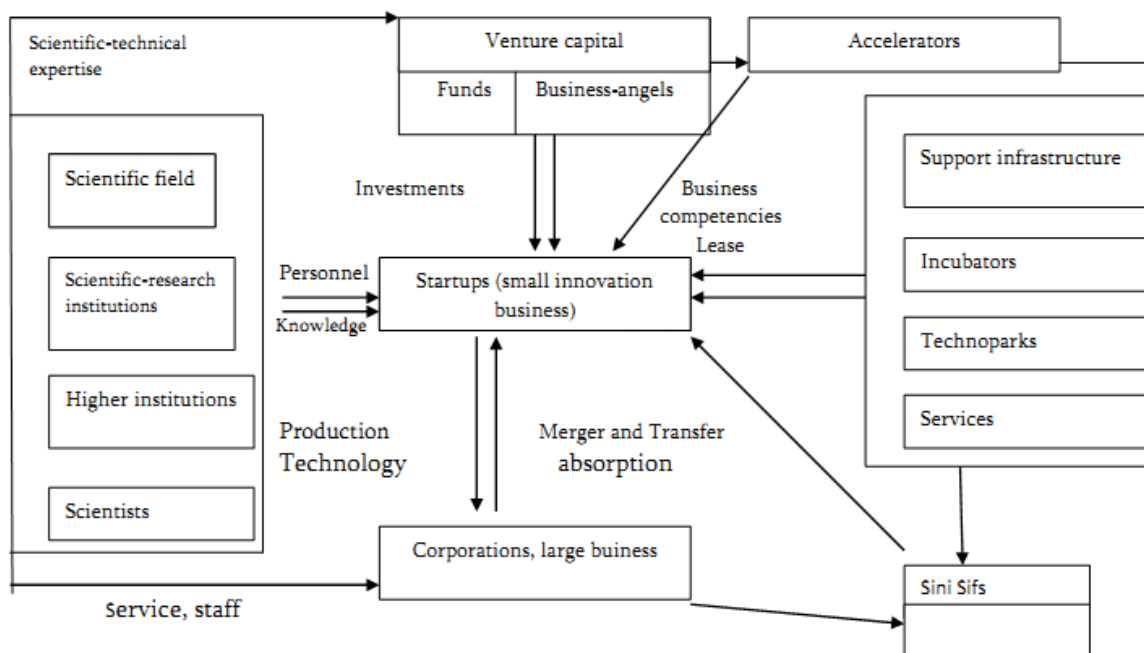


Figure 3. Basic model of interaction of the subjects of innovation ecosystem [2]

Figure 3 represents main interactions between the subjects of the innovation ecosystem. Central rage is the small innovation business (which are startup project groups, as well as registered small firms), which are in the national innovation ecosystem, receive qualified staff and technology processing from the scientific environment for commercialization, financial and consulting assistance, infrastructure assistance and funding, as well as outsourcing of the services specialized companies. Large business plays the role of potential user of cultivated innovation products and services under the innovation ecosystem, as well as the possible buyer of the innovation company itself and, correspondingly, it is the player providing additional financial impact in the field of innovation ecosystem and the stimulation of creation of new projects.

CONCLUSION

Classification of innovation ecosystems is presented in the work, according to the different signs, along with the significant elements of the innovation ecosystem, which is important issue of classification of the innovation system. Study of all

considered types of ecosystem: global, national, regional, local, corporate, industrial and innovation individuals allows scientific evaluation of their theoretical and practical importance, to determine performance and direction of each of them.

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SMALL AND MEDIUM ENTERPRISES DEVELOPMENT TRENDS AND CHALLENGES IN GEORGIA

Udesiani Khatia

Ivane Javakhishvili Tbilisi State University, PhD Student. (Georgia)

E-mail: khatia.udesiani@gmail.com

Introduction. Developing countries in the modern world have many challenges, between them - Georgia. One of the main challenges is the development of small and medium enterprises. Although several reforms have been implemented in Georgia in recent years, such as: creating a conducive environment for business development, reducing the tax burden, limitation of various artificial barriers and more, small and medium enterprises have some problems.

The article discusses the trends of product launches by small and medium enterprises since 2015, the share of their output in total output, number of employees by enterprise size categories. The article analyzes the measures taken by the government in this direction.

Aim and tasks. The purpose of the research is to study and analyze the trends and challenges of small and medium enterprises development in Georgia, the generalization of existing state support and justification of objective necessity, develop practical recommendations.

Results. The article discusses the current state of development of small and medium enterprises in Georgia, its contribution to the improvement of the socio-economic situation in the country and the objective necessity of state support.

Conclusions. In recent years, as a result of reforms in Georgia, the country's investment and business environment have improved significantly - administrative barriers have been significantly reduced and public services improved. However, some measures are needed to support the development of small and medium enterprises, namely, it is necessary to increase the competitiveness of the private sector, improve the investment and business environment, political stability, strengthen property rights, support state production, increase access to finance, develop innovation and technology.

Keywords: Small and Medium Enterprises, Reforms, Produce in Georgia, Products, Number of Employees.

INTRODUCTION

Developing countries in the modern world have many challenges. Despite recent reforms in Georgia, which include creating a favorable environment for business development, reducing the tax burden, limiting artificial barriers and so on, special attention is paid to problems related to small and medium enterprises development. However, it is noteworthy that the country's economic development is unthinkable without the development of small and medium enterprises.

In developed countries, small and medium enterprises account for a large share of existing enterprises, accounting for more than 50% of total turnover in the entrepreneurial sector and two out of every three jobs in the private sector. In the Organization for Economic Co-operation and Development (OECD) countries, more than 99% of companies are small and medium enterprises and, on average, generate 2/3 of GDP. In emerging and transition economies, small and medium enterprises account for more than 90% of the total number of enterprises, although their share in GDP is generally quite low - often less than 20% [1].

In a time of economic crisis, state-supported small and medium enterprises' policies are important for sustained economic growth. Production support allows solving important socio-economic problems, such as demonopolization of production and sale of products and services, deconcentration of unjustifiable enterprises, multiplication of independent producers, dynamic change of production structure according to customer demand [2].

Analysis of recent research and publications. The issues presented in the article are discussed based on studies of Georgian and foreign researchers and scientists. It should be noted that their research and recommendations are an important step forward in overcoming problems in the small and medium enterprises sector. However, due to the complexity of the issue caused by the economic or political situation in the country, many problems still require evaluation, analysis, and resolution.

Nowadays, researchers and scientists agree that the development of small and medium enterprises will support the growth of the country's GDP. It is an important area of employment that promotes the formation of the middle class, enhances economic and political stability, reduces poverty and is an effective social problem-solving institution. Importantly, their role in the economy as a prerequisite for competition and the development of large businesses [3–4].

The development of small and medium enterprises has a major impact on the economic development of the country. The most important of these are: creating opportunities for development and ensuring political stability through economic

freedom, entrepreneurship independence, and decentralization of power; Ensure a competitive market environment - Small business development is the best tool to avoid monopolies and concentrate power in the hands of only a few entities; Unemployment Reduction - Small businesses have a stabilizing effect on the labor market and create more jobs in times of crisis than large ones; Introducing Innovation - Small businesses play a crucial role in innovation processes. The number of innovations and inventions in small and medium-sized businesses per employee is four times higher than in large corporations. Also, small businesses provide invaluable experiences to young people who go to the labor market after receiving their education. Small enterprises are in the process of innovation, on the one hand, experimenters for large companies, and on the other, pioneers of new products. In most cases, the implementation of innovative ideas starts with a small-scale business [5–7].

The economic policy in Georgia is based on three main principles. The first principle is to ensure rapid and effective economic growth focused on the development of the real (manufacturing) sector of the economy, which will solve the economic problem in the country, create jobs and reduce poverty. The second principle is to pursue an economic policy that fosters inclusive economic growth, which implies universal involvement of the population in economic development (including diaspora, migrants, ethnic minorities and other groups), it welfare of each member of society as a result of economic growth, their social equality and improved living conditions for the population. The third basic principle is the rational use of natural resources in the process of economic development, ensuring ecological safety and sustainability and avoiding the risks of natural cataclysms [8].

Based on world experience and practice, the key feature of the normal development of the economy is recognizing the optimal ratio of small, medium and large enterprise sectors. Small enterprises are predominant among them due to its advantages. Small enterprises are more dynamic, responding quickly and effectively to emerging or emerging economies. Small enterprises often play the role of disproportionate regulators in some commodity markets. government spending is effective in supporting small enterprises, as small enterprises create new jobs, develop the fair competition, accelerate the market for goods and services, and bring more share of innovation to the economy[9].

Small and medium enterprises have significant advantages such as proximity to the market; Ability to adapt quickly to changing conditions; Relatively low-cost activities; a Relatively small amount of start-up capital; Ease of doing business and tax advantages; Employee loyalty; Operational and flexibility of decision making, enforcement; Great opportunities for the realization of entrepreneurial ideas; High return on equity, etc. Despite the advantages, small and medium enterprises are also characterized by shortcomings, such as high levels of bankruptcy risk; Volatility of market positions; Dependence on large companies; Disadvantages in management; High dependence on environmental variability; Difficulty attracting financial resources and more.

Aim and tasks. Because of the above, the purpose of the study is to generalize the state of entrepreneurship support and justify the objective need to support small and medium enterprises, also, develop recommendations for small and medium enterprises development.

Results. To discuss the necessity and necessity of small and medium enterprises development, it is important to consider the situation in Georgia in terms of production. According to Fig. 1, production in 2015-2018 is steadily increasing in Georgia. Production output in 2015 was 29993.9 million GEL, in 2018 - 41649.3 million GEL.

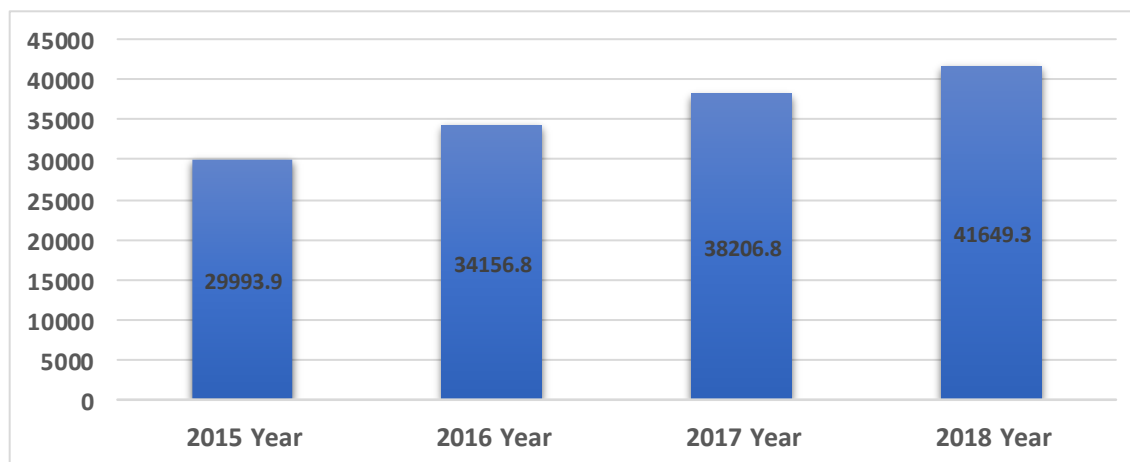


Figure 1. Production Release (MillionGEL), 2015-2018 Years

Source: Compiled by the author, based on data from the National Statistics Office of Georgia [13].

Although production has been rising in recent years, there is a reasonable doubt as to whether this growth is "sufficient" for the country to achieve the desired economic result in a short time.
 It is important to consider the share of small and medium enterprises in total output.

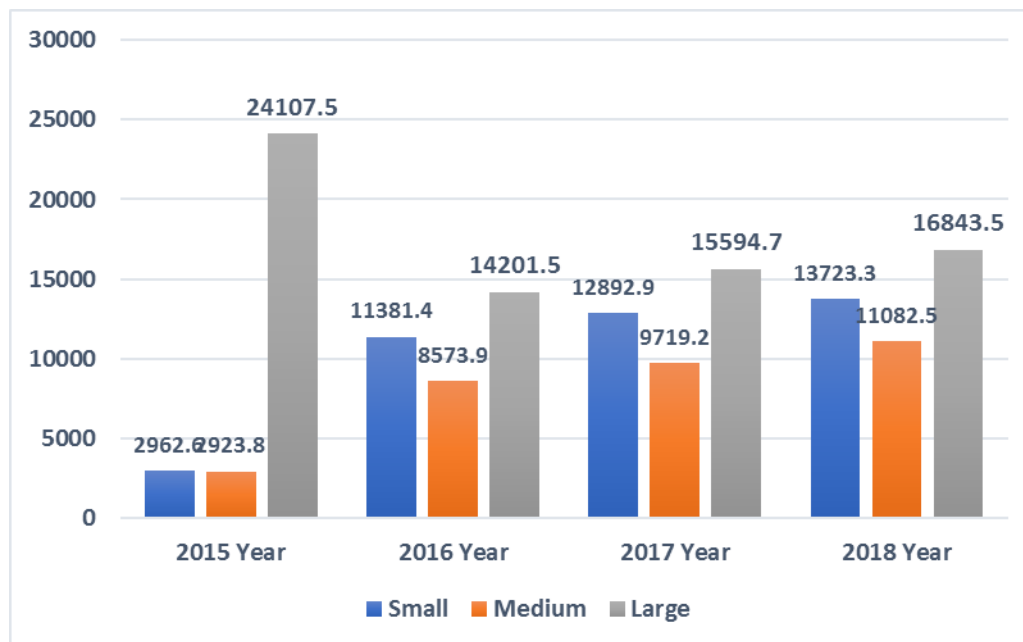


Figure 2. Production Output (Million GEL) by Enterprise Size, 2015-2018 Years

Source: Compiled by the author, based on data from the National Statistics Office of Georgia [13].

As can be seen from the graph, the share of small and medium enterprises in the total production of Georgia in 2015 was 19.6%, And in 2016 it was -58.4%. In 2017 - 59.2%; In 2018 - 59.6%. The analysis shows that the production of small and medium enterprises is increasing from 2015 to 2018. The analysis shows that the production of small and medium enterprises is increasing from 2015 to 2018.

In 2014, the Government of Georgia launched a state program to support small and medium enterprises "Produce in Georgia". The program aims to support entrepreneurs in industrial and agricultural areas, to create new enterprises and to expand existing ones, to increase the competitiveness and export potential of the private sector through access to finance, real estate and technical assistance. LEPL "Produce in Georgia" is one of the first state agencies in Georgia whose main goal is an improvement of the entrepreneurial environment, development of the private sector, popularization of Georgia's investment climate and export promotion. To ensure dynamic economic development, the agency combines three components, three interrelated layers of economic development: business (local production), export and investment [10]. The aim of "Produce in Georgia - Business" is to develop entrepreneurship in Georgia, entrepreneur support, Creation of new enterprises/hotels and promotion or expansion of existing enterprise/hotel; The aim of "Produce in Georgia - Export" Promoting Georgia's export potential, increasing the competitiveness of Georgian products in international markets, Increase of export volume of Georgian products and diversification of Georgian export markets; The aim of "Produce in Georgia- Investment" attracting foreign direct investment in Georgia, promotion and development. This direction is a kind of mediator between foreign investors and the Government of Georgia, It works on a "one-stop-shop" basis and assists interested investors in obtaining information and communicating effectively with the Georgian side.

As of 2015-2018, under the program "Produce in Georgia", 5313 projects have been supported with a total investment of up to 50 million GEL, with a co-financing of 22949474 GEL with 8412 beneficiaries/beneficiaries. The project is implemented in all regions of Georgia except Tbilisi [12]. It should be noted that most of the resources within the program focused on business extensions [11].

The development of small and medium enterprises, in addition to the growth in production, should have a positive effect on employment. Therefore, it is important to consider the current situation in Georgia in this regard.

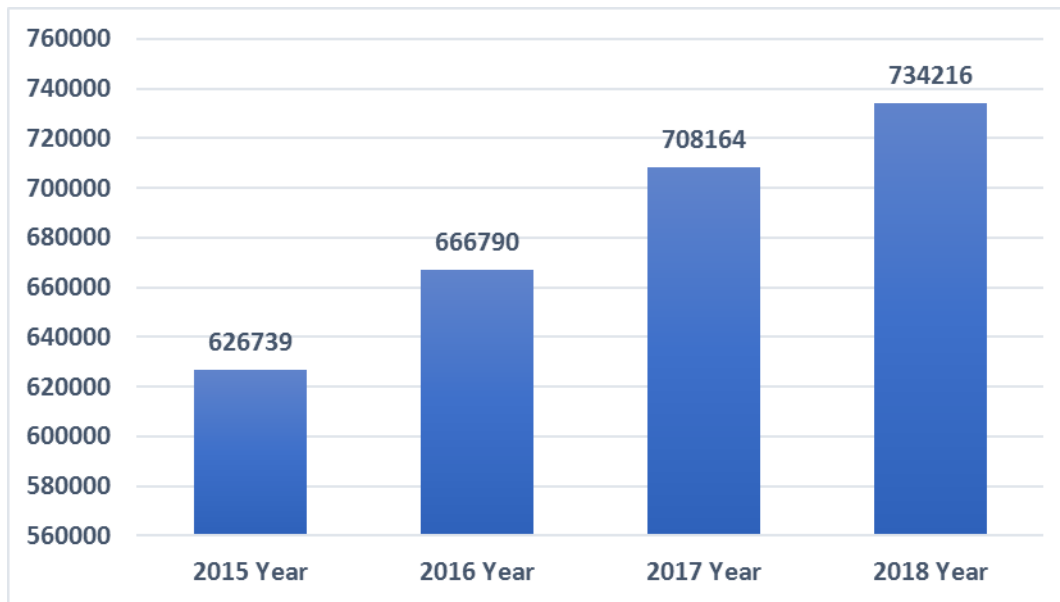


Figure 3. Number of employees in enterprises in Georgia, 2015-2018 Years

Source: Compiled by the author, based on data from the National Statistics Office of Georgia [13].

According to data published by the National Statistics Office of Georgia, in 2015 there were 626739 people employed in enterprises in Georgia. Since 2015, the number of employees has increased significantly and in 2018 amounted to 734215.

It is important to consider the number of employees by enterprise size category.

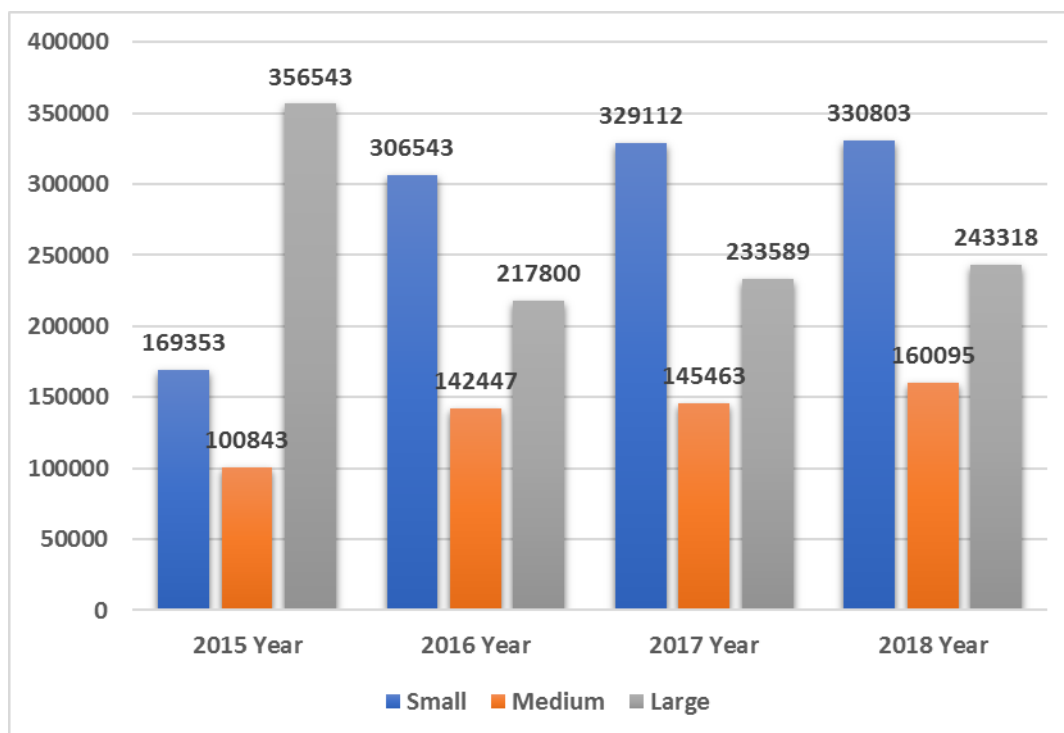


Figure 4. Number of Employed by Size Category of Enterprises in Georgia, 2015-2018 Years

Source: Compiled by the author, based on data from the National Statistics Office of Georgia [13].

The diagram shows that the number of employees in both small and medium enterprises is increasing from 2015 to 2018. Also, it is noteworthy that the share of employees in SMEs in 2015 was 43.1%, in 2016 - 67.3%, in 2017 - 67%, in 2018 - 66.9%.

CONCLUSIONS

Despite the government's efforts to strengthen small and medium enterprises, such as the development of a strategic development plan, the implementation of various types of support projects, which mainly increase in their number, it is not sufficient to develop and strengthen the mentioned business sector.

Research shows that in recent years, particularly in 2015-2018, the trend of small and medium enterprises growth has been higher in small and medium enterprises than in previous years, but this is not enough for full employment of the population and improvement of the economic situation of the country. If 66.7% of the working population in the highly developed countries employs a small enterprise, only 16.5% in Georgia. 12.7% of the population is unemployed due to unemployment, which is why the standard of living is low.

The entrepreneurial sector, especially small and medium enterprises, plays an important role in the development of the economy and contributes significantly to ensuring sustainable and inclusive economic growth. Small and medium enterprises, with the potential for job growth and job creation, as well as contributing to the development and growth of the economy, can be considered as the cornerstone of any country's economy. A strong and well-developed small and medium enterprises sector contributes significantly to export, innovation, the creation of modern entrepreneurial culture, and at the same time plays a key role in raising the country's prosperity [10].

In recent years, as a result of reforms in Georgia, the country's investment and business environment have improved significantly - administrative barriers have been significantly reduced and public services improved. However, some measures are needed to support the development of small and medium enterprises.

To improve the difficult socio-economic situation in Georgia, it is necessary to increase the competitiveness of the private sector, improving investment and business environment, political stability, strengthening property rights, state support for production, increasing access to finance, developing innovation and technology.

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CORRELATION OF REFRACTORY STATUS EPILEPTICUS (SE) WITH CLINICAL AND ELECTROPHYSIOLOGICAL CHANGES

Ia Rukhadze¹, Guliko Kilptari²

¹Neurology. Central University Clinic after Academician N. Kipshidze (Georgia)

²Critical Care. Central University Clinic after Academician N. Kipshidze (Georgia)

ABSTRACT

Purpose: Status Epilepticus is severe illness, which needs urgent intervention and it is characterized by the high mortality. Timely and correct management of SE is important for determining an outcome. The main goal of our research was to evaluate status epilepticus in patients with coma and from them to differentiate ones having medicament resistant forms.

Methods: For every patient we have used long-term- EEG monitoring in dynamics and also CT and MRI diagnostics. The degree estimation of coma was done through GCS. **Results:** Under our clinical observation there were 11 patients with medicament resistant status epilepticus. Their conditions varied, because of different types of damages, such as: autoimmune encephalopathy, amaurotic idiocy, post hypoxic disorders of brain, and etc. The most difficult to manage was the status epilepticus in patients with autoimmune encephalopathy. The recurrence exacerbated the progress of disease and the status practically became uncontrollable in some of cases. Status epilepticus in patients with post anoxic brain damage finished with exitus. In all the case we have founded some specific epileptic patterns on EEG monitoring. We used anticonvulsive drugs in different combinations and after all we were changing them depending on the development of main diseases.

Conclusion: Performed clinical and electrophysiological researches show correlations of these parameters. The resistant status epilepticus is dependent on the development of main pathology. Timely and appropriate treatment is important in order to get the positive outcome. Unfortunately, in some of the cases it wasn't possible to manage treatment for recovery.

Keywords: status epilepticus, convulsion, coma

INTRODUCTION

There are many ways to categorize the various types of status epilepticus. In part, a classification scheme depends on one's goals. One can aim to understand the basic biology, including genetics, of individual syndromes and their relationship to one another. Ultimately, better genetic and anatomic explanations of seizure disorders and SE provide a rich intellectual understanding of SE. The largest categories of status epilepticus, and the initial approach to their recognition, involve a determination of focal versus generalized clinical and EEG patterns, and also a distinction between convulsive and nonconvulsive (NCSE) presentations. The latter is evident to the examining physician's eye. The former (focal vs generalized) may also be obvious, but particularly with NCSE, focal and generalized presentations may appear identical at some point in the evolution of the status. This is still a useful distinction to make whenever possible because different types of NCSE may have different etiologies, causes, treatments, and prognoses. The correlation with pathophysiology is imprecise, however, and different etiologies may present with the same type of SE. Nowadays is important evaluate status epilepticus in patients with coma and from them to differentiate ones having medicament resistant forms-refractory and super refractory SE.

MATERIALS AND METHOD

Under our clinical observation there were 11 patients with medicament resistant status epilepticus. There were 6 patients with autoimmune encephalitis, 1 case –patient with amaurotic idiocy, in 3 case there were patients with hypoxic brain damages and in 1 case etiological factor was unknown. In all cases we have used long-term- EEG monitoring in dynamics and also CT and MRI diagnostics. The degree estimation of coma was done through GCS. More than 30 min of recurrent, discrete electrographic seizures on the EEG was an evidence of ongoing SE. In this case, the EEG is persuasive, even without any clinical manifestations during the intermittent electrographic seizures. Patients with ongoing electrographic seizure activity (continuous or in discrete seizures), usually with minimal or no motor activity, often following earlier generalized convulsions or GCSE or in the setting of severe medical illness (such as anoxia, sepsis, autoimmune encephalitis or severe metabolic derangements), have been given several different labels. Such patients with ongoing discharges on EEG, with no obvious clinical manifestations except diminished consciousness, are not rare. CT of the brain is usually the initial study performed to detect a structural lesion. Lumbar puncture is performed for cerebrospinal fluid analysis when CNS infection or subarachnoid hemorrhages suspected. We used MRI study in all cases, especially in patients with autoimmune encephalitis.

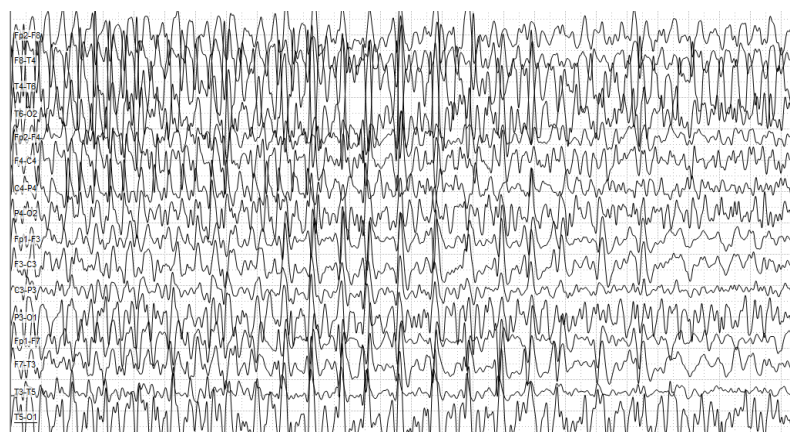
Results: Different types of convulsion were observed in all cases (Table 1)

Number of patients	GCS	Lateralized periodic discharges (LPDs)	Bilateral periodic discharges (BPDs)	Generalized periodic discharges (PDs)
4	5-6	2	1	1
3	4-5	1	1	1
4	3-4	1	1	2

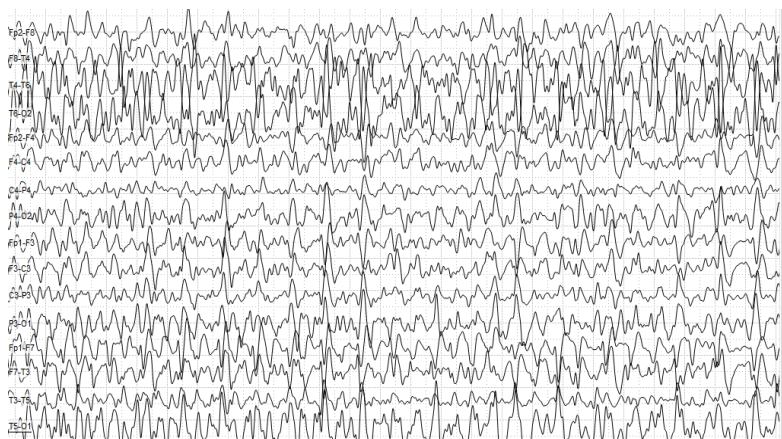
Table 1

Especially severe developing of status epilepticus- refractory status epilepticus we observed in patient with autoimmune encephalitis (there were 2 patients with NMDR , 1 patient with LG1 autoimmune encephalitis and 3 patients with Hashimoto's encephalitis).In developing these conditions there identified following clinical studies: Acute progressive No convulsive and convulsive epileptic status. Hole control of seizures Re-exacerbation of seizures Serial convulsive seizures. Half part control of seizures. Psychotic disorder.Stabilization (with tendency of enhancement of cognitive functions).

Picture 1 and 2 shows refractory status epilepticus in 21 years old parent with NMDR-encephalitis

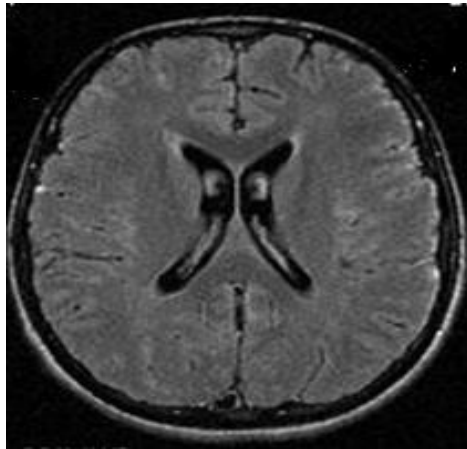


Picture1



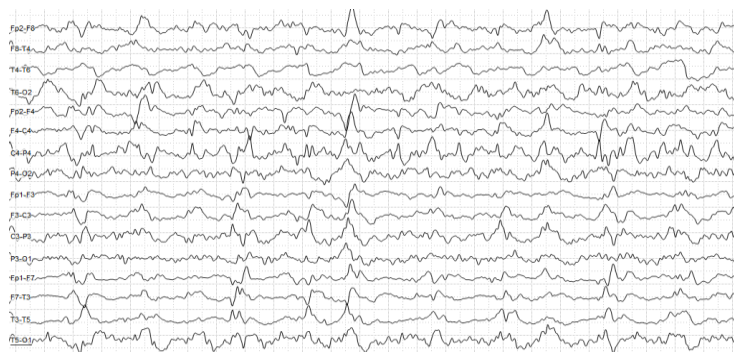
Picture 2

By MRI we can think about encephalitis on the right side of frontal-parietal part of brain, and on the both side of parahippocampic areas (there might be post ischemic or postictal disturbance of these areas in the brain).. Picture 3 and 4 shows this change.



Picture 3

Picture 5 and Picture 6 shows Generalized periodic discharges (PDs) in dynamic

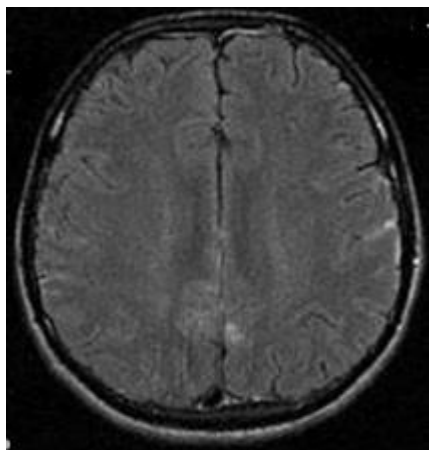


Picture 5

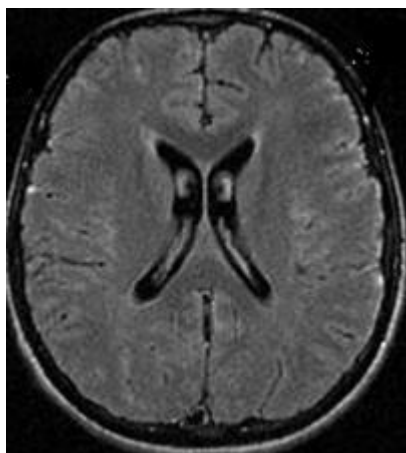


Picture 6

On the MRI of brain with (i/v contrast) the contrast fluid was more comprised in para hippocampal areas, also fragmentally in the shells (more on the left side). There is no hyper intensive area around of optical nerve (Picture 7 and 8)



Picture 7



Picture 8

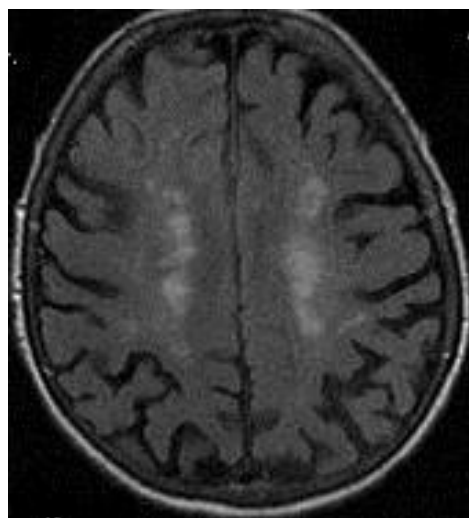
The recurrence exacerbated the progress of disease and the status practically became uncontrollable in some of cases. Status epilepticus in patients with post anoxic brain damage finished with exitus. In all the case we have founded some specific epileptic patterns on EEG monitoring. Picture 9 and picture 10 shows refractory status epilepticus in patient with unknown coma.



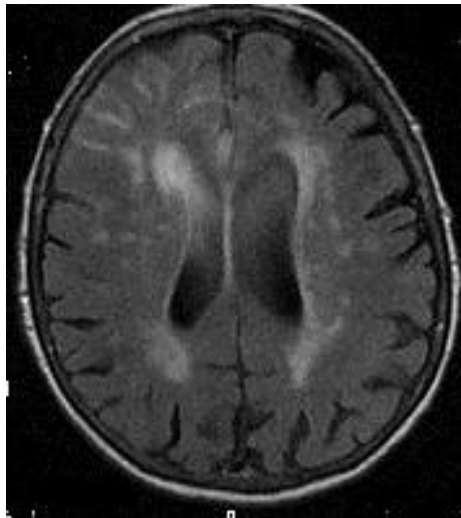
Picture 9



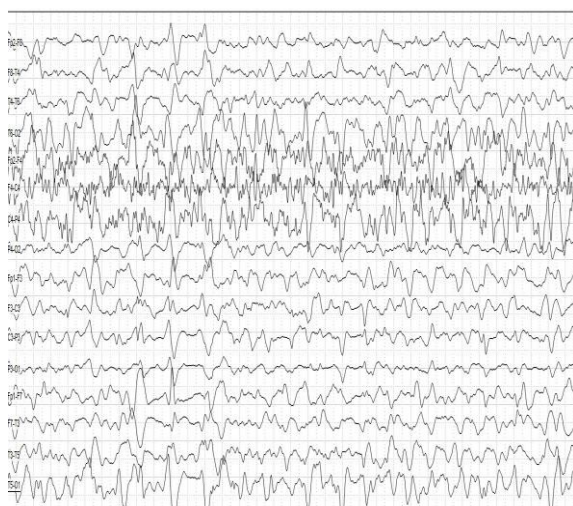
Picture 10



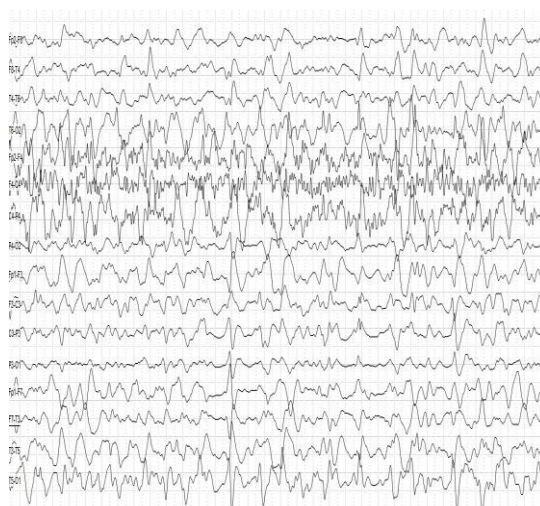
Picture 11



Picture 12



Picture 13



Picture 14

For treatment in patients with autoimmune encephalitis we used: Immunoglobulin therapy, Pulse therapy, Plasmapheresis, Anticonvulsive therapy. In these and all of other clinical cases we used following types of management for convulsive and non-convulsive status epilepticus: Intravenous anticonvulsants (levetiracetam, valproic acid), oral anticonvulsants (carbamazepine, levetiracetam, valproic acid), intravenous infusion of midazolam and propofol, intravenous infusion of thiopental with increase dosage, when seizures are primary exacerbated.

The cause of difficultness of management of seizures presents: Progressivity of encephalitis, which is confirmed clinical electrophysiological and radiologic evidences, concomitant infection with fever, metabolic disturbance (suction). In clinical developing in most patients we achieved followings: Full control of epileptic seizures, Positive dynamic in neurological status- better cognitive functions. Tendency of regress of psychological disturbance. Psychological rehabilitation and under neurological control.

CONCLUSION

Performed clinical and electrophysiological researches show correlations of these parameters. Also, we can say that the resistant status epilepticus is dependent on the development of main pathology. It is important timely and appropriate treatment in order to get the positive outcome. SE etiology is a potentially modifiable outcome predictor that should always be specifically addressed. Refractory, SE represents a heterogeneous entity which is regularly encountered in every hospital setting. The overall aggressiveness of treatment depends on the type of SE. Generalized convulsive SE should be treated aggressively given the danger of systemic and neurological injury with ongoing seizures. The identification of autoimmune encephalitis has changed paradigms in the diagnosis and management of several novel and treatable syndromes that occur with seizures and status epilepticus previously attributed to viral or idiopathic etiologies.

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ECONOMETRIC MODELS OF DURABLE AND STABLE ECONOMIC DEVELOPMENT OF AZERBAIJAN INDUSTRIAL ENTERPRISES

¹Suleymanov Gazanfar, ²Ibrahimova Sadaqat, ³Shakhveranova Emilya

¹Doctor of Economic Science, Professor. ²Associate professor, PhD in Economic. ³Assistant professor.

^{1,2,3}Department of "Economics and Management of Energy and Petrochemicals"

^{1,2,3}Azerbaijan State Oil and Industry University.

Email: ibrahimovasadat06@gmail.com

Introduction

In the globalized modern world innovations and achievements obtained in social, practical, economic and cultural fields of the country in legislative state and civil society construction are the results of right internal and foreign policy carried out by Azerbaijan. As a result the Republic turned to rapidly developing country in the world due to a lot of indices and successful economic reforms. In 2018 a number of macroeconomic indices in Azerbaijan were at high level.

Observations show that currently in the world economy there are a sharp increase in the crises periodicity, stability in the encirclement of markets. But global financial-economic crisis passed away disorder Azerbaijan and Azerbaijan economy preserved its rapid development rate and stability and on the whole achieved big economic raise. Currently in the proceeding crisis condition due to the results of 2018 our country achieved increase in the non-oil section of the industry and new competitive enterprises have been created in the non-oil industry, i.e. in machine-building, making construction materials.

It should be noted that means gained as a result of development of oil industry have to be directed to develop non-oil industry due to the market requirements. Additionally we can emphasize that new economic models have been worked out to develop more efficiently industrial enterprises in the market relations.

In connection with its strategic road map on the economic perspectives "State Program on the development of Azerbaijan Republic industry for 2015-2020-s" accepted on 6 December 2018, has been considered to speed industrializing process. Measurements plan is carried out. Due to the industrializing policy developing cosmic, defence, alternative energy, ship-building and other new fields have been created. Besides new industrial and refining enterprises began to be operated successfully.

Keywords: economic development model, regression model, econometric models, economic development policy of industrial enterprises, opportunities for scientific and technological progress, competitive production, innovation projects.

Assessment of total industrial production volume of Republics

It is known that during assessment of existing condition of industrial-manufacturing funds of industrial enterprises, disordering and etching levels, fund output indices, technico-technological level of the industrial enterprises doesn't create opportunities to produce and export a number of products meeting international requirements and as a result, modernization or reforming of industrial enterprises increase. From other side, organization of the industry in the international level, insufficient providing of domestic and foreign markets by the industrial enterprises show incapability of existing control systems to meet market relations, improper application of efficient forms and methods of the management. With this purpose, building of the following economic development models have been realized.

1. Model of regression among industrial fields influencing total volume of the product (table 1)

Construction of econometric models and their prognoses indices

Using extrapolarity and indices of all four tables the dependence among them can be suggested as

Here, y and x_i ($i=1,2,3,4$) are the correlation coefficients of regression equation.

For the first model (table 1.)

Y is total volume of all industry goods

X_1 is total volume of mining industry goods

X_2 is total volume of processing industry goods

X_3 is production, distributing and providing of electric power, gas and steam, total volume of products

X_4 are indices of total volume of water supply, waste cleaning and treatment products.

For the second model of Y -processing industry product.

X_1 -manufacturing of food, wearing and clothes industry, jewelers art, music, sport and medicine equipment.

X_2 -polygraphy, oil and chemistry, construction and metallurgy industry.

X_3 -production of electric equipment

X_4 -production indices of machinery and equipment

Here Y is total volume of machine-building product

X_1 is availability of main funds

X_2 are main capital investments

X_3 is volume of innovation product due to novelty level of economic activity types

X_4 are the indices of expenditures spent on technological innovations.

The followings are related to the expenditure spent on technological innovations.

X_5 is obtaining of machinery and equipment connected with technological innovation

X_6 is obtaining of new technologies

X_7 is obtaining of program facilities

X_8 is production of automobiles and trailers

X_9 is application and use of new products, services and new processes

X_{10} is training and preparation of workers related to innovation

X_{11} is industrial designing of new products, other types of preparation for the industry and application of new services and methods on their production

X_{12} are scientific researches and developments

For the fourth model (table 4)

Here Y is volume of total domestic goods

X_1 is total volume of industry products

X_2 is total volume of the investments directed to main capital

X_3 is total volume of population's outcome

X_4 are total volume indices of state budget

If to apply regression model algorithm for all four models we can get following correlation coefficients of the regression equation

For the first model

$a_0=0.86$, $a_1=0.75$, $a_3=0.05$, $a_4=0.02$ and $R^2=1$

If we write these coefficients in (1) then we will get (2)

Thus, obtained model (2) makes it possible to indicate the following results

1. In 2009-2016 more special weight in the mining industry.
2. 1% increase of total product in the industrial enterprises
3. As a result, 1% increase of total product factor of processing industry as a result brings to 0.17% increase of total product volume in the industrial enterprises
4. 1% increase of total volume factor of the products of electric power, gas and steam production, distributing and supply brings to 0.05% increase of total product volume in industrial enterprises.
5. 1% increase of total volume factors of water supply, waste cleaning and processing products also brings to 0.02% increase of total product in the industrial enterprises.
6. 0.86 coefficient makes it possible to say 1% increase of factors not included into the model brings to 0.86% increase of total product in industrial enterprises
7. $R=1$ shows that offered model is adequate, that's, it reflects economic process exactly.

For the second model:

$a_0=1.53$; $a_1=0.38$; $a_2=0.44$; $a_3=0.05$; $a_4=0.08$ and $R^2=1$

If to write these coefficients in (1), then $Y=1.53x_1+0.38x_2+0.44x_3+0.05x_4+0.08$ (3)

Thus due to model (3) we can conclude:

1. In 2009-2016 the most special weight belongs to polygraphy, petrochemistry, construction and metallurgy industry factor.
2. 1% increase of polygraphy, petrochemistry, construction and metallurgy brings to 0.44% increase of total product in machine building industry enterprises.
3. 1% increase of food, weaving and clothes industry, jewellery's art, music sport and medical equipment production brings to 0.38% increase of total product in machine building enterprises.
4. 1% increase of production factor of machine and equipment brings to 0.08% total product volume in processing industry enterprises.
5. 1% increase of production expenditure factor of electric equipment brings to 0.05% increase of total product volume in processing industry enterprises.
6. 1.53 coefficient grounds that 1% increase of factors brings to the 1.53% increase of total output volume in refining industry enterprises.
7. $R=1$ shows that suggested model is adequate and it reflects economic process exactly

For the third model

$a_0=2.21$; $a_1=0.66$; $a_2=0.10$; $a_3=0.09$; $a_4=0.15$ and $R^2=1$

If to write this coefficients in (1), then ...

$Y=2.21x_1+0.66x_2+0.10x_3+0.09x_4+0.15$ (4)

Thus, obtained model (4) makes it possible to say:

1. In 2009-2016 more special weight in the increase of total volumes of machine building industry output belongs to the existence factor of main funds.
2. 1% increase of existence factor of main funds brings to 0.66% increase of total output in machine- building industry enterprises.
3. 1% increase of the factor of investments put on the main capital brings to total output volume in machine- building industry enterprises.
4. 1% increase of innovation output volume factor brings to 0.09% increase of total output volume in machine building industry enterprises.
5. 1% increase of factor of expenditure spent on technological innovations in the industry brings to 0.15% increase of total output volume in machine building industry enterprises.
6. 2.21% coefficient makes it possible to say 15% increase of factors not included into the model brings to 2.21% increase of total output in machine-building industry enterprises .
7. $R=1$ shows that suggested model is adequate, that is, accuracy of economic process.

For the fourth model:

$$a_0=2.82; a_1=0.36; a_2=0.28; a_3=0.09; a_4=0.10 \text{ and } R^2=1$$

If to write these coefficients in (1), then

$$Y = 2.82 x_1 0.36 x_2 0.28 x_3 0.09 x_4 0.10 \quad (4)$$

Thus, obtained model (4) makes it possible to say the following results:

1. In 2009-2016 more special weight in the increase of total domestic output volume belongs to the industry products.
2. 1% increase of total volume of industry products brings to 0.36% increase of total domestic product volume.
3. 1% increase of total volume factor of the investment directed to main capital brings to 0,28% of total output volume in the industrial enterprises.
4. 1% increase of population's income factor brings to 0.09% increase of total product volume in industrial enterprises.
5. 1% increase of total volume factor of state budget brings to 0.10% increase of total output volume in industrial enterprises.
6. 2.82% coefficient makes it possible to say 1% increase of the factors not included into the model brings to 2.82% increase of total domestic product.
7. $R=1$ shows that suggested model is adequate that is it reflects economic process exactly.

CONCLUSION

It should be noted that depending on the economic development policy of industrial enterprises the models described by the authors can change. Besides it, these models make it possible to assess competitiveness, stability, essential stability and durable economic development of industrial enterprises of Europe, Asia and other countries having developing economy. Thus, competitive development of enterprises must be realized by effective use of opportunities of scientific technical progress, and it makes possible to manufacture qualitative and competitive product. Only scientific of new technique and technologies achievement and their rapid application to the industry will make it possible.

Scientific technical progress (STP) influences strongly efficiency of the production, mainly it provides development of market economy of the industry on the way required by economy. It causes increase of the efficiency and creates favorable condition for competitive product manufacture. The role of innovation activity in expedient development of the production and efficiency increase is great. Innovation activity influences industry efficiency on its common, special and new directions. It also influences all industry elements- labour facilities, labour object and labour itself positively, improves them and creates condition for their entire use.

As a rule, labour, fund and material capacity of the product unit manufactured by STP speeding decreases, scientific capacity increases.

It results in the increase of production efficiency. Thus, innovational development of the economy is the main factor of the production development. But, carried out analysis shows that development speed of STP of innovation activity in industrial enterprises of the republic doesn't meet requirement of market economy entirely. If to apply STP achievements in the oil section of the industry happens very slowly. That's why carrying out innovational projects in machine-building enterprises and research works in this field must be strengthened.

Table 1

Indices	Measure unit	2012	2013	2014	2015	2016	2017	2018
All industry(Y)	mln.man	22564	27978	35027	34565	33898	32110	26369
Government section,	mln.man	5036	5575	6817	6875	6397	6747	6228
-non- government section	mln.man	17528	22403	28210	27690	27501	25363	20141
Mining industry (X1)	mln.man	16460	20862	26894	25607	24655	21981	16362
Refining	mln.man	4836	5736	6392	7032	7244	8071	7880
Electric energy,gas and steam production, sharing and	mln.man	1148,3	1225,5	1555,9	1724,3	1773,9	1824,4	1887,2
Water supply, cleaning and refining of waste(X4)	mln.man	119,5	154,5	184,3	201,7	225,1	233,4	239,5

Source: Azerbaijan industry. It has been worked out on the basis of statistic collection

Table 2

Regression model among the fields of the refining industry and influencing total volume of its product

Indices	Measure unit	2012	2013	2014	2015	2016	2017	2018
1.Total volume of refining industry (Y)	mln.man	4836	5736	6392	7031	7244	8071	7880
2.Food, and clothes, jewellery, music, sport and medical equipment industry (X1)	mln.man	1781	1970,8	2151	2621,6	2565,7	2657,4	2608,8
3.Polygraphy, oil and chemistry, building and metallurgy industry (X2)	mln.man	2596	2905	3194	3269	3377	3914	3518
4.Production of electric equipment (X4)	mln.man	76,5	129,7	244,1	252,6	286,8	227,7	177,3
5.Production of machine and equipment (X5)	mln.man	382,4	365,9	369,9	464,6	564,3	784,8	1,1299

Source: Azerbaijan industry: It has been prepared on the basis static collection. Baku-2018

Table 3

Regression model among innovation indices influencing total volume of machine building product included into refining industry

Indices	Measure unit	2012	2013	2014	2015	2016	2017	2018
1.Volume of in- dustry product(works, services) (X)	mln.man	93,3	151,2	156,7	151,5	257	278,5	198,8
2.Existence of main funds (X1)	mln.man	232,7	262,5	396	480,8	560,2	708,3	705,8
3.Investments of main capital (X2)	mln.man	0,3	0,2	0,1	0,01	1,7	0,1	19,5
4.Volume of innovation product due the innovation degree and economic activity forms (X3)	mln.man	-	-	-	-	1036,7	-	-
5.Expenses on the technological innovations in the industry	mln.man	100,3	0,7	196,8	130	113,5	12667	15872
-of machine and equipment by technological innovations(X5)	mln.man	100,3	0,7	196,8	35,8	3,2	1,4	1,6
-producing of new technologies (X6)	mln.man	-	-	-	-	-	38,0	16,0
-producing of program facilities (X7)	mln.man	7	-	-	-	13,2	35,0	68,0
-producing of autos and trailers (X8)	mln.man	-	-	-	-	-	-	-
-application and development of new products, services, new processes (X9)	mln.man	17,8	-	-	32,3	35,1	8208	10609
-teaching and preparation of workers in connection with innovation (X10)	mln.man	-	-	-	-	32,5	32,5	37,2
-designing industrial of new products for output, other types for production preparation or application of new services or methods for their production (X11)	mln.man	-	-	-	16,2	12,3	4400	5200
-scientific research and working outs (X12)	mln.man	-	-	-	45,7	17,2	10,4	9,5

Source: Azerbaijan industry Statistic collection Baku-2018

Thus, using mathematical methods and generalization of obtained models are collected in table 4

Table 4

Regression model among the fields influencing total domestic output volume of the Republic

Description of models	Goal of models	Essence of indices
1.	increase of total output of the industry	Y -Total volume of all industry product; x_1 total volume of mining industry x_2 - total volume of processing industry products x_3 -water supply, total volume of waste cleaning and processing products
2.	Increase of total product of processing industry	Y-total volume of processing industry product; x_1 -food, wearing, and clothes industry, production of jewellery art, music sport and medicine equipment production; x_2 -polygraphy, petrochemistry, construction and metallurgy industry; x_3 -production of electric equipment; x_4 -production of machines and equipment.
3.	Increase of total product of machine-building industry	Y-total volume of machine-building industry product; x_1 -availability of main funds; x_2 -investment put on main capital; x_3 -volume of innovation product due to novelty level and economic activity types; x_4 -expenditures spent on technical innovation in the industry
4.	Increase of total domestic product	Y-volume of total domestic product; x_1 - total volume of industry product; x_2 -total volume of investment directed to main capital; x_3 - total volume of population's income; x_4 - total volume of water state budget.

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WORKING CONDITIONS AND HEALTH OF SEAFARERS

¹Aytekin Hasanova, ²Simuzar Hajizada

¹Azerbaijan Medical University. I Preventive Medicine Faculty. PhD in Medical Biology.

²The Ministry of Health of the Republic of Azerbaijan. Azerbaijan State Institute for the Improvement of Physicians named Aziz Aliyev. PhD dissertant.

Email: ¹aytakin_hasanova@mail.ru, ²ehm@rambler.ru

ABSTRACT

Relevance of a problem

Modern development of the fleet is inextricably connected with the solution of the problem of preservation and improvement of seafarers' health, improvement of their working, living and rest conditions. The most important condition for the health of seafarers is the provision of optimal habitat on the vessel. At the same time, the vessel should be considered as an artificial ecological closed system, which provides the crew with a long-term active existence.

A complex of interconnected environmental factors (climatic conditions of the navigation area, microclimate of ship's rooms, noise, vibration, electrostatic radiation, electromagnetic radiation, harmful substances in the air, microflora in the room, psychophysiological factors, etc.) simultaneously acts on the human body in the conditions of buoyancy. The person in the final outcome responds to the environment as a whole. Therefore, the criterion reflecting the influence of the ship's environment on the human body is the level of functional state of the worker and his health [Lane T, et al., 2002; Rohrer JE. 2004; Heistaro S, et al., 2001; Jensen OC, et al., 2001; Thomas M, 2003].

There are currently poor working conditions and a high rate of occupational morbidity among maritime workers. The intensification of labor in the flight is increasing. There is poor quality of pre-trial and pre-trial medical examinations, reduction of medical positions on ships, leading to a deterioration of the quality of medical care or its complete absence. Obsolete vessels with expired service life are used. These circumstances lead to a deterioration of the habitat on ships and pose a threat to the health of workers. However, research on comprehensive hygienic assessment of working conditions and on the state of health of seafarers in modern conditions is scarce and often contradictory. This justifies the relevance of conducting a scientific study on the further study of the complex of factors that form the conditions of habitation on ships.

Work purpose

Develop a modern system of science-based measures to prevent adverse effects of ship environment factors on the human body to preserve the health and high efficiency of seafarers.

Research problems

To carry out a hygienic assessment of the physical and chemical factors forming the conditions of habitation on sea-going vessels, to assess the severity and intensity of work on ships of the sea-going fleet;

Undertake a comprehensive assessment of seafarers health;

To carry out an analysis of industrial injuries on ships of the marine fleet;

Provide scientific justification for the system of preventive measures and recommendations for the protection of labour and health of marine vessels in the modern period.

Methods of research

included hygienic, psychophysiological, sociological (questionnaire and interviewing) and analytical.

Provisions for protection

The leading adverse production factors on ships should be considered noise, vibration, microclimate parameters, lack of recovery, tension and severity of work;

Work in harmful conditions of production contributes to the development of changes in the state of health of seafarers, determines the structure of production - due to and occupational morbidity, increases the risk of occupational injuries;

The condition of labour and health of ship specialists justifies the need to organize a system of labour protection and health of seafarers, the main purpose of which is to create safe working conditions that exclude or minimize the risk of an employee receiving a professional disease or accident, preserving the life and health of ship specialists.

Scientific novelty of work

For the first time in the conditions of the Azerbaijani region, a comprehensive sanitary and hygienic assessment of working conditions, an analysis of the state of health and industrial injuries of specialists working on sea vessels was carried out.

Leading harmful production factors have been identified, and features of occupational and production-related morbidity have been identified.

For the first time, an assessment of the natural resistance of the body of seafarers was given, as well as an analysis of individual risk factors. On this basis, a system of labour protection and health of seafarers is justified and developed.

The practical value of the work

lies in the fact that the comprehensive assessment of working conditions and the state of health of seafarers proposes a system of labour protection and health of persons working on sea vessels, which will ensure working conditions that meet the requirements of safety, which will contribute to the preservation of the life and health of maritime transport workers.

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PECULIARITIES OF HUMAN CAPITAL FORMATION IN GEORGIA

Lela Kintsurashvili

Akaki Tsereteli State University, Faculty of Law, Business and Social Sciences, Department of Economics, Kutaisi, Georgia

ABSTRACT

Under the globalization of economic systems and resource constraints, investing in human capital is determined as a system of measures aimed at increasing the labor productivity of workers, the most important of which is investing in education. As international experience confirms, an educated and skilled workforce can perform better and more difficult work.

In this regard recently a number of reforms implemented in the Georgian education system, however according to statistics, the results achieved are significantly lower than similar education indicators in developed countries. Its development requires an analysis of the ongoing processes in the education system and an increase of state control, that will reduce the risk of making possible mistakes and make the management of the education system more efficient.

Mental and physical abilities, innate skills and acquired habits, knowledge and experience of a human can be considered as human capital if they are using effective and profitable.

The efficiency of human capital can be increased by spending on education, vocational training, health care, etc. of which spending on education is particularly important.

As experience has shown, investing in human capital has a positive effect on human economic activity and revenue growth. It is much easier for a knowledgeable person to master new technologies and adapt to current social changes.

The article discusses the essence and evolution of a theory of human capital and the peculiarities of the formation of human capital in Georgia.

According to the research, the number of students in each academic year greatly varies by program. In process of choosing a speciality, most entrants have neither its own sphere of interest nor the demands of the labor market have been understood, which leads to misallocation of human capital and inefficient spending of the budget.

Differentiation is also observed in the gender perspective. If the number of boys among students enrolled in the 2000s exceeded the number of girls, in recent years this trend changed in the opposite direction. Among the graduates, boys have advantage over girls too.

Although expenditures on human capital development have been growing in Georgia in recent years and the education system is being actively reformed but education rating of Georgia is still low compared to other countries. This indicates the need to revise the reforms.

Keywords: Capital, Human capital, Education.

The Diversity of the Essence and Forms of Capital

Capital theory has a long history. A separate case of capital analysis is found in the writings of Barbon (1690). He viewed capital as a stock and commodity. His focus was on „renting capital” and „payment for stock”.

The role of production and capital is also discussed in the studies of physiocrats. However, instead of term "Capital" they used the term of „advances” and spread it in the field of agriculture.

The term „Capital” first was used by Adam Smith (1723-1790) a representative of classical political economy. He described capital as a form of wealth and studied its impact on labor wages and profits.

Later other representatives of classical political economy – David Ricardo (1772-1823), John Stuart Mill (1806-1873), Jean-Baptiste Say (1767-1832), Karl Marx (1818-1883) and others also studied the term of capital. They explored the nature, essence and forms of capital and its impact on various aspects of economic, social and political life in society.

Then, the economic category „Capital” was studied by other representatives of the neoclassical political economy – Leon Walras (1834-1910), Alfred Marshall (1842-1924), Irving Fischer (1867-1947), John Richard Hicks (1904-1989) and others.

Most modern economists consider capital to be the value of profit or the wealth that bring fixed income in over a long period of time.

In the XX century, researchers continued to develop the theory of capital, introducing new forms of capital and defining their characteristics. Researchers have introduced various forms of capital, such as fiscal capital, real capital, industrial capital, financial capital, human capital, symbolic capital, social capital and so on [Kepuladze G., Arnanian-Kepuladze T., 2017, p.331].

A special place in the theory of capital has occupied the concept of humancapital.

Evolution of the Human Capital Theory

Human capital is defined as a stock of productive skills, knowledge, education, experience in labor, as one of most important factor of production.

Human capital is a combination of innate human skills, mental and physical abilities, acquired habits, acquired knowledge and experience, which a person acquires in the process of receiving education, upbringing, work activity and through which it receives income.

The workability of human, the ability to develop and applicate own opportunities were discovered in the field of social science as early as the XVII century. From this period human labor ability was recognized as the main driving force of the production process (William Petty, Adam Smith, Jean-Baptiste Say, etc.).

Adam Smith attributed the knowledge and skills to capital, which is the property of the worker.

Jean-Baptiste Say implies that investment in capital is the provision of the next generation with education. Useful skills and capabilities are seen as an intangible form of capital by his, that is formed as a result of annual investment and is a "productive sum" [J.B.Say 1896].

The use of the term "Human Capital" and its scientific study has begun in the mid-20th century [Kepuladze G., Arnania-Kepuladze T., 2017, p. 331] and it was first used in 1958 by Jacob Menser, representative of the Chicago School, who is also believed as the father of the modern labor economy. The latter and Gary Becker contributed to the development of empirical foundations of human capital theory.

Gary Becker noted that there are many ways to invest, including school tuition, job training, medical care, and much more and each of them differs in its effects on income and consumption. In addition, each of them improves physical and mental abilities and thus increases the perspectives of real income growth.

In the United States, empirical studies have found that the more educated person is, the higher is his or her intellectual potential and income.

Although thinkers at various stages of their lives have developed new views about human capital, all of them share the common view, that one of the main driving forces in the modern world of labor productivity and economic growth is human, his/her knowledge and skills.

Formation of Human Capital in Georgia

Of the many forms of investment in human capital (education, healthcare, etc.), the initial and most important is an investment in education. The share of education expenditures in the country's GDP is the higher the priority development of human capital for the state is. Through it is possible to increase the quality of labor and its productivity.

In Georgia, as well as many other countries the formation of human capital begins at an early age and considers the following stages:

- Preschool education system
- General education system
- Vocational education system
- Higher education system

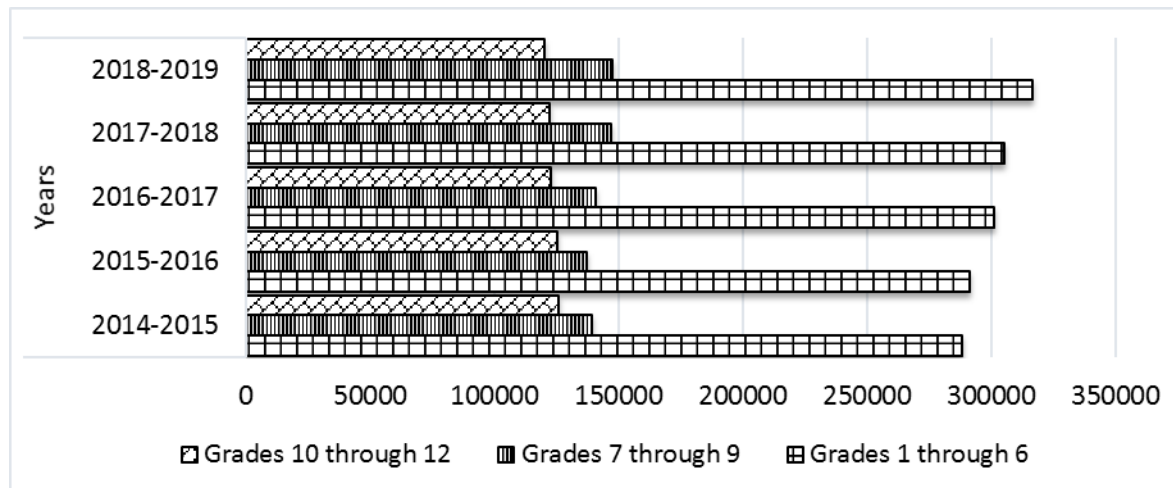
The quality of preschool education has a significant impact on the formation of human capital. Preschool education can have a positive impact on academic success, reducing crime and law enforcement in the future [Barnett 2008].

In this regard, the level of involvement of preschool children in relevant institutions in Georgia is about 50%. In the regions, its share is even lower, that negatively affects the level of development of human capital.

After preschool education, the formation of human capital usually continues in school institutions, which covers a period of 12 years and is implemented in three steps: primary, basic and secondary.

With increasing the stage of the study, the number of pupils in Georgia is characterized by a decreasing trend. In 2019 the number of basic school students is 53% lower than the number of primary school students while passing the first two levels (primary and basic) of school is mandatory for all citizens. This indicates inadequate control and effectiveness of legislative regulation.

Scheme 1: Dynamics of the numbers of pupils by steps of teaching (2014-2019)



Source: Compiled by the author according to the statistical yearbook of Georgia in 2019, based on https://www.geostat.ge/media/28915/Yearbook_2019.pdf

In order to promote vocational education, since 2013, the state has been fully funding tuition fee at state vocational education institutions. In 2015, trainings were conducted in various vocational colleges to improve the internal quality management system. Nevertheless, the number of students enrolled in vocational education is declining each year years. The prestige of vocational education is low, that causes a low level of demand for it.

The next step in the Georgian education system is higher education. According to the data of 2018-2019, there are 63 accredited higher education institutions in Georgia, where up to 148000 students study and 9500 academic staff are employed.

According to the 2018-2019 academic year, social sciences, business and law are considered the priority programs as a bachelor, as master and vocational program students, that are chosen by 43-44% of students on average, while programs such as service, agriculture and education characterized by a lack of students. Only 2-4% of students study on these programs. All these lead to a sharp differentiation on the programs and the imbalance between the demand and supply of potential labor on the labor market.

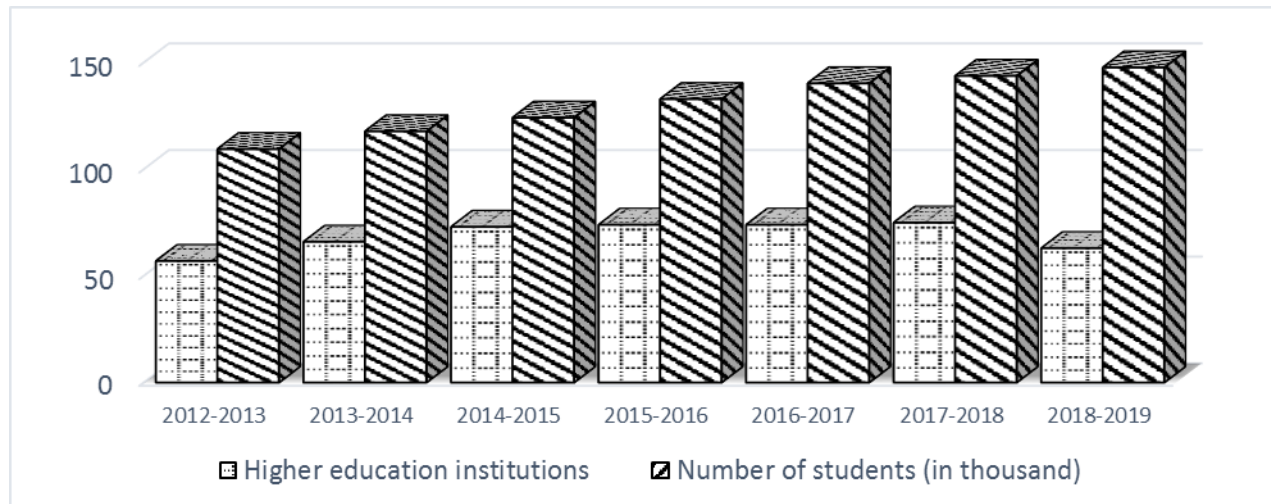
The higher education system in Georgia includes three levels:

- Bachelor's degree
- Master's degree
- PhD

Education levels are interrelated. A person has the right to study at the next level if he/she successfully completed the previous level of education on the desired educational program.

From 2012 to 2019, the number of higher education institutions in Georgia increased from 57 to 63, as for the dynamics of student' s quantity in the last seven academic years characterized by a growing trend. Most of the students are studying in public higher education institutions.

Scheme 2: Dynamics of Higher Education Institutions and Students of Georgia (2012-2019)

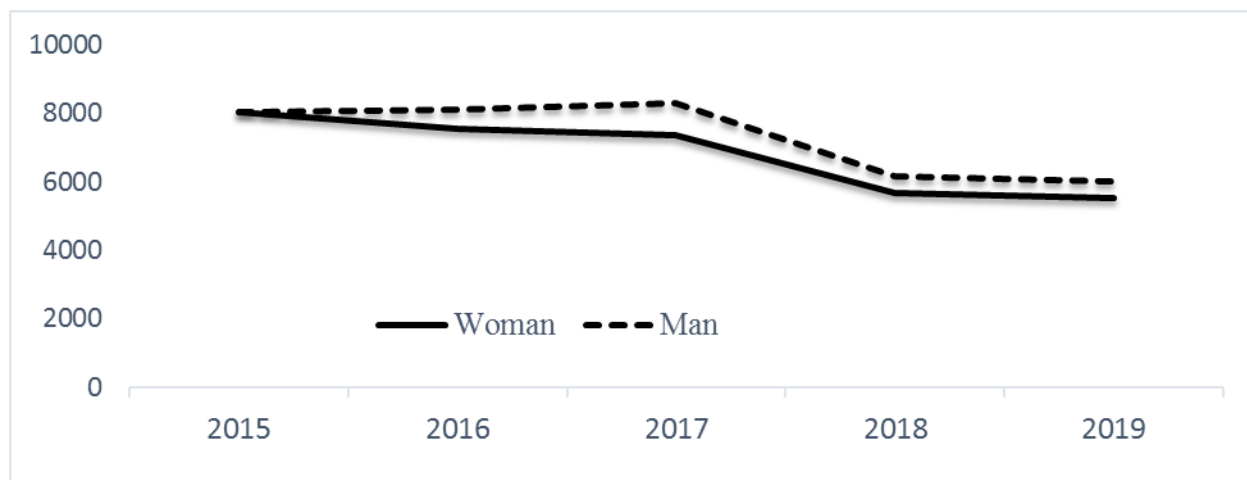


Source: Compiled by the author according to the statistical yearbook of Georgia in 2019, based on https://www.geostat.ge/media/28915/Yearbook_2019.pdf

Against the fast-growing trend of the higher education institution students, there is the slight increase number of graduated students in the period of 2012-2018, and from 2017-2018 to 2018-2019 academic year the number of graduate students decreased by 7%. As for the share of graduates among students, only 16-18% have been able to complete their studies, that means investments in education are spent inefficiently.

The formation of human capital in Georgia should be discussed in term of gender. It is noteworthy that if in the early 2000s the number of women in the second and third levels of general education and higher education exceeded the number of men [Arnania-Kepuladze 2011; Arnania-Kepuladze 2009], the number of enrolled men exceeds the number of women in the last four years (Scheme 3).

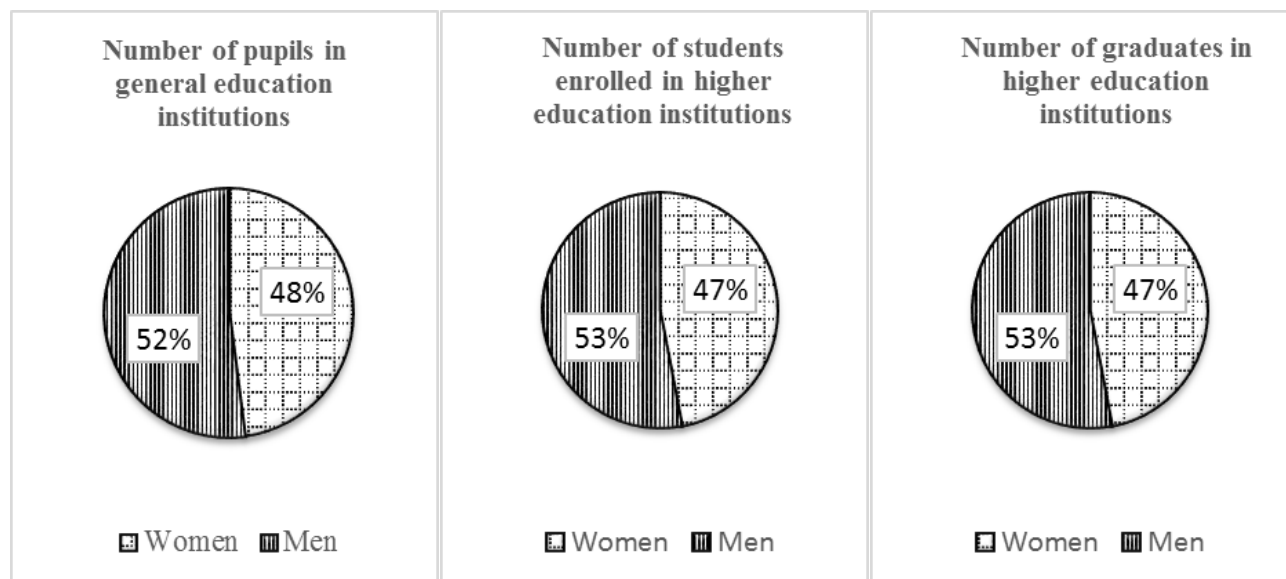
Scheme 3: Dynamics of students enrolled in vocational education institutions in terms of gender.



Source: Compiled by the author according to the statistical yearbook of Georgia in 2019, based on <https://www.geostat.ge/ka/modules/categories/60/profesiuli-ganatileba>

This trend is characteristic of as general education institutions, where the ratio of female students to male students is 48:52, as well as higher education institutions, where the number of men among enrolled students and graduates exceeds the number of women by 5% (Scheme 4)

Scheme 4: Gender Distribution of Students in Educational Institutions



Source: Compiled by the author according to the statistical yearbook of Georgia in 2019, based on <https://www.geostat.ge/ka/modules/categories/60/profesiuli-ganatileba>

It should be noted that in recent years, certain measures have been taken in Georgia to promote the development of human capital at all levels of education but the results are still low.

Today the main challenges of the education system are:

- Low quality of education
- Low student motivation
- Low level of compliance with the education system and labor market requirements
- Lack of state control

In response to these challenges, it is necessary to strengthen state control and focus on results. The main thing is not to increase the number of students in universities but to increase its quality, to form qualified and competitive staff. The state should take care to inform the students about all possibilities of further education and increase their motivation.

Each step of the education system must ensure the establishment of a knowledge-based society with a purpose to increase public welfare.

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TOURISM INDUSTRY AND EMPLOYMENT PERSPECTIVES EXAMPLE OF COUNTRY GEORGIA

Maia Diakonidze

Akaki Tsereteli State University. Agrarian Faculty, department of Tourism and landscape Architecture. Kutaisi, Georgia
Email: maia.diakonidze@atsu.edu.ge

ABSTRACT

Purpose: Based on mathematical- statistical analysis the main aim of the research is, to show positive impacts of the tourism industry development on economic growth, this work is for to demonstrate positive trends of the development of the field.

Design/Methodology/Approach: Research build on 6 years of the data, from 2010-2016 about the tourism development in the Georgia, it possible to identify forecast for the future tourism development and its impact on national economy.

Findings: Statistic forecast was made in 2019 for to show tourism development dynamic. Forecast does not provide Covid -19 influence, therefore this work is meaningful in case of other equal conditions. As the result Direct share of the Tourism Industry in employment would increase from 6 to 9% and revenues could reach to 3 billion Gel. Moreover, the econometric results shows tourism industry's influence on the main indicators such as, tourist flows and direct share in total GDP.

Practical Implications: A set of measures have been identified able to influence the industry in a positive way regarding its direct and indirect effects on employment perspectives. Some findings can be implied as a base for the future development of the field.

Originality/Value: Each country is trying to use all the available resources to achieve economic growth, Georgia also belongs to the ranks of such countries. But there is a lack of statistical information for the future development needs or expectations. Statistic forecast could be good precondition to pursue the goals established by the government.

Keywords: Tourism Industry, Employment, Economic development, Georgia.

INTRODUCTION

Over the last decade Tourism Industry become an integral part of economic growth of each country, For example, in Spain, share of the tourism industry in GDP is 16%, in Italy - 10.3%, in Morocco - 17.3%, in France - 9.3%, in Norway - 9.1%, in Turkey. - 12.6%, in the UK - 11.3% and others (WTTC - *World Travel & Tourism Council*). One of the most important features of tourism, and especially for international tourism, is - growth of employment, as the functioning of tourism as an economic field is based on a wide range of human resources. Therefore, the countries where the share of tourism is significantly higher, the number of employees is accordingly proportionate to it. For example, in Europe, where by 2015 the number of people employed in the tourism industry was 14 229 000 people, Which, constituted 3,6% of total employment (WTTC - *World Travel & Tourism Council*, 2015-18).

In 2019 European tourism expanded by 4%, a more moderate pace of growth compared to 2018 (6%) Continued trade and geopolitical disruptions dragging down sentiment towards global trade, China's group-travel ban to curb the coronavirus outbreak and weaker global economic activity are some of the factors that threaten to disrupt the tourism sector's outlook for 2020. Latest available data features positive numbers in terms of arrivals or overnights across most reporting destinations, although increases are slower than previous years.

The direct contribution of the travel and tourism industry accounted for 3.3 percent of the total global GDP in 2019, showing a small rise over the previous year. Comparatively, the total contribution of the travel and tourism industry in 2019 accounted for 10.4 percent of the total GDP worldwide. The tourism industries employ over 14 million people in the EU, from the first quarter of 2016, number of visitors in Europe has increased by 3,4% followed by increase of 1,8% of the number of employees, and by 2016 the number of employees in the tourism industry amounted to 14 492 000 people.

According to the data from UNWTO, number of employees in tourism industries in Georgia has grown across most tourism sector. In 2017, the number of employees in visitor accommodation services increased to 13.6 thousand, up from nine thousand three years earlier.

Tourism develops along with of material-technical progress and it is relevant impact to its socio-economic environment. Development of mass tourism is associated with several issues, such as:

- reduction of working hours in favor of free-time hours;
- Increase of material welfare of society and change of values;
- Globalization of socio-economic relations.

Based on above mentioned, it is possible to distinguish a number of factors that define tourism development and its impact on employment growth:

- Increased demand for tourism services: means, that people have an increasing interest on unknown and foreign places. Formation of demand for tourism service includes number of factors, as: psychological, material. These factors can explain the motivation and material possibilities of human travel;
- Peculiarities of customer demand on tourism services: Despite of economic stagnation and crisis, we can see positive dynamic of demand growth due to the substitution of relatively cheap service. Tourism service customers segmentation and its impact on demand formation. Growth and development of tourism services is reflected not only on customers, but also on the number of people employed in the tourism industry and on their professional skills.
- The price of the tourist services: Realization of tourism services determines the purchasing power of consumers, therefore, tourism is an area where we can find differential solvency for the service user, which means differential tourism services and therefore, availability for any customer segment (*Diakonidze M., Arnania-Kepuladze T. 2017*).

The Research Rationale

The most important feature of the tourism industry is the growing demand on labor force. Tourism can be considered as one of the dominant sectors in case of job creation, in small and developing countries, more than 50% of employed are engaged in activities directly or indirectly associated with tourism. Such countries have a closed economy system, which means before tourism industry development they were depend on the particular sector of the economy (agriculture). There is a different situation in the big countries that have developed major industrial trends. Tourism industry creates only 5% of employment in these countries. Development of the tourism industry has two kinds of impact - direct and indirect - on employment growth. An impact is direct when the number of employment growth directly in tourism services (tourist agencies, hotel, restaurants and others). Indirect impact is when employment growth in different areas, as: trade, banking, insurance and other adjacent sectors of the tourism industry. As the Swiss experience shows, in tourism, in particular for the field of employment, have a multiplier effect. Swiss professor Schmidhauser's calculations show that, every 1000 workers employed in the sphere of accommodating comes 459 workers employed in the other services (employed 2/3), also every 100 workers employed in the sphere of accommodating, comes 11 workers employed in the trade sector and, 2 workers employed in banking and insurance services (*Schmidhauser, H. (1989). 'Tourist Needs and Motivations'*). Indirect effect of the development of tourism industry on adjacent fields is also visible on the areas of Primary Purpose Productions, sports and other similar productions. Development of the tourism industry always works as catalyzer for increase, activity of the economic sectors, such as transportation, communications, trade, agriculture and other consumer products (*Diakonidze M.2019*).

In the developing world, tourism industry creates more jobs, than the other sectors of economy. If there is not such natural resources, as oil or gas in the country and needs to increase an income within a short term period, tourism can be a rescue ring that will allow the country to increase budget income in a very short period of economic activities. Travel and Tourism has a noticeable impact on employment all over the world, according to the data of WTTC (World Travel and Tourism Council) in 2019 there was 330 million employed in tourism industry what is equal of 1 in 10 jobs through the world. Also, 1 in 4 of all net new jobs were created by Travel & Tourism over the last five years.

It should be pointed out, that tourism is a very specific field and involves many sectors of economic, that makes difficult to determine the exact number of employees in the field. Tourism product includes not only services but also planning, branding, and packaging. Characterized by seasonality. Tourism is very sensitive it is distinguished with high sensitivity to political changes. Tourism product is very special as much as we can't touch or save, move or predict positive or negative

features, etc. In the absence of any one of the components of tourism service, the impression is completely violated. It is not an autonomous developed sector, tourism development in itself embraces many other fields.

Tourism industry has one more positive feature, it can employ different profile specialists, since it is a multidisciplinary complex. Positive economic impact of tourism industry in the country can be reduced, if there is a high number of imported goods and services, majority of tourist company facilities are owned by foreigners, but, it should be noted that some of the tourism types can't be implemented without foreign investment.

Development of tourism business is an important prerequisite for employment (*Armania-Kepuladze T., 2017*) of the population. Studies conducted by the World Travel Agency found that every eleventh people employed on earth in the sphere of tourism. World tourism provides of employment about 9% of the economically active population. Half of those employed in tourism are working in hotel business. In addition, tourists are consuming local produced products, stimulating development of the national economy and providing foreign currency inflows in the country.

World Tourism Organization (UNWTO) was predicted that growth of tourism industry development will be an irreversible process in the 21st century and by 2020, international tourist visits would reach 1,6 billion. But as it was not expected and taken into account world pandemic conditions has been changed all the data what was forecasted before the Covid-19.

Modern tourism has become a sphere of international information technology and processes based on introduction of computer techniques. Traveling through the Internet, due to global distribution and spatial limitations, geographical expansion continues and its contribution (4 trillion US dollars) in the world economy is annually growing. Clear evidence of all this is, that tourism sector creates about 10% of world GDP, 7% of investments and every 11th person employed is in tourism sector. Over the last year tourism was one of the fastest growing services in Georgia. There are many opportunities to invest in tourism sector (*WTTC - World Travel & Tourism Council*).

Tourism in Georgia is an increasingly important component of the country's economy. In 2015 it employed around 158,500 people, producing 6.7% of Georgia's GDP and providing US\$1.94 billion of revenue. In 2019, the number of international arrivals reached a record high of 9.3 million people with foreign exchange income in the year's first three quarters amounting to over US\$3 billion. According to the government, there are 103 resorts in different climatic zones in Georgia. Tourist attractions include more than 2,000 mineral springs, over 12,000 historical and cultural monuments, four of which are recognised as UNESCO World Heritage. Sites (Bagrati Cathedral in Kutaisi and Gelati Monastery, historical monuments of Mtskheta, and Upper Svaneti). Rational use of existing potential is a precondition of promotion several tourism types in the country such as: Cultural, medical, resort, rural, agro, eco, pilgrim, etc.

The Empirical study

With an aim to show the tendency of tourism industry development and its impact on employment we have made based on 6 year, data we have made statistical forecast for this year - 2020. Unfortunately our accounting does not includes, Covid - 19 case influence. Pandemic conditions are the foundation for future economic research.

While reviewing the tourism situation in Georgia, it is necessary to identify an issues, such as country's economic policy, tourism environment, tourism potential research and seasonality. It is very important to define an economic effect at this stage of the tourism industry development in the region. The economic indicators given by the Georgian National Tourism Administration include statistical data, number of employees employed in tourism sector, export-import of tourism services, share of tourism in GDP, direct foreign investment in hotels and restaurants, capacity of Georgian Railways and Airports. The data is displayed in different ways:

- Employment: Number of employees and their dynamics in hotels and restaurants, as well as in transport and other services;
- Import / Export of Tourist Services: Quarterly and annual data on revenues from international tourism and expenses incurred abroad by Georgian residents;
- Direct foreign investments: quarterly and annual data on foreign direct investments made in hotels and restaurants;
- Capacity: Data about Georgian Railway and Tbilisi, Batumi, Kutaisi and Mestia Airports.

The problem of unemployment is quite acute in the Georgia as well as in the whole world. It is extremely important to identify each way of solving the problem regarding unemployment. As it was above mentioned, Tourism industry is, an important factor of employment growth. An employment in tourism industry has complex character, tourism represents an interdisciplinary complex, which involves development of many neighboring branches, leading to the accommodation,

transportation, food and beverage sectors. According to the data of National Tourism Administration in 2017 and 2018, total number of employees in tourism amounted to 126, 8 and 142,8 thousand people (Table 1).

Table 1. *Employment in the Tourism Industry 2017-2018*

Number of Employees (Thousand Man)	2017	2018
Hotels and Restaurants	37,3	44,4
Transportation	68,8	78,3
Other services	20,7	20,1
Total	126,8	142,8

Source: *Georgian National Tourism Administration, Tourism Statistical Report of 2018.*

In 2015, budget for the development of tourism was about 25 million GEL, and the revenues from the tourism sector - 1,9 billion. Considering other costs, which is very difficult to account, because of such expenditures serve not only to promote tourism, but also to improve the quality of life of local population (interregional importance projects) and can not be defined as an exact tourism expenses. Therefore, should be said, that direct flow rate to attract one tourist is 4,2 GEL, and if we add "indirect" costs incurred by objective circumstances, this number may increase to 25-30 GEL. As for the revenues from the tourism sector - in 2015, 1,9 billion. While the number of tourists was 5.9 million. man. Accordingly, the average revenue of each tourist was GEL 322. (*Georgian National Tourism Administration, Tourism Statistical Report of 2016, 2017 and 2018*). If we subtract our presumptive average "indirect" costs (25-30 Gel) for one tourists, then the difference between cost will be an economic effect - 290 GEL - country will receive from one tourist visitor, which is almost 10 times higher than, incurred expenses.

Tourism industry is one of the most important and most prospective economic and business activities. Despite of positive dynamic of tourism industry, sometimes it is difficult to define economic priorities and exact polarization on economic sectors, that are new, popular, demanded and consequently oriented on economic outcomes. We can say, that tourism industry is a field, which is mostly requires, predictive assessment, because of determination of positive trends, the data obtained from the forecasting is an important motivation of the government for the economic policy making process.

The Research Models

Forecasting in the field of tourism can be made by two approaches, Qualitative and Quantitative, each of them combines several methods. Qualitative methods of forecasting are used in "obscure" situations and in the absence of data. These methods are mainly based on the personal experiences and intuition of forecasters. Quantitative methods are used in stable situations, in the existence of data and each one more or less complexity uses mathematical apparatus (Bakuradze a. Virsaladze N. 2014. Theory of Statistics, Hand Book). Statistical forecasting requires implementation of stages. On the first stage of the work (which called forecasting orientation) We have determined an aim of the research and overall description of the tourism industry - retrospective development of the forecast object.

With this method, we implemented a study of the prospects for development, main indicator – employment. In order to create a dynamic column, we have chosen the period from 2010 to 2016 the direct share of tourism in total employment as a forecast parameter for the calculation (*Georgian National Tourism Administration, Tourism Statistical Report of the 2010-2016*).

Table 2. *Direct share of the Tourism Industry in Employment (%)*

year	2010	2011	2012	2013	2014	2015	2016	2020
Y (factual) %	3,5	3,8	5,3	4,8	4,9	5,8	6,0	
$\hat{Y}_n = Y_1 + \bar{\Delta}(n-1)(\bar{\Delta})=0,41$	3,5	3,91	4,32	4,73	5,14	5,6	6,0	7,64

Source: (Georgian National Tourism Administration, Tourism Statistical Report of 2010-2016)

In the beginning we can note, that a simple method of equalization the dynamic column can be done with:

- Equalization (correction) with average absolute increments;
- Equalization (correction) with an average annual growth (increase) rate;

In analytical period the average of absolute growth of dynamic column ($\bar{\Delta}$) we have calculated by the chain method of mathematical calculations with the help of absolute growth:

$$\bar{\Delta} = \frac{\sum_{i=1}^{n-1} \Delta_{n-1}}{n-1}, \quad n - \text{the number of rows.}$$

Therefore, we have:

$$\bar{\Delta} = \frac{6,0 - 3,5}{7 - 1} \approx 0,41$$

Thus, in the current calculation we have got the data for 2020 (7,64%) years. To determine the trend, need to equalize(correct) the level of dynamical rows, i.e. "Liquidation" of the "leap changes" during the recession and growth, and revealing general picture of development. Thus, in the current calculation we have data for 2020 (7,64%) years. By the second method, the average annual growth(increase) rate - based on the first-factual level we can find equalized levels with the formula:

$$Y_n = Y_1 \cdot \bar{K}^{n-1}$$

From Table 3 we can see - ($\bar{K} = \sqrt[n-1]{\frac{Y_n}{Y_1}}$ -from), $\bar{K} = \sqrt[7-1]{\frac{6,0}{3,5}} = 1,09$

Table 3. Direct share of the Tourism Industry in Employment (%)

Year	2010	2011	2012	2013	2014	2015	2016	2020
Y	3,5	3,8	5,3	4,8	4,9	5,8	6,0	
$\bar{K}$ (1,09)	3,5	3,81	4,15	4,53	4,94	5,38	6.0	8,5

Source: Prognostic indicators developed by author.

This time, we have got the data 2020 (8.5), it was observed the slightest change. About an equalization of the dynamic column with linear function method, although a simple method of equalization (correction) gives a possibility to imagine/see a general development of an event, but can't provide an accurate statistical assessment of its progress. To get more accurate results, we have used analytical methods for the dynamical column equalization/correction, where the theoretical levels are found on the basis of the functional nature of the factorial (empirical) changes in time

Depending on the nature of the deviations, was have inserted an appropriate function $\hat{Y}$ - and we got formula:

$$\sum (Y - a_0 - a_1 t)^2 = \min$$

from this

$$Y = a_0 + a_1 t$$

Economically a_0 - shows original level of the mark, as the a_1 - is single time change of the original level, which will change with a few units. And also a_1 - shows the nature of development an event in the time. We have used calculation method/formula: where $\sum t$ for our example (when the number of levels is odd) is -0 , i.e. $a_0 = \frac{\sum Y}{n}$ and $a_1 = \frac{\sum Yt}{\sum t^2}$.

We have inserted the results in formula: $\hat{Y} = \frac{\sum Y}{n} + \frac{\sum Yt}{\sum t^2} \cdot t$.

Then we found theoretical levels (Table 5):

$$\hat{Y} = 4,87 + 0,39 \cdot t$$

Table 4. Direct share of the Tourism Industry in Employment (%)

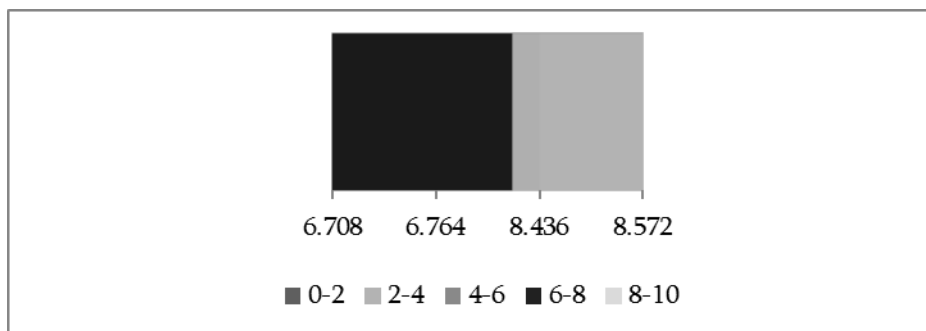
Year	2010	2011	2012	2013	2014	2015	2016	2020
Y (factual)	3,5	3,8	5,3	4,8	4,9	5,8	6,0	
Y(Factual.)*t	10,5	-7,6	-5,3	4,8	4,9	11,6	18	
$\hat{Y} = 4,87 + 0,39 t$	3,7	4,09	4,48	4,8	5,3	5,7	6,0	7,6

Source: Prognostic indicators developed by author.

According to this forecast the data is: 2020 (7,6%).

Deviation rate (error) for the growth rate (increase) in employment will be 0.836%, which means that by the 2020 it will be relatively accurate: between 6,764% to 8,572% (Diagram 1).

Diagram 1. Direct share of the Tourism Industry in Employment (%) 2020.



Source: Forecast developed by author.

Therefore, we assume that in 2020 - the growth of the share of total employment from tourism industry would be 8,6%.

Discussion

Accurately obtaining tourism statistics is crucial for determining the effectiveness of tourism industry. In turn, tourism statistics consist mainly of two components: a) tourist statistics and b) tourist expenses and revenue statistics. Both of these data give us an information of how important or insignificant it is for the country's economy.

Tourists statistics - considered as an information data base on the number of tourists arriving at the state border (tourist visa users). The purpose of the abovementioned statistics is to determine the relatively accurate quantity, to optimize tourism services and to determine the effect of tourism activity.

Thus, it is expected that by 2020 growth of the share of total employment from tourism industry would be 8,6%. which gives the possibility to make positive conclusions, considering all of the above-mentioned opinions and researches, we can say, that tourism industry is an instrument, that can solve an economic, problems such as, unemployment and an economic advancement of the state.

Conclusions and Recommendations

Tourism industry is an economic sector characterized by a development trend and therefore, able to help solving of many economic problems such as, unemployment, foreign exchange revenues, infrastructure development and etc.

In order to support tourism development, it is necessary to be a clear, proper state-economic policy, that will allow the private or public sector to identify priorities and establish future work plans.

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Mikhail Z. Vaynshteyn

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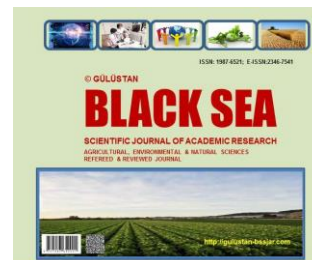
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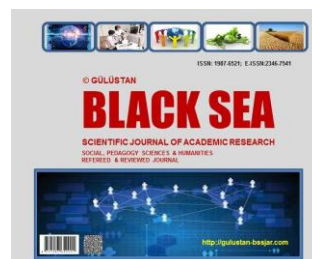
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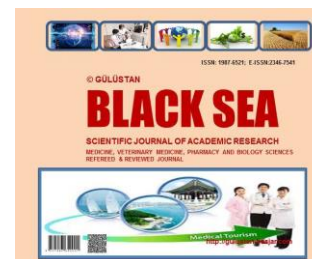
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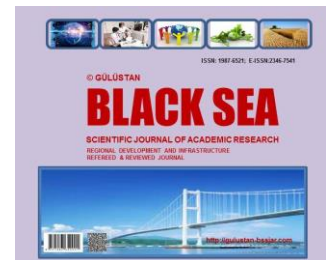
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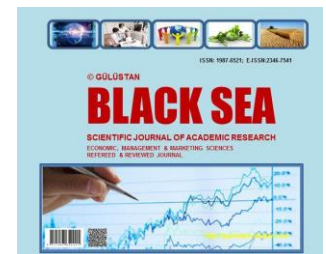
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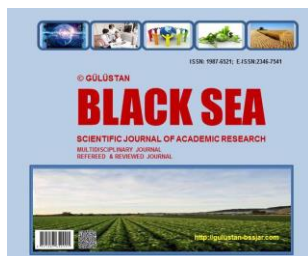
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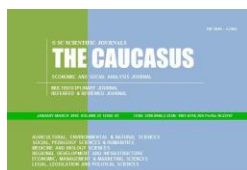


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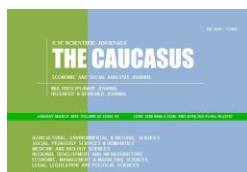


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